TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

DIPLOMARBEIT

A Technology Headquarter in Shanghai

ausgeführt zum Zwecke der Erlangung des akademischen Grades

eines Diplom-Ingenieurs / Diplom-Ingenieurin unter der Leitung

Ass.Prof. Arch. Dipl.-Ing. Dr.techn. Mladen Jadric

E253-04 – Forschungsbereich Hochbau und Entwerfen

eingereicht an der Technischen Universität Wien

Fakultät für Architektur und Raumplanung

von

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1326116

Wien, am …….

Erklärung

Hiermit erkläre ich, dass ich diese Arbeit selbständig verfasst, die verwendeten Quellen und Hilfsmittel vollständig angegeben und Stellen der Arbeit – einschließlich Tabellen, Karten und Abbildungen –, die anderen Werken oder dem Internet im Wortlaut oder dem Sinn nach entnommen sind, auf jeden Fall unter Angabe der Quelle als Entlehnung kenntlich gemacht habe.

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Abstrakt

Ziel dieser Diplomarbeit ist die theoretische Untersuchung der Beziehung von öffentlichen Räumen innerhalb hochhausdominierender Umgebungen. Die Analyseergebnisse werden anhand einer Planung eines Technologie Headquarters im Central Green Space in Lujiazui, Pudong auf ihre praktische Gültigkeit hin untersucht.
Um die wichtigsten städtebaulichen Probleme moderner Städte, wie die Zugänglichkeit, die Nutzbarkeit und die Multifunktionalität zu verstehen, werden in der Literaturübersicht und anhand von fünf Fallstudien bestimmte Mängel und Benchmark-Erfolge verschiedener Arten von öffentlichen Räumen und Turmtypologien untersucht.
Zweitens verwischt die Hybridisierung des städtischen Gefüges die einzelnen Häuserblöcke. Um auf die anhaltende Klimaveränderung, die städtebauliche Verdichtung und die Veränderungen der menschlichen Bedürfnisse zu reagieren, wird das LPS-Modell (Layered Public Space) eingeführt, um den räumlichen Schichtungsprozess mit Parametern zu definieren.
Die Durchführung, Dokumentation und Auswertung der Interviews dreier praktischer Architekten bereichern das Verständnis für die untersuchte Dualität von öffentlichem Raum und Hochhäusern und ermöglichen Einblicke in den aktuellen Veränderungsprozess in Asien.
Der Autor versucht, eine interdisziplinäre Wahrnehmung zu gewinnen und Ziele zu identifizieren, um Gebäude gemischter Nutzung von öffentlichem und privatem Interesse als integrale Serviceplattform zu etablieren.

Schlüsselwörter: multilevel urbanism, layered public space, elevated pedestrianization, urban hybridization

Abstract

The purpose of this thesis is the theoretical examination of the nature of relationship of public spaces in layers in high-rise dominating environments and the exemplification of the analysis findings by means of a practical project at Central Green Space in Lujiazui, Pudong.
First, to understand the key urban problems of modern cities, accessibility, usability and multifunctionality, certain defects and benchmark achievements of different types of public spaces and tower typologies are examined in the literature review and through five case studies to outline previous strategies with a related scope.
Second, the hybridization of the urban fabric blurs building blocks. To respond to the ongoing climate variability, urban densification and changes of human needs, the 'Layered Public Space' (LPS) model is introduced to define the spatial stratification process with parameters.
The execution, documentation and analysis of the interviews of three practical architects enriched the understanding of the examined duality of public space and high-rise buildings and helped to get insight in the contemporary alteration.
The author tries to gain an interdisciplinary perception and to identify targets interested in the practical field of integrating new ground rules and smart landscape into large mixed-use developments to establish an integral service platform.

Key words: multilevel urbanism, layered public space, elevated pedestrianization, urban hybridization

"What we observe as material bodies and forces
are nothing but shapes and variations
in the structure of space and time!"

Erwin Schrödinger

Acknowledgements

I want to thank my parents for everything they have done for me and for their tremendous support. Furthermore, I want to thank my CAUP-Tongji Professor Xu Kai for his help to clarify my ideas for my theoretical thesis and my Professor from TU Vienna Mladen Jadric, who fostered me with my project. I also have to thank numerous peers, especially Harvey Abrams, Matthias Neuber and Jing Xu.
During my time working on my thesis, I could count on experts from the practical field of architecture and want to express my gratitude for their time and helpful inputs to Hongxi Yang, Garett Wang and Hannes Pfau.

Contents

1. Introduction

Modern cities, especially in Asia, have reached a certain density and size for which conventional solutions for urban living need to adapt in order to provide for safe and efficient traffic movement, pedestrian walkability and security control. Direct observations of public spaces in Shanghai, Chongqing, Shenzhen, Hong Kong and Singapore revealed the need for a specification of the term 'public space' according to the massive changes, how people use and experience their built environment. The idea of multilevel urban development is not new as it can be dated back to the 19th century. However, in the past this kind of project mostly foredoomed or stayed a theoretical hypothesis.
This thesis tries to achieve a very practical approach by analyzing previously built projects with certain defects, as well as benchmark achievements. The author has relied upon the expertise of three practical architects in the field of large-scale developments through personal interviews and data collection. The intensive collaboration with these experts, including its documentation, and the analysis of the impact on the city of case studies in the above-mentioned Asian cities are the main focus area of this thesis.

On the one hand, the ground plane gets inexorably occupied by infrastructure and makes it very difficult to allow pedestrian and traffic flows. On the other hand, the buildings we live and work in get ever larger in terms of height and lot coverage, causing the loss of any kind of reference point to the natural landscape. Therefore, integrating artificial landscapes in the sky is necessary to counteract the imbalance of accessible space, the public space. The potentials of these publicly available areas and how they can be integrated and layered is crucial to get to a dense and prospectively sustainable urban habitat. To decrypt our three-dimensional urban framework, the term 'Layered Public Space' (LPS) is established for further categorization. Complexes that contain these layers are defined as 'Multi-Dimensional Tower Clusters' (M-DTC) and consider the future habitat as a true hybrid of public space and built structures, redefining the urban density of cities. When understood as neutral condition, urban density can be defined as a network of relational and dynamic phenomena, having numerous considerable effects on the physics of public space, functionality and complexity.

The present definition of "public space" is vague and, in general, just defined as the "open space that is accessible to people." The author suggest that this definition should be expanded by arguing that public space is a place for social interaction of different user groups, presupposing that the inclusion of all social classes is ensured. Cultural and historical usages of public space are extremely manifold and therefore make it impossible to provide a universal solution, which is also not the intention of this thesis. Over the last century, the understanding of public space as formerly outdoor places with high flexibility shifted radically to a present well defined and programmed indoor area within private

developments. The precursor of these large-scale projects is the single iconic tower demonstrating superiority and affluence, not having the focus on the synergetic values with its embedded surrounding. At the end of the 1990's, simply stacking of uncountable floors adding up to massive towers became an outdated typology.

Due to population growth, climate change, rapid urbanization problems, social-, political and economic change, the M-DTC as high-dense building of the 21st century is a logical consequence facing these ongoing challenges on this planet. The LPS - model needs to be understood as an alternative concept to 'Privately Owned Public Space' (POPS) to categorize public space according to its accessibility, usability and function, rather than ownership.
The definition of both public and private spheres has increasingly been blurred to a re-conceptualized definition of public space and its notion has developed to become more flexible and inclusive. In this way, an interpretation and classification of the level of the "publicness" of public space is aspired.[1] A synergy of architect's design intention, developer's vision and government policy makers approach is key to balance public and private interests.

1.1 Aims and Objectives (Problem Statement)

The primary objective of this pilot investigation is to identify the nature of the relationship between public space and tower structures in high dense environments. The potential of integrating flows of various user groups, tangibles and services across multiple levels are analyzed by data collection, site visits and virtual models for data comparison.
The investigation strategy of the final project site of Lujiazui, Pudong Shanghai was compiled by prior analysis of relevant case studies. Due to the public relevance and its embedding by high-rise buildings, the intended development's program needs to protect the site as a green oasis for Pudong and even has to increase the amount of truly publicly accessible space. Therefore, the LPS model will be exercised and hierarchically structure the area to achieve a special stratification of the urban habitat. The surrounding buildings will be visually and physically integrated to the plot to meet the demands of an M-DTC. A high-rise project directly on Central Green Space is excluded due to public and greening demands.

1.2 Research Purpose and Scope

The tendency of continuous mass urbanization is a logical transformation process due to

[1] Cho, Heng, and Trivic, *Re-Framing Urban Space: Urban Design for Emerging Hybrid and High-Density Conditions*, 4–5.

population growth, climate change and the urban-rural gap. Principally, there are three different scenarios that can consequently occur: horizontal overcrowding (slums), urban sprawl (suburban belt) and vertical densification (vertical city).
The scope of this document encompasses the concept of vertical densification. Specifically, the analysis of the relationship of public space and tower clusters, their impact on the built environment and the reconfiguring processes of public flows.

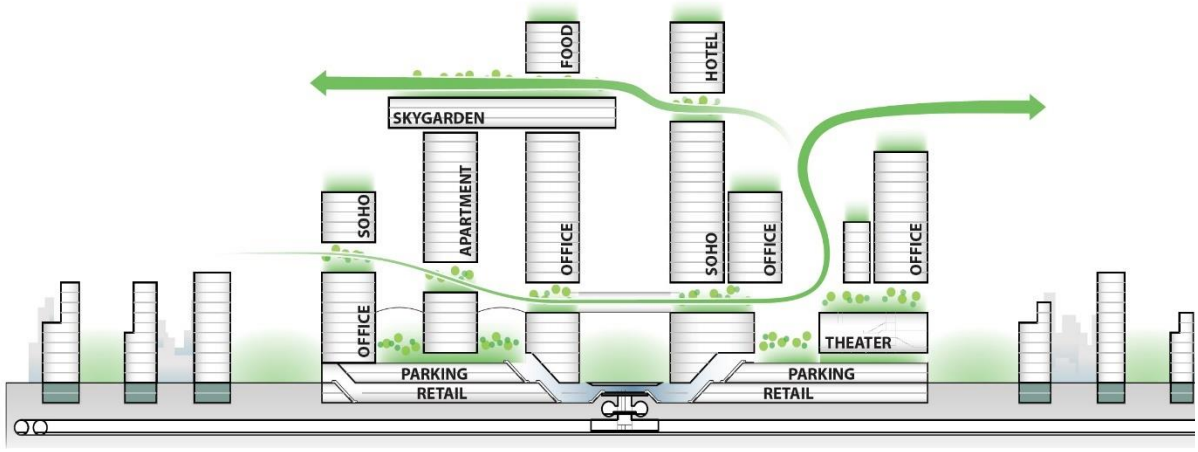

Fig 1: Vertical City (drawn by the author)

1.3 Research Questions

The research approach will attempt to answer two major questions that are interdependent:

- How can public space be defined in layers to elaborate manifold usages to meet the zeitgeist?

- What are the fundamental requirements within tower structures to turn them into multidimensional networks?

1.4 Glossary (Terms and Definition)

Spatial Stratification:
The term ‘stratification’ is commonly used in the field of sociology statistics, to describe the distribution of a population.
A metropolitan area, which can be roughly classified in city center, inner districts and suburbs, is divided into political jurisdictions and neighborhoods. These units are often highly segregated by ethnicity, race, class, income and they can differ dramatically in their physical conditions.[2] With “spatial stratification” the three-dimensional distribution of different physical

[2] Altshuler et al., *Governance and Opportunity in Metropolitan America*, 192.

conditions is defined and be represented by building and outdoor spaces.

Layered Public Space (LPS):

The public spaces of our three-dimensional urban framework can be further categorized according to their level of privacy, noise and speed of interaction. Since the ground plane gets occupied by giant footprints of developments the open space needs to be reproduced elsewhere. Current tendencies in urban development are causing a comprehensive hybridization of our built environment. When working, living and commercial needs are all addressed within one building, the public space should be conceptualized as connecting node for human interaction that is less treated as transitional space but rather as destination for certain activities. The distribution and execution of these different nodes is th primary interest for this thesis.

Multi-Dimensional Tower Clusters (M-DTC):

For this term a 'Tower' needs to be understood as a vertical, but nowadays sometimes also horizontal (for instance the Horizontal Skyscraper by Steven Hall), structure limited to its dimensions in two directions according to illumination and ventilation. These objects have the possibility to intertwine, be stacked or they can add-up to big vertical structures. Within a 'Cluster', these structures are stacked and linked with each other offering further possibilities in terms of usability. The Adjective 'Multi-Dimensional' needs to be understood in several ways. First, by adding and layering ground plane functionalities, the pedestrian is no longer restricted to a two-dimensional plane, but can also transfer in the vertical axis, which ads an additional dimension. Second, it should imply the antithetic attitude to the homogenization of urban concepts, what Michael Sorkin describes as 'one-dimensional fantasies' of planners.[3] Multi-Dimensional Tower Clusters are hybrid complexes mixing numerous functions, neutralizing the need to leave the complex.

Privately Owned Public Space (POPS)

The process of privatization is given when state-owned property is sold to individuals or corporations, in this case land lots. Such spaces are for instance, commercial spaces such as shopping malls and theme parks. Critics argue that this process is an indirect attack on the freedom of speech and results in the erosion of public space in its original sense. Most of the inner urban spaces with economic interests need to be seen as neither 'private' nor 'public, but rather in a gray status between these two. Public schools, public assistance, public transit or public hospitals have additional house rules and restrictions, which also makes a classification difficult.[4] Also places in front of museums or theater, railway stations

[3] Sorkin, *Some Assembly Required*, 3.
[4] Kohn, *Brave New Neighborhoods: The Privatization of Public Space*, 3,7.

and public parks are often part of a private foundation or company, which is in fact owned by the state. The inclusion of managed social spaces has reinforced a hierarchy of spaces within the urban habitat.

Due to safety concerns, the accessibility of high-rise buildings was mainly limited to the observation deck. Modern Visitor Management Plans try to incorporate the public by still fulfilling a certain level of security standards. To generalize these terms, public space is free of charge accessible space even though there are certain house rules to obey. Semi-public space is space that is accessible by paying a fee, while communal space is just accessible to residents or employees. Spaces that are accessible but require a registration for a slot-time in advance and are limited in the duration of stay should be also considered as semi-public space. The borders of private and public spheres blur and even if an effort was made to be consistent, some sample spaces might still not be explicitly categorizable.

1.5 Methodology (Methods and Analysis)

As fundamental preparation for further studies, the demographic change and topic relevant global shifts are examined and introduced.
In the Literature Review, the initial focus will be on historic existing public spaces and tower typologies to understand their respective backgrounds and their ongoing formation of an interdependent relation. On the basis of the existing performance data, the development of the LPS classification was attempted. The assessment of existing handling of physical, operational and logistic barriers influenced the advocated network model. Furthermore, resulting follow-up challenges are highlighted. The engagement of practical architects that have comprehensive know-how of large mixed-use developments extensively enriched the pursued research with informative interviews. By means of a comparative interview study an attempt was made to work out the different positions and assessments. Due to the scope of the whole thesis, 5 case studies are elaborated to illustrate the qualities and approaches of each individual layer of the LPS-model. Making a comparative case study is not intended, since the focus is always placed on one layer of the LPS-model in each case, which is separately highlighted. This was necessary because not ever case study uses the full set of the LPS vocabular and would cause as a comparative case study, a fragmented data which might then have no significance. Certain parameters of all case studies get compared by a juxtaposition.
Finally, an on-site Study of Lujiazui helps to understand in person the usage patterns and pedestrian flows. The study of journal papers and scientific data available of Lujiazui is additionally used to formulate a possible redevelopment strategy of the site. The public character of the plot needs to be circumspectly treated and should play an essential role in the suggested approach.

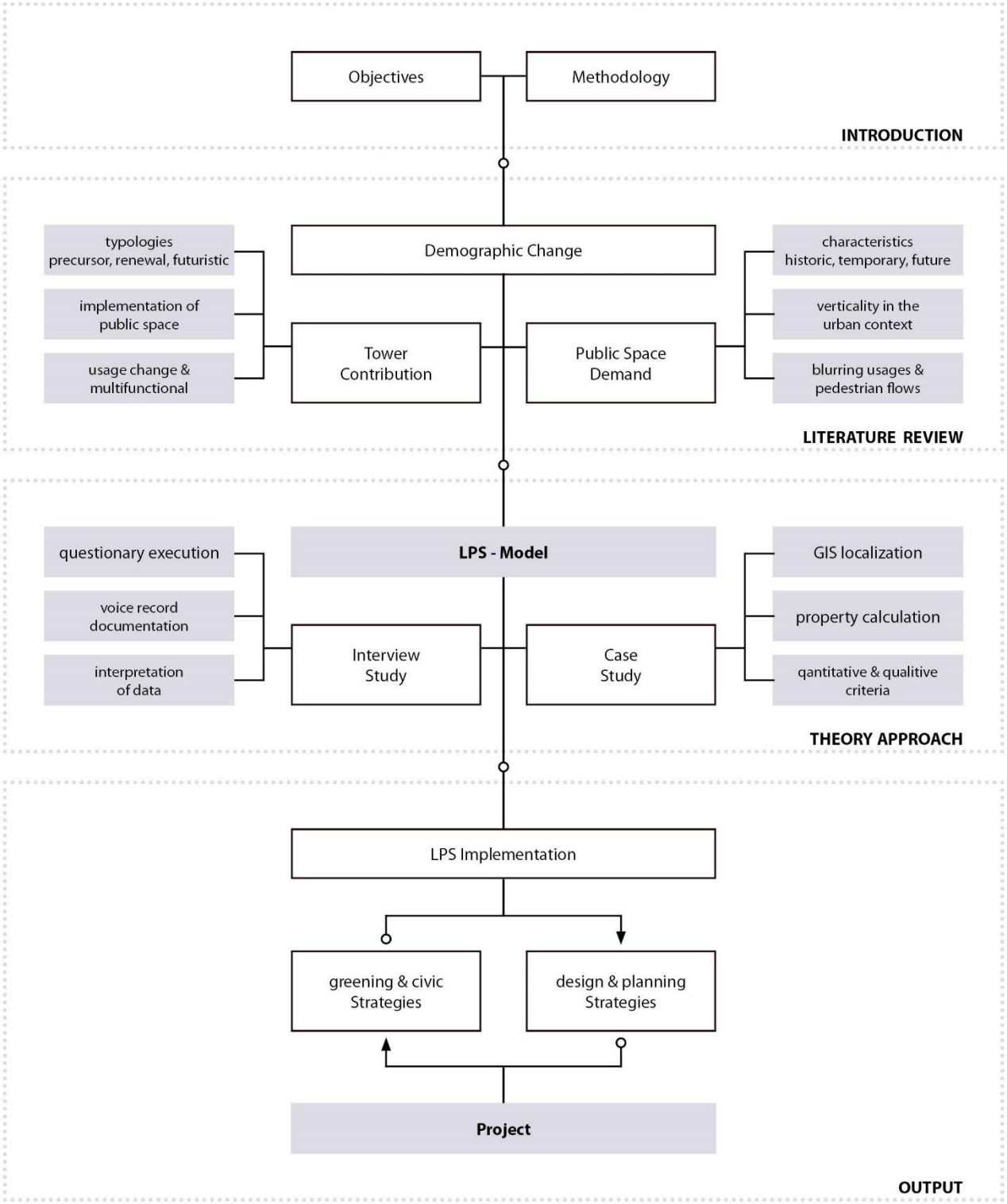

Fig 2: Framework (by the author)

1.6 Assumptions and Limitations

When using the two phrases “realization of the possible” and “the actualization of the virtual” of the terminology of the strategy of Gilles Deleuze to categorizing urban concepts, the focus of this thesis is on practical, redundant and buildable cases. Futuristic ideas are only mentioned when the context makes it necessary.[5]

Due to existing structures and urban concepts, not every city is a possible candidate for the implementation of LPS. It is restricted and interdependent with the inhabitant’s behavior, local predominating culture, natural topography and density. The scope of this thesis is geographically limited to mostly Asian case studies, because analyzed urban phenomena occur differently in Western countries, however it will be necessary to mention also other examples, especially when going back in history. Until the last century the United States set the benchmark in the field of high-rise buildings with iconic skylines like Chicago or New York. For several decades the leadership shifted to especially Asian metropolis and some honorable mentions in Saudi Arabia.

The thesis will also limit its research on projects, books, research papers and other input data that were published before its submission in 2019.

1.7 Significance and Contribution

The synergy of high-rise building and public space is one of the main objectives in today’s hybrid developments. With resource managing, energy generators, recycling systems and the use of new materials, the modern High-Performance Tower (HPT) needs to be further developed towards having a zero-carbon footprint.

Although this thesis will focus on the field of architecture, it extends beyond design boundaries and also incorporates a basic understanding of other fields including engineering (Structural Health Monitoring, SHM), urban planning (Landscaping for Urban Spaces and High-Rises, LUSH), facility management (Destination Control System, DCS) and economics (Social-, Return on Investment calculation, S-,ROI).

The buildings of the future will be the product of multidisciplinary collaborations and Building Information Modeling (BIM)is one of the most promising tools to achieve that. This thesis tries to utilize a wide spectrum of the architectural field that is not limited to design and storytelling.

1.8 Outline of the Document

According to general valid standards, the thesis is structured in a literature review and a theory approach. Each of these sections is split into three parts. Two additional chapters deal with research relevant case studies as well as an individual project on Central Green Space

[5] Cache, *Earth Moves: The Furnishing of Territories (Writing Architecture)*, xiii.

in Lujiazui.
The literature review chapter is separated in the section outlining the contemporary situation of high-dense environments and points out the specifics of the current demographic change. The other two subchapters of the literature review need to be understood as circular referencing of tower and public space, to understand their respective backgrounds and their ongoing formation of an interdependent relationship. Therefore, the second (focus on towers) and the third (focus on public space) chapters are consecutively, in different sections, analyzing the historic background, the evolution of the 21st century and finally recent and future innovations and changes. The synergy of public space and towers fosters in the clustering of towers and the formation of the hybrid building.
In the theory approach the tower cluster gets defined as multidimensional object that cannot be properly described anymore with the classical skyscraper concept base/shaft/crown of Frank Lloyd Wright. The LPS-model distinguishes the tower cluster in transit-orientated core/podium/podium deck/skyspaces/skyplane.
The comparative interview study is comparing the opinions and estimations of three practical architects from Europe, USA and China to get an insight into how the actual building industry is dealing with upcoming evolutions. While in the theory approach the potentials and weaknesses of each layer is examined, the following case study chapter is outlining every layer separately on a relevant building.
Finally, a project formulates a possible redevelopment strategy of the Central Green Space in Lujiazui. Currently, it is a publicly accessible park with accessibility issues and needs to be further integrated into the urban fabric. The handling of public interests and pedestrian flows is treated very carefully to improve Central Green Space and enable it to become the beating urban heart that Pudong needs.

2. Literature Review

2.1 Contemporary Situation of High-Dense Environments

2.1.1 Demographic Change

The incontrovertible alteration of economic, political and social dynamics is driving people into the cities and causes a rapid urbanization by the global shift of our age. The first city crossing the one million inhabitants mark and beyond was Beijing around 1800. One century later, already 16 cities reached this figure. The number exploded to 378 cities by 2000 and it is estimated to almost double by 2025.[6] In 2018, 23% of the global population, in absolute numbers 1,7 billion people, lived in a city with 1 million or more inhabitants. This value will

[6] Schröpfer, "The Dense and Green Paradigm," 12.

increase by 5% within the next 7 years. The world's population living in urban settlements already surpassed the 50 percent mark (2018: 55,3 Mio.) and will increase to 60 percent in 2030. The population of Delhi will increase by more than 10 million by 2030 and Delhi will overtake Tokyo as the world's largest city. Japan's population will decline by almost 900 000 inhabitants, which will drop Tokyo from the top of the list and will cause Osaka to drop out of the list of the 10 largest cities of our planet. This will make China the only representative with two cities, Shanghai (2018: 25,5 Mio. to 33 Mio.) and Beijing (2018: 19,6 Mio. to 24 Mio. in 2030), in this list. Furthermore, the move up of Kinshasa (DR Congo, 2018: 19,3 Mio. to 22 Mio) causes a drop of the number of Asian representatives to 6.[7]

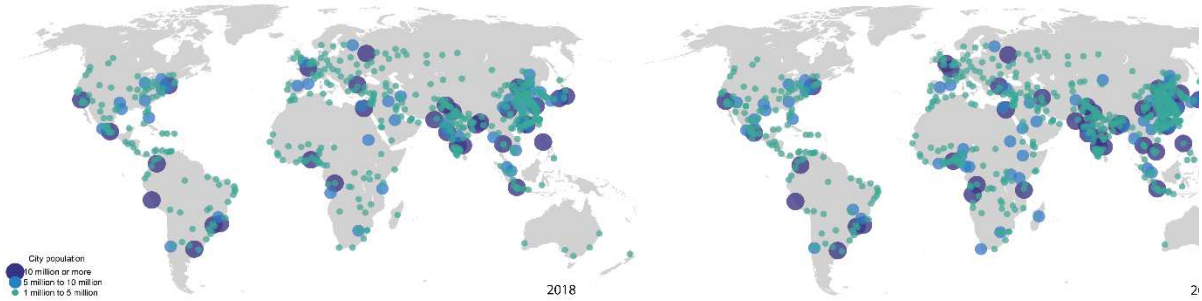

Fig 3: Cities with 1 million inhabitants or more, 2018, 2030 (United Nations, 2018, p.2)

Between 2015-2030, 85% of the global urban population increase is projected to occur in Africa and China. In the past 5 years, governments, in especially less developed regions, adopted the exercised policies and strategies to regulate the spatial distribution of rural and urban population.[8]

2.1.2 Determination of trend-setting Developments

The ongoing urbanization process is affected by drivers in agriculture, energy supply, drinking water, ocean utilization and human health. The global population and per capita incomes will grow, while the number of undernourished people will decline from topical 650 to 300 Mio., in 2030. Consequently, the global agriculture and food production is projected to increase by 50-60%, followed by an increase of global water demand by 25-40%. By 2050, the changing rainfall patterns will double the pressure on regional water availability. This puts pressure, especially in Asia, on the non-renewable groundwater reserves.[9]
The energy consumption is estimated to continue growing on an average level of 2% each year. In order to meet these increased demands, the energy resources will depend upon 80% in fossil fuels, a potential disaster. The Global Energy Assessment (GEA) is trying to counteract this development by examining future energy pathways. The declared goals are

[7] United Nations, "The World's Cities in 2018: Data Booklet," 1–4.
[8] United Nations, "Policies on Spatial Distribution and Urbanization: Data Booklet," 1–5.
[9] van Vuuren, Calvin, and Bouwman, "Pathways Toward Sustainable Development," 486, 490.

to stabilize the global climate change to 2 °C compared to the pre-industrial level, to enhance a sustainable resource application and to try to eliminate ambient household and air pollution.[10] The building industry plays an essential role in the greenhouse gas emission. The cement manufacturing on its own is responsible for 5% of global anthropogenic greenhouse gas emission, however typically just 10-12% of concrete is cement.[11] Comparison and research on other materials should enable the elaboration and demonstration of CO_2 potential savings, including economic consideration.

Addressing these drivers can only be achieved in a reasonable amount of time when we incorporate problem solutions within our built environment and make untapped potentials accessible. This can be reached by active renewable systems, for instance, by waste energy harvesting, vertical greening, urban farming, vertical wind turbines and solar energy plants.[12] The popularity of mixed-use high-rise buildings in all its different forms and occurrences of hybridization will further increase. When cities like Shanghai have an economy that achieves a double-digit growth for over a decade, the growth of a suburban belt around the city is inevitable. However, the strategy to focus development and renovation on CBD areas helped the city to work as a dynamic network. Today Shanghai is not struggling with the same amount of center core weaknesses than to the extent visible in many American cities caused by sprawl. A unique aspect to developments in China is a significant involvement of the government in every project. There are pros and cons coming with this behavior, but it is definitely ensuring the protection of public interests and it is an important factor for China's upswing.[13]

[10] Johansson et al., *Global Energy Assessment: Toward a Sustainable Future: Key Findings Summary for Policymakers Technical Summary*, xii–xv.
[11] Carter, "Sustainability in the Cement Industries and Chemical Admixtures," 27–29.
[12] Imam and Kolarevic, "Towards Resource-Generative Skyscrapers," 162.
[13] Portman, "30 Years in China: An Architect/Developer's Perspective," 231–33.

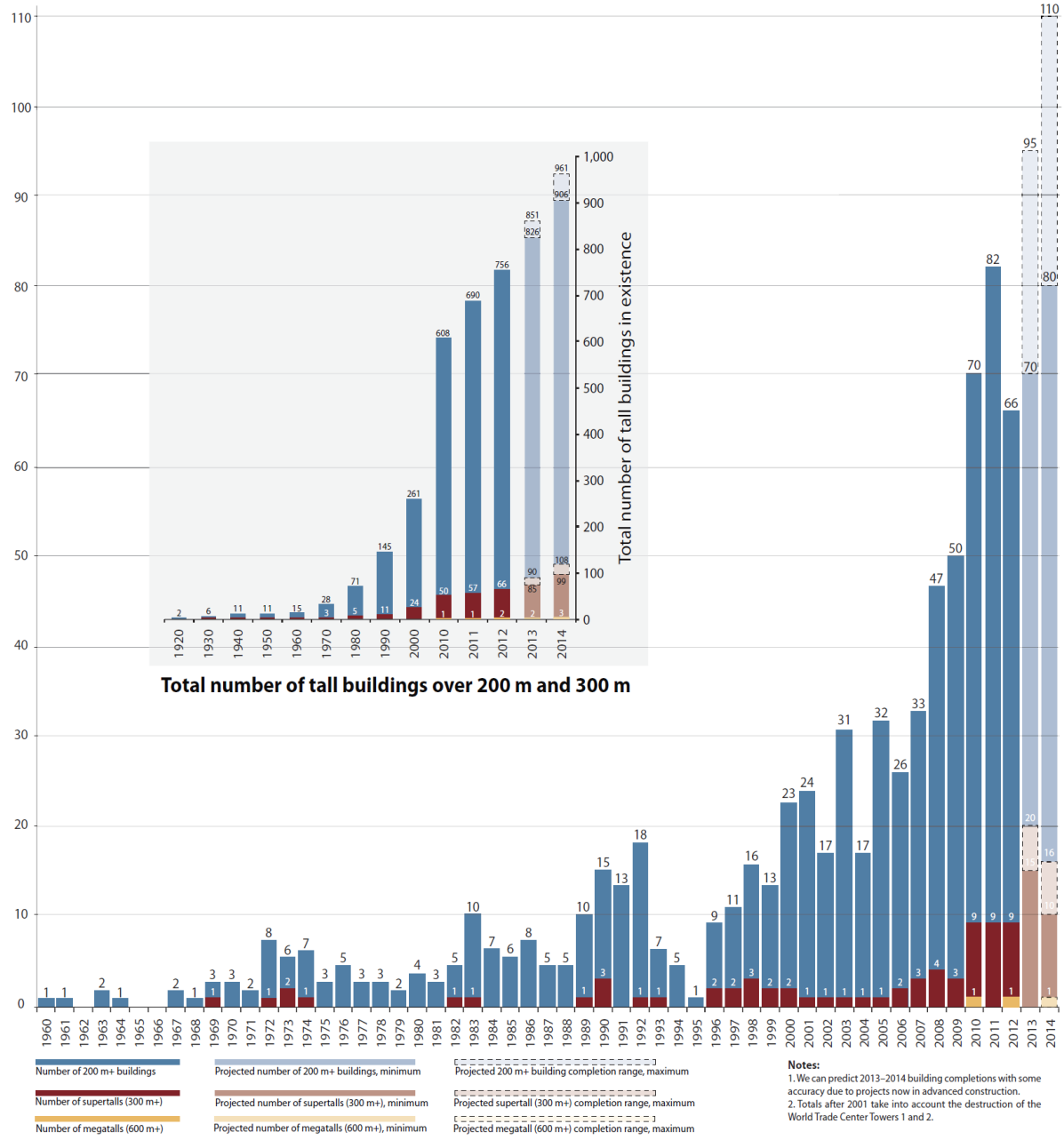

Fig 4: tall buildings completed each year over 200 meters (656 feet) (King and Wong, 2013, p.159)

2.1.3 Demands for New Principles of Large-Scale Projects

In the last century, the modernist movement radically changed our urban life by rejecting the city space. Their approach, which became dominant in the 1960s, shifted from the European building block to the focus of the individual tower.[14] For a successful concept of a large-scale development environmental, social and economic aspects need to be elaborated by a multi-

[14] Gehl, *Cities for People*, 4.

scale, integrated, interdisciplinary approach.[15] An alternative to the singular, sculptural object, is the tower atop a podium topology, which is clustering several usages and makes the building an introverted, self-contained and privatized development. Research on lifestyle, social interaction, construction technologies, and real estate economics are required to rethink the dense city block as 3-dimensional cluster. The building block gets reshuffled by stacking, linking, and bridging building volumes of different functionality and it enables the establishment of a horizontal and vertical urbanity.[16]

> *"If we are to progress, we must take lessons from the mega-city, not the Italian hill town, nor the American pre-industrial village. We must study the airport, the mega-mall, the convention centers, the enormous parking lots and structures, the freeways and their interchanges … for an understanding of current needs, contemporary behavior, and real economic necessities. We need not accept, but we must understand the powerful patterns that shape the city today"* [17]
>
> Moshe Safdie

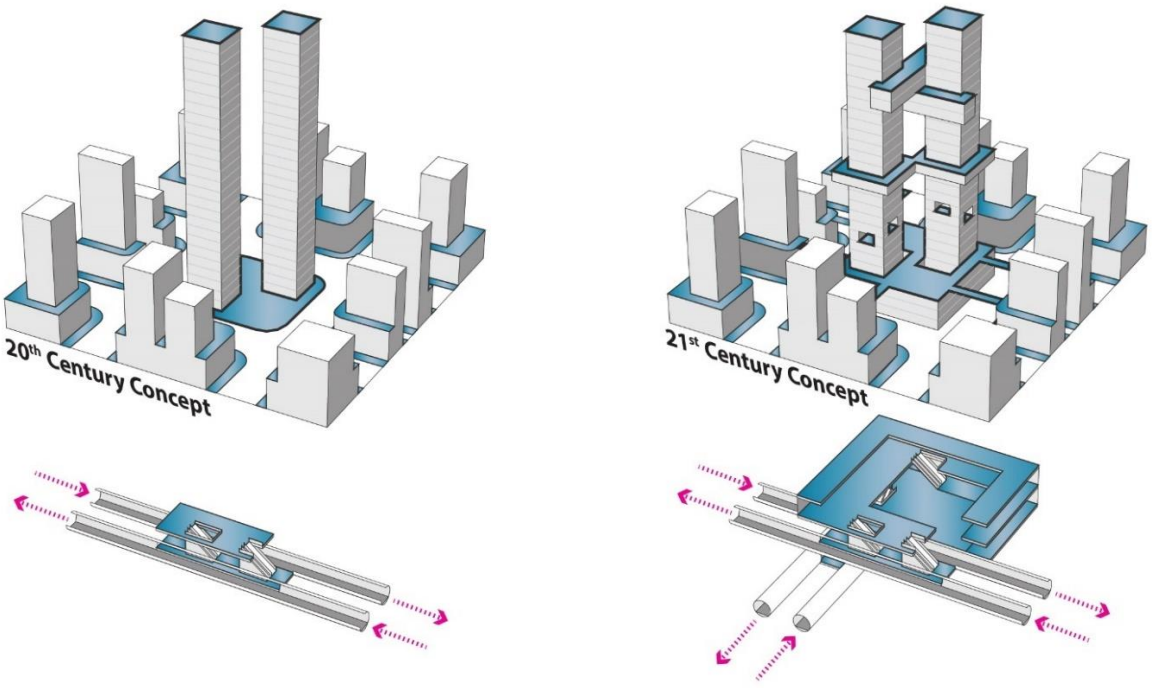

Fig 5: Change in Vertical Urbanity (drawn by the author)

2.2 Contribution of Tower-Structures

2.2.1 Historic Local Value of Tower Typologies

The wish to build not just cities but also tower structures seems to be a fundamental pursuit

[15] Regan, "Systems Approaches for Global Transformations: IIASA Research Plan 2016-2020," 9.
[16] Safdie and Lubin, "Dense Urbanism: The High-Rise Tower as a Building Block for the Public Realm," 88.
[17] Safdie, *The City After the Automobile: An Architect's Vision*, 8.

of mankind and is already mentioned in narratives of pre-historic scriptures.
The tube in compression is conceptually seen as the chief element that specifically constitutes the tall building idea. Together with the frame construction method and the curtain wall, the fundamental concepts to build slender and tall structures were found.[18] In Egypt, Mesopotamia and the Far East, evidence was found that tall structures functioned as stairways to God in a literal sense and are referencing to human tradition and rituals.[19] The Tower of Babel tells the story of the building process of a tower made out of brick and bitumen. This man-made structure should top in the heavens to create a wide recognizable monument and to make a name for its builder.[20]
The content of the city can be classified in 5 typical physical forms referred to as paths, edges, districts, nodes, and landmarks. Main interest is given to the relationship of the node as strategic spots where paths are crossing in a city. These intersections mark the necessary immediate proximity of a point reference as a physical object, the "landmark".[21] Reasons for tall structures included saints or hero worship, cultural features, military purpose or serving as a guidepost.
The Lighthouse of Alexandria (283/2 BC) is a true multi-functional building. The Egyptian coastline has a low-lying monotony, almost devoid of towering topography. This makes it difficult to distinguish features and to identify the Nile Delta from the distance. The Lighthouse of Alexandria is one of the most iconic examples combining beauty, practicality and visual landmark functionality of the twin harbors. The height of the tower has reached over 100 meters and the beacon could have been seen for up to 300 miles. Besides that, it also served as splendid watchtower and communication device. Incoming ships used flashing lights to interact with the tower long before pulling into the harbor.[22]
The ancient perception of Chinese people was based upon the vision of a dynamic sky and a static earth. This view of the world results in the design language of ancient Chinese architecture, where a circle and a square are representing heaven and earth respectively. To investigate the celestial theory called "earth's core" and to institute a standardized calendar nationwide, observation stations across the country were built. Even though certain significant observations of scientific importance could be made, contemporary ideologies were influencing the interpretation of the data. The Gaocheng Astronomical Observatory (1276) located in Denfeng is considered as one of the oldest observatories in China and was used to make round-the-clock observations of the sun and the stars. The tower platform is made out of brick and stone and tapers all the way to the observation platform. Most features of the complex sundial mechanism like the 'tall ruler' and 'heaven-measuring ruler' are

[18] Peters, "The Relative Value of Invention and the History of Tall Buildings," 26–29.
[19] Graham, "Tall Buildings as Symbols," 117.
[20] *Old Testament*, bk. Genesis 11, 1-9.
[21] Lynch, *The Image of the City*, 46–48.
[22] Miles, *A Companion to Greek Architecture*, 450–52.

located on the northern wall and perpendicular on the floor.[23]
In the Dong villages in the south of China, the 'heart of the village' is the Dong Tower of about 20 meters in height, which is used as 'council house'. Generally, no upper floors are integrated. The primary habitation occurs on the ground floor as the main hall. It has no sense of enclosure and smoothly merges with the external public square, which is surrounded by private housing. The tower is based on a multi-eave, timber frame structure and defines the village skyline with its umbrella like appearance. Visually, it celebrates the village pillar from a structural point of view. Originally based on the single-column tree structure, later it transformed to a four- or six-column structure.[24]
A tower typology of private residential purpose is the 'casa torre'. It represents an inner urban tower typology first mentioned in 954 in Toscana, Italy. The precursor of the residential tower (torre d'abitazione) was the fortress-house tower (torre gentilizie), which was inspired by rural fortress architecture and can be ascribed to the 12th century.[25] San Gimignano has, beside Florence, Bologna, Siena, Pisa and Lucca, numerous fortress-house towers and is well known as the 'Manhattan of the Middle Ages'.[26] The desire for individual prestige and family status by building the highest symbol on mini plots has topped out physical boundaries in the 14th century. Massive shading issues and safety concerns became an ever-growing problem. Zoning boards or planning commissions have not been established yet and due to their absence, catastrophic failures of the towers were inevitable.[27] An exceptional role plays the Torre Guinigi (1400-30 reconstructed), which has a hanging garden with four holm oaks on top. Originally, it was part of the family headquarters of the city regent Paolo Guinigi. Today the 44m high tower is open to the public and offers an observatory on the top. Many other medieval high-rise buildings were taken down and new, private tower constructions, were forbidden.[28]

2.2.2 Precursor of 21st Century Tower-Structures

Due to population and city growth, the capacity of buildings was out of balance with the demand for livable and affordable space within the city center. The analysis of representative towers that are dealing with public interests shows that in the past the ideas and solutions to current questions about scale, connectivity or accessibility have already been put into practice. During the Modernism era, many public amenities were canceled by rationalization.

[23] Wang, *Geo-Architecture and Landscape in China's Geographic and Historic Context: Volume 1 Geo-Architecture Wandering in the Landscape*, 7, 33–42.
[24] Ruan, "The Dong Tower," 75–80.
[25] Tragbar, *Vom Geschlechterturm Zum Stadthaus*, 46,139,323.
[26] Kothmann and Bühler, *Toscana: Handbuch Für Individuelles Entdecken*, 256.
[27] Graham, "Tall Buildings as Symbols," 117.
[28] Kothmann and Bühler, *Toscana: Handbuch Für Individuelles Entdecken*, 423.

To many historians the presentation of the first steamed powered elevator with safety device by Elisha Grave Otis in 1853 was the single most influential factor in the development of the modern city.[29] Early tower designs had to work with the existing formal building vocabulary and operated with a style ranging from Neoclassical to Gothic. Louis Sullivan is a representative of a group who relied on a more original variation composed of a base, middle and top, or crown. The base is made accessible to the public and is thought as part of street life. The concept effectuated the generating of buildings that are enabling the pedestrian to perceive a continuous public space on street level.[30] Early examples to expand the pedestrian condition vertically can be seen in the theoretical concepts from Sant' Elia to Metropolis, to explore the unique potential of the "streets in the sky".[31]

At the end of the 19th century, in New York and Chicago, the idea of the 'skyscraper' represented the most promising solution to the space problem. However, this was in contradiction to the former notion of urban decorum, affected congestion, cast shadows and became an instrument of advertisement. Subsequently, a radical transformation process of cities' skyline and profile was the resulting consequence. From the beginning the greatest evidence of concern was on the relationship of the skyscraper as object and the public domain.[32]

Due to the increasing complexity of the three-dimensional shape of the skyscraper Carol Willis propagandized the 'aesthetic of simple, sculptural mass' to overcome the earlier styles, which could be criticized as 'short buildings made taller with additional stories'.[33] The Singer, Metropolitan Life, and Woolworth Tower tried to outperform their competitors in height, urban profile. This race radically changed the skyline of New York. The Woolworth Tower (1913-30) is a composition of an office block from which a graceful Gothic tower extends. It was designed by Cass Gilbert and he could place his trust on Gunvald Aus's engineering skills. The Tower became the world's tallest building from its completion in 1913 until 1930. Groundbreaking for its time was the integration of a gracious public lobby and an array of public and semi-public interior spaces located throughout the whole building on several floors. The function of these spaces ranged in usability from a shopping arcade to a health club and a proposed downtown club to a spectacular pinnacle observatory. The style of the individual areas varied in character representing numerous styles from all parts of the globe and simulated the experience of cosmopolitan traveling while offering the comfort of a 'city within a city'. This made the Woolworth Building an urban destination and predicted the scale and character of the setback towers of New York in the 1920s, which set new standards for

[29] Edgett, "Vertical Circulation: Past, Present and Future," 329.
[30] Safdie, *The City After the Automobile: An Architect's Vision*, 56.
[31] Safarik, "The Other Side of Tall Buildings: The Urban Habitat," 22.
[32] Fenske, "A Brief History of the Twentieth-Century Skyscraper," 13.
[33] Al-Kodmany, *Eco-Towers: Sustainable Cities in the Sky*, 6.

tower's relationship with the city.[34]

In 1916, the first zoning law ordinance, better known as the 'setback law', was introduced as a necessary consequence because of buildings like the 42-story Equitable Building (1913-15) in New York. It forbids the continuous wall from base to top and should counteract the 'canyon syndrome' to ensure daylight conditions at the bottom for the public realm. It caused a more dynamic skyline and had a decisive effect on both the outside and inside of the tower mass. The terracing and stepping back from the streets generated outdoor and indoor spaces of different quality and let rise a new generation of ziggurat-like towers. One of the most iconic buildings of this time is the Rockefeller Center (1931-40) in New York with comfortable outdoor spaces and the domain of the public realm was naturally extended into the building by secondary pedestrian precincts and piazzas.[35]

In the 1950s, the modernism phase was started by the European school represented by Gropius, Mies van der Rohe and Le Corbusier. Critics generalize their design approach loosely under the rubric of the International Style, which aimed to find a universal model for global application that is independent of local constraints like local climate or cultural identity.[36] The ground plan is used as a certain kind of a stage for the new office buildings, which evolved an entirely new role in the urban city design. The building as sculptural object is defined as an independent entity in the city than being part of a public realm having a singular, simple and undifferentiated skin from where it touches the ground and meets the sky. Due to economic optimization and minimalist vision of repetitive floor plates and simple massing, human needs and social sustainability didn't play an essential role.[37]

In contrast, Hugh Ferris sees the Modernism phase as evolution from the 'wedding cake' typology. The 'slab' based massing was propagandizing the minimalistic three-dimensional 'envelop' to the full and added the ground floor to the street realm by lifting the masses and allowed shaded breathing spaces with vistas. One example of this modern version of the ancient plaza is the Lever House (1951-52) in New York designed by Skidmore, Owings & Merril (SOM).[38] The horizontal base block of the tower is suspended from the ground floor and occupies almost the whole lot. In the middle, it opens up to a courtyard and creates a covered public plaza with free passage between the streets.[39] Problematic is the passage below the low horseshoe shaped podium, which enables pedestrians to enter the courtyard. Richard Sennett describes it as 'dead space' due to the lack of provided function and diversity of activities to intermix the people. The ground floor is treated by planners just as a function of motion of a 'traffic-flow-support-nexus' for the vertical whole and has degenerated

[34] Fenske, "A Brief History of the Twentieth-Century Skyscraper," 17–19.
[35] Safdie, *The City After the Automobile: An Architect's Vision*, 57–58.
[36] Al-Kodmany, *Eco-Towers: Sustainable Cities in the Sky*, 11.
[37] Safdie, *The City After the Automobile: An Architect's Vision*, 58–59.
[38] Ferris, *Power in Buildings; An Artist's View of Contemporary Architecture*, 52.
[39] Oliveira and Pisani, "Privately Owned Public Space: POPS in New York City," 119.

into a derivative of pass-through movement area.[40] To improve the public image of the Seagram Company, a conglomerate company specialized in the spirituous beverages industry, Mies van der Rohe placed the corporate headquarters, the Seagram Building (1953-54), with a plaza setback of 90 feet (about 27,5 meters) from the plot line and created a recognizable public plaza located in front of the building to achieve a positive implication on the urban fabric. The project caused the revision of the Zoning Resolution of 1916 and resulted in the city's FAR (floor area ratio)-based code in 1961, which significantly shaped the future of the city of New York.[41] The street pattern consists of elongated rectangles, with streets and a building depth of 100 feet (30,5m) on the long side. In contrast, the short side is facing avenues and the city blocks have a building depth of 125 feet (38,1m). This extra lot depth enables the building to set back from the avenue and allows the city block to open up to a plaza. In turn, the 'plaza bonus' allows to add square meters in the amount of 2 FAR to the overall FAR of the tower.[42] In general, today this kind of public-private partnership is a significant strategy in urban development. However, due to differences of public and private interest, Privately Owned Public Space (POPS) caused some tension. Using this strategy, the Hyatt Regency Atlanta (opened in 1967) is an example of unconventional atrium designs that was chosen based on consideration of financial evaluation including efficiency and qualitative aspects of the tower. Due to its dimension the atrium with spectacular spatial effects can be considered as externalities offering bars, restaurants and even nature conditioned in the interior space of the hotel.[43]

For Jane Jacobs, traditional sidewalks or car-based streets were the key elements to interconnect the pedestrian spaces to reach urban vitality. In the 1970s, the 'pedestrian revolution' transformed the morphology of street concepts. Instead of fostering a ground plane unifying all participants independent of their approach and speed, the pedestrian ways were accommodated above and below the street and established a network of skybridges, outdoor spaces, atriums and corporate lobbies.[44] Therefore the 'social skyscraper' is an attempt to interconnect the economic and social life of the city into the tower and tries to overcome the International Style that treated the tower as individual object.[45] The IDS Center (1972) by Philip Johnson in Minneapolis is a mixed-use development and contains a public plaza called 'Crystal Court' with two floors of shops and restaurants and is the social hub of the downtown area. Goldberger sees it as "the skyscraper connected with the agora" and consequently as the marketplace of the town connected to a second story indoor maze of walkways. This is fundamentally changing the pedestrian traffic patterns.[46]

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[40] Sennett, *The Fall of Public Man*, 12, 14.
[41] Fenske, "A Brief History of the Twentieth-Century Skyscraper," 23.
[42] Huberman, *The ABC of Zoning*, 15.
[43] Rice, *Interior Urbanism: Architecture, John Portman and Downtown America*, 6, 41.
[44] Rice, 104.
[45] Goldberger, "Architecture and Society," 107–8.
[46] MnDOT, "Local Historic Bridge Report - Abridged," 7.

In 1956, Frank Lloyd Wright proposed The Mile-High Building of 1580m height, 528 floors and 76 quintuple deck lifts (5 decks on top of each other). Later studies revealed that more than twice as many elevators would have been necessary to meet common practice standards. It also showed the need for a reconsideration of the traffic by breaking down the tower into several stacks and implementing sky lobbies. These neuralgic points within the tower contribute to human interaction. The World Trade Center (WTC, NT-WTC1: 1962-67, ST-WTC2: 1968-73) with its 417m of height is one of the first buildings with this new strategy, which today is brought to perfection in Asian super-tall buildings. Each of the WTC Twin Towers was divided in 3 stacks with an elevator system of double deck shuttles to single deck local elevators.[47] The innovative structure of each of the two towers was based on the 'tube concept' which is using a central core combined with a bracing associated with rigid columns on the perimeter. These sky lobbies disclose the potential to experience communication and recreation differently than in the center plaza or the main lobbies on ground floor of the complex.[48,49,50]

The whole master plan of the urban context of 1979 was prepared by the architects Cooper and Eckstut, which emphasized in its final version a return to traditional forms of city planning. After joining 9 blocks to one giant city block with a center plaza, the gridiron 'street and block' system had to be reestablished to provide greater continuity with existing urban forms.[51] The whole complex is topped on a transit-oriented core with the WTC concourse connecting all WTC buildings in the underground and enables to enter the PATH station protected from environmental influences. Advertised with its slogan 'the greatest bar on earth', the roof top restaurant 'Windows on the World' and the observation deck made the building accessible to the broad population. This was one important factor that helped to shape its mythos and after its tragic collapse, being immortally memorized in the minds of the people around the globe.[52]

The Petronas Towers (1996) of 452 m height in Kuala Lumpur are also part of a whole complex called 'Kuala Lumpur City Center' (KLCC), which is intended to be a northern node. Beside the twin towers it includes the Petronas Concert Hall, a six-level shopping mall, a luxury hotel, two additional office blocks and a public park, which includes a 'prayer hall. The skybridge that joins the sky lobbies of the 41st and 42nd floor gives the Petronas Towers their well-recognized silhouette and it defines a symbolic 'gateway' that shaped Malaysia's image worldwide as a developed and modern country.[53] The 88 floor towers are divided into two

[47] Barney and Al-Sharif, *Elevator Traffic Handbook: Theory and Practice*, 175.
[48] Fenske, "A Brief History of the Twentieth-Century Skyscraper," 26.
[49] Wilkinson, "Aesthetics, Symbolism and Status in the Twenty-First Century," 34.
[50] Hanson and Courtenay, "Islands in the Sky, Cities on the Ground: The Public Realm and Its Impact on Tall Buildings," 111.
[51] Kohn, *Brave New Neighborhoods: The Privatization of Public Space*, 112.
[52] Skillings, "World Trade Center Photos."
[53] Bunnell, *Malaysia, Modernity and the Multimedia Super Corridor: A Critical Geography of Intelligent*

stacks. They use, in contrast to the World Trade Center where means to travel is achieved by shuttle lifts, overlapping zones within the transfer floors on 23 and 61/62.[54]
In the 1990s, the analysis of the earlier understanding of the notion of civility heightened the attention of urban neighborhoods and their importance to establish a public domain in the sky. This urban potential resulted in the concept of the 'green skyscraper', which integrated communal spaces like interior plantings, sky courts and shaded roof terraces into the tower structure itself.[55]
The Commerzbank (1991-97) in Frankfurt has 60 floors and it is almost 300 m high. It is meant to be the world's first ecological high-rise tower. Each office is designed to have natural ventilation with openable windows. The social eye-catchers of each four-story cluster of office floors are the winter gardens spiraling up the tower. All of these gardens are visually connected to the central atrium, which is achieving a natural ventilation chimney effect of the inward-looking offices. To achieve a relationship with the surrounding neighborhood, the perimeter edge of the adjacent buildings was rebuilt and restored. The whole city block of the Commerzbank is opened up by a diagonal gateway route in the form of a winter garden and provides restaurants, cafes, performance spaces and exhibitions.[56]
Throughout history, tall buildings have been used as a marketing tool to portray the vitality of a corporation, like famously the Petronas Towers and CCTV Building, or are referring directly to the name of their eccentric founders, like Winfield Woolworth, Richard Warren Sears or Donald Trump. Cities have noticed the tremendous importance of not only its skyline as a whole, but nowadays also use the impact of corporate branding of the location by naming major signature buildings after it, like Taipei 101 or Shanghai Tower.[57]

2.2.3 Focus of Next Generation Towers

The global environmental and social consciousness is increasingly challenging the precursors of tall buildings of the 20th century. The ongoing shift in tall building design is causing a re-evaluation of functional program, organization, architectural vocabulary and structure. Observation decks turn into green courts absorbing solar radiation and beside intending to be a social condenser, it has also a positive effect on the necessary amount of artificial cooling and results in minimized running costs. These approaches can increase the sellability of real estate, causes a vertical densification and fosters economic benefits, which in most cases is, of course, the driver of future developments.[58]

Landscapes, 66,67,69.
[54] Barney and Al-Sharif, *Elevator Traffic Handbook: Theory and Practice*, 174.
[55] Fenske, "A Brief History of the Twentieth-Century Skyscraper," 27–29.
[56] Quantrill, *The Norman Foster Studio: Consistency through Diversity*, 204.
[57] Wood, "Tall Trends and Drivers: An Overview," 8.
[58] Pomeroy, *The Skycourt and Skygarden: Greening the Urban Habitat*, 64.

China's earlier narrow production orientated perspective of urbanization in major agglomerations shifted to an urban platform for a society, where the focus is set more on the service industry. While the United States was dominating the 20th century with their skylines, the present ongoing evolution in Asia resulted in taking over the global leading role in the high-rise industry. Political events like the Urgent Improvement Zone Legislation of 2002 in Tokyo and the handing back of the territory of Hongkong from the United Kingdom to China in 1997 mark a general drift towards a turning point and enabled Asian nations to become completely competitive. Around that time, regional economic crisis helped former crown colonies like Shanghai and also other cities to turn into metropolises with an important trading position in the East Asian market. The Chinese post-modern approach of 'one size fits all' tower cluster typology is getting less put into practice in major urban zones. Influencing this change is the rising living standards and the fact that the focus is less embossed on industrial, but on the service industry.[59] Having arrived in the 21st century, the high-rise building is undergoing a transformation in many ways. The economics of tall buildings support the generation of real mixed-use habitats. Paul Goldberger is pointing out that the major challenge is to guarantee the connections that turn the high-rise building into a complex that possesses genuine urban qualities.[60]

In 2009, more people lived in cities than in the country, which makes humanity an urban species from that time on. This upwards trend is expected to continue and offers new possibilities. There is a direct dependence of density and the size of dwelling units. Even though the high-rise building is more resource intensive than horizontal sprawling, it is more durable in the long run. The sharing factor increases in dense regions the efficiency of the subway compared to the individual traffic automobile. Tall buildings are, especially in Asia, often not standing alone objects, but are integrated into more efficient utility infrastructures and as a consequence can rely on district heating and united cooling systems. In this context, the high-rise building has a tremendous sustainability potential that is ever increasing in mixed-use developments, offering the amenities for a global operating society, reducing transport demands and balancing out peak loads of resources by sharing them. In the tall buildings of tomorrow, human comfort, health and productivity play an essential role for the proper operation and function of the whole complex. This can just be addressed by finding solutions for the disconnection of ground floor and individual units in the sky and requiring innovations in design, structure and demands technology-based building systems.[61] Modern structural solutions for towers call for a performance-based design including the optimization of in-service structures. This approach predicates on a life circle assessment analysis to minimize the total amount of costs during the service duration of a building, which

[59] Rowe, *Emergent Architectural Territories in East Asian Cities*, 7–9.
[60] Cooperman, "Time's Arrow: Tall Moving Targets And Social Research," 56–57.
[61] Cook, Browning, and Garvin, "Sustainability and Energy Considerations," 145–46.

consequently results in a sustainable development of the society. Major effort is put into the monitoring of dynamic and static response to verify the robustness by vulnerability analysis.[62] Therefore, the Burj Khalifa (2004-2010, 828m) is a pioneer example having installed a comprehensive full-scale Structural Health Monitoring (SHM) system, which was the basis for future Intelligent Building Management System developments.[63] In contrast to the 'bundled tube' concept of the Sears Tower, the Burj Khalifa uses a hexagonal central core which is buttressed by wing shear walls and outriggers. This arrangement results in a Y-shaped cross section. The aerodynamic analysis to minimize the lateral wind load onto the tower resulted in the modular design of the curtain wall facade and defined the position of the setbacks.[64] By including this new technical innovations, it is an example of a 'vertical city' stacking offices, residential units and a hotel and offers a number of publicly accessible levels including a mall, a health and recreation annex, exterior terraces, indoor observation decks, sky lobbies, the 'At.mosphere' restaurant and the 'At The Top' observatory.[65] The Guangzhou International Finance Centre (IFC, Guangzhou West Tower, 2005-10, 432m) is a mixed-use complex which is further developing the efficiency of the sky lobbies as semi-public connecting nodes. It offers office space, a luxury five-star hotel and at the top an observation deck. It would overtop the WTC Twin Towers just about 15m, has a totally different appearance but in certain ways has learned some lessons from them. On the perimeter, instead of using a bracing associated with rigid columns, the building can rely on a diagrid structural system which provides gravity and lateral resistance. The central core is made out of a reinforced concrete section and gets continued by a braced frame tube at the top to open up to an atrium for the hotel. In contrast to the elevator and sky lobby concept of the WTC Twin Towers, which were divided in 3 stacks, the Guangzhou IFC is by far more complex. With 3 low zones, 2 middle zones and 2 high zones the tower is divided in 7 local lift zones. The 4 upper lift zones possess sky lobbies that insure the peoples transfer, circulation flows and foster social meeting nodes throughout the whole building. The MEP and refugee floors are located below each of the sky lobby floors to have the ability to place the lift machine room (LMR) in a way that it can support the lower and upper lift zone. The lift shafts contain several elevators supporting different lift. With this concept and the use of double deck shuttle lifts, the lift shaft area is reduced by 50 % compared to conventional systems.[66]

Optimizations in terms of energy efficiency and CO_2 reduction is addressed in the High-Performance Tower (HPT) design approach, which aims to move towards a concept of a 'net-zero' annual energy impact on the city. The approach includes reduction, absorption,

[62] Lin and Huang, *Comparative Design of Structures: Concepts and Methodologies*, 63.
[63] Abdelrazaq, "Validating the Dynamics of the Burj Khalifa," 7.
[64] Günel and Ilgin, *Tall Buildings: Structural Systems and Aerodynamic Form*, 111.
[65] AT THE TOP, "Fact Sheet: Burj Khalifa," 6–10.
[66] Kwok and Lee, "Engineering of Guangzhou International Finance Centre," 61–63.

reclamation and generation as key strategies. To address them, the Pearl River Tower (2007-2011, Guangzhou) has radiant ceilings, double wall systems, photo-voltaic systems and wind turbine technology. Within the four “building portals” of the tower, vertical axis wind turbines are capable of harnessing winds from both prevailing wind directions to generate electrical power. The tower is expected to consume 58% less power than an energy code compliant equivalent building. The double skin facade provides ventilation in the cavity. The outer layer consists out of photovoltaic panels and consequently produce energy, it also works as solar shading device.[67] In contrast, the Al-Bahr Tower (2007-still under construction, 150m) facade is made of a weather-tight glass curtain wall and a dynamic shading system as second layer to insure the lighting control. The umbrella like components are arranged in a honeycomb pattern, which is inspired by the characteristic Arabic mashrabiya pattern. According to daylight conditions and seasons, the solar gain and solar glare adapt. Unique are the provided outdoor sky gardens as open space being hidden behind the dynamic shading system, providing an almost private atmosphere.[68]
To minimize energy usage, the funnel like top of the Shanghai Tower (2008-2015, 632m) features wind turbines providing 300 MWh per year of green energy and collects 20 000 cubic meters of rainwater annually. Together with the recycling of grey water and the use of water-saving devices, the water usage rate decreases by 40% compared to traditional sanitary-wares.[69] 70% of the available fresh water on this planet is used for traditional agriculture and gets consequently polluted. The National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) are working on sustainable food production methods to enable the viability of long-term Mars or Moon missions and beyond. These ‘Closed-loop’ or so called ‘self-contained systems’ are using hydroponic and aeroponic agricultural technologies. These are promising solutions to minimize in extreme cases the damaging side effects of agricultural runoff by 95% on our planet. Vertical gardens, hanging greeneries or vertical farming on facades are facing similar supply problems. Against practical experience of humanity, plants do not require soil intrinsically. The earth is just serving as kind of a physical support system. This cognition reveals the potential of weight reduction and degrades the necessary thickness of soil layers of artificial greening.[70] Singapore’s Urban Redevelopment Authority (URA) introduced in the Landscaping for Urban Space and High-Rises program (LUSH) the Green Plot Ratio (GPR).[71] New developments in high-density clusters need to provide greenery and communal spaces within the building in the same amount as the site area. In Singapore, 2 out of 3 new residential units and 1 out of

[67] Frechette and Gilchrist, “Case Study: Pear River Tower, Guangzhou, China,” 3–9.
[68] Karanouh and Kerber, “Innovations in Dynamic Architecture,” 192–97, 217.
[69] Gu, “Shanghai Tower: Re-Thinking the Vertical City,” 30.
[70] Rassia and Pardalos, *Sustainable Environmental Design in Architecture: Impacts on Health*, 270.
[71] Wong, Hassell, and Phua, “Oasia Hotel Downtown, Singapore: A Tall Prototype for the Tropics,” 14.

2 commercial oriented units are using LUSH incentives.[72] The Oasia Downtown (2016, 191m) is one prototype for building in the tropics and represents the shift from the vertical city to the "garden city". It is a mixed-use tower being split into an upper hotel and club rooms block, as well as a lower offices stack. The cores of the tower are located in the corners and allow the green terraces to become legible human-scale environments in the sky with an almost 360-degree view. Due to the orientation of the windows mainly to the inner sky terraces, the majority of facade square meters are used as vertical foliage. Based on the seasons, rate of growth and other natural circumstances, the density of the green coverage supported by the red structure changes and the changes of the tower itself is reflecting the natural cycle of life.[73] When adding all the vertical and horizontal greening, the Oasia Downtown achieves a GRP of 750%, which significantly multiplies the lost footprint area.[74] The South Beach Towers in Singapore (2007-2016, 2017.5m) are featuring a canopy, which is sheltering the MRT Station and the public plaza from the harsh summer sun. It reduces the ground temperature by 25 °C below the canopy. The towers are covered with an external screen with a louver system to provide horizontal shading. This environmental screen is connected to the canopy and results in a dynamic wavy form that collects rainwater to irrigate the development's LUSH greenery. The towers have several sky gardens that are improving the microclimate by enhancing natural air ventilation and heat exchange to minimize energy consumption. The design forecast of air movement, which was inhibited below the canopy and should not increase like in a wind tunnel, proved effective as demonstrated in analysis and modeling. The comparison of wind speed revealed an almost identical value below and off site as intended.[75]

As parameters for greening are being developed, also the way of how we look at the high-rise building typology need to evolve further. The China Central Television (CCTV) Headquarter (2002-2012, 234m), including a theatre-hospitality center with a hotel and the Television Cultural Center (TVCC), is pushing the skyscraper typology beyond its typical vertical limit. The form of the building incorporates a 'public loop' following a corporate strategy that aims to bring the internal company processes closer to a broad public. By lifting major building structures into the air, the area becomes part of the public realm as the Media Park. Below the 75m overhang of the CCTV is a public plaza for events and entertainment, extending the green axis of the CBD.[76] The linkage structures of the majority of building examples are often minimized to light sky bridges to conserve the slender appearance of the joined towers. Instead, the looped form of the two leaning towers of the CCTV is achieved by

[72] Wen, "A LUSH and Resilient City: LUSH 3.0," 12.
[73] Wong, Hassell, and Phua, "Oasia Hotel Downtown, Singapore: A Tall Prototype for the Tropics," 14–17.
[74] WOHA, "Oasia Downtown," 237.
[75] Schnizer et al., "South Beach Towers, Singapore," 12–18.
[76] Gianotten, Koolhaas, and Chan, "The Public Meaning of Skyscrapers: Shenzhen Stock Exchange and CCTV," 61.

a connection at the base and at the top by a 14 floor 'cranked' cantilevering link structure. Specific requirements for the more unpredictable linking towers in comparison to 'standard' tall buildings got consequently also clarified as 'Complex Tall Buildings' in the Chinese Building Code.[77] The cubature of this building started a serious discussion about justification of elevators going not just vertically but also horizontally.[78] Current research of leading companies (Kone, Schindler, ThyssenKrupp, Hitachi) focus on layouts referred to two-dimensional and three-dimensional systems, which use multiple lifts in the same shaft. The most attractive arrangement is using the same principle as the Paternoster elevator. Hereby elevator cars circulate in two vertical lift shafts in opposite direction. Horizontal sections enable the elevator cars to stop without blocking the main route and can take a shortcut downwards on the other side. Simulations show that this strategy would enable the core to get reduced by 50%.[79] Since buildings get more porous and public, passengers cannot enter any lift car that arrives at specific floors. Therefore, the use of destination control systems (DCS) define the served floors of elevator lobbies or even each elevator separately. Comparison to conventional control systems shows that the handling capacity using DCS is doubling and at the same time it insures the adherence to modern safety rules.[80]
The urban habitat of especially dense city centers has the greatest potential to improve living and working qualities of a large population and to mitigate the boost of climate change. Even though large cities are the main polluters causing the majority of greenhouse gas emission, the per capita emission is significantly lower than other, sprawling environments like for instance the suburban belt of a city. The phrase of Edward Glaeser 'to save the planet, built more skyscrapers' is in this context a clear statement that is radically illustrating this fact.[81]

2.3 Demand of Layered Public Space

2.3.1 Historic Typologies of vertical influenced Public Space

The term 'pure nature' describes the status of complete absence of urbanization and can be seen as the point of origin of the development of an urban reality. The anthropologic and ethnologic consciousness of the first human groups mark the initial catalyst to explore, mark out and consequently name places to define fundamental typologies long before a continuous street pattern was established.[82] First primitives of public space can be dated back to the Neolithic world where boulders were deliberately upended to overcome the

[77] Luong and Kwok, "Finding Structural Solutions by Connecting Towers," 27–29.
[78] King and Wong, *Vertical City: Solutions to Sustainable Living*, 419.
[79] Barney and Al-Sharif, *Elevator Traffic Handbook: Theory and Practice*, 401.
[80] Hakonen, Siikonen, and Sorsa, "Elevator Selection with Destination Control System," 3, 9.
[81] Binder, *Tall Buildings of China*, 8.
[82] Lefebvre, *The Urban Revolution*, 7–8.

forces of nature and served as funeral markers. Complex clusters of these standing stones like Stonehenge were used as calendars for the annual planting and harvesting cycles and fulfilled cultural, spiritual and social purposes.[83] The platonic idea of a construction is described by Vitruvius as the 'rustic cabin', which is made out of wood. It combines vertical supporting columns, horizontal spanning beams and triangular pitching roof elements in a fundamental scheme. While residential buildings of that time were mainly built out of wood, public site for ceremonial gathering represent architectural examples of the transposition of wooden construction into stone.[84]

The agglomeration of these defined places in clusters indicated a spatial grid. The cultivation of the surrounding land fostered an ideology of the farm civilization that slowly and secretly formed an urban reality and the first villages. Lefebvre's diagrammatic illustration of the 'public revolution' starting with the political city and continuing with mercantile city, industrial city and entering the critical zone however presupposes the existence of urbanization to enable the development of public space.[85]

The examined examples of public space include traditional outdoor spaces as parks and plazas and publicly accessible indoor spaces like arcades, atriums and street galleries. Evidence of layered public space or the vital link between the horizontal and the vertical cells of the city are main interest of the analysis of chosen historical precursors. Therefore, outstanding public spaces, which do not have any relationship between horizontality and verticality are not examined in further detail.[86]

The focal point of Greece's past public life was the ancient 'agora', the assembly space of Athens. Even though a lot of Greek cities had an agora, the most referred to is the one in the capital. Until the 6th century (BCE) Athens remained the cultural and educational center of the Mediterranean. The Athenian Agora is basically a large open square of civic life used as a marketplace as well as a lawcourt. A library, a concert hall and a temple with numerous small shrines located in the plane met the cultural, social and spiritual needs. The square is surrounded by the council chamber, archives and public office buildings, the stoas. A stoa is a long colonnade providing long shaded walkways for political and philosophical gathering.[87] The agora was the hub for commercial, social and political life, while the upper city, the Athenian Acropolis located on a rocky enhancement, was the center for ritual and ceremonial events. It's an early example of correlating public areas of different functionality that are in a vertical correlation with each other.[88] Le Corbusier's architectural approach bases on the understanding of the Acropolis as horizontal platform and the column pattern of the

[83] Keating, "Tall Buildings in the Public Domain," 87.
[84] Miles, *A Companion to Greek Architecture*, 488–89.
[85] Lefebvre, *The Urban Revolution*, 14–15, 48–49.
[86] Lollini, "Tall Buildings, Tight Streets," 277–79.
[87] Camp, *The Athenian Agora: A Short Guide to the Excavations*, 4.
[88] Miles, *A Companion to Greek Architecture*, 10.

Parthenon as vertical plane. The geometric superimposition enables the lifted ancient citadel to stand in absolute reference to the 'mass' of mountains in the background. This contrasting juxtaposition of the specific form of the mountains and the generic form of the column pattern results in a dialectic setting.[89]

The strictly rectilinear planned layout of the configuration of the agora and the surrounding buildings as a fully enclosed peristyle courtyard became the accepted norm in Greek cities throughout the time of the Roman Empire.[90] Due to the different urban grid of Rome, the fundamental achievements of Grecian city planning had to be adapted. The streets were too narrow and the houses were piled up to 10 floors to ancient skyscrapers.[91] The Greek plan of a squared forum bases on a ground level with shops between the double colonnades and an upper level with boarded floors as promenade for public gathering. In contrast, a Roman forum also needed to be a sport venue to allow gladiatorial shows. This functionality caused the almost quadratic square of Greece examples to get redesigned in form of rather an elongated rectangle in Rome. For better usability and visibility onto the place, a roomy intercolumniation around the spectacle was integrated on the ground floor. The backstage niches were used for shops and silver smiths. The upper level got programmed with conveniences and areas for public revenue to meet the demands of the growing dimensions of the audience.[92] As part of the Roman forum and in relation with the Piazza, the 'basilica' was the ancient building for jurisdiction. It was oriented to the sun to ensure a comfortable atmosphere to make businesses and negotiations also in the winter months.[93] Later, the basilica of jurisdiction became the fundamental typology for the sacral church architecture in Europe which is basically "a roof over an altar".[94] As the church was built at the central point along the street, it established a surrounding urban fabric with shopping areas, places for meetings and casual observation.[95]

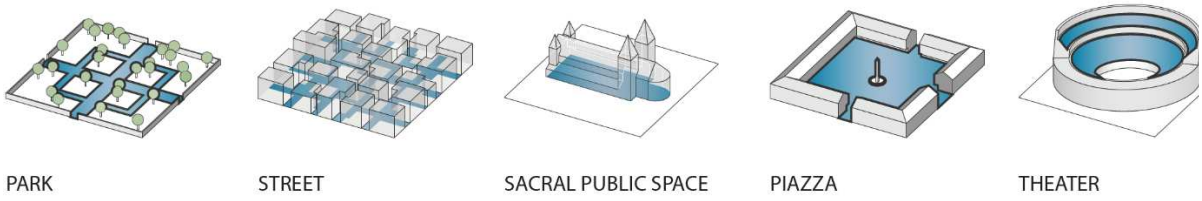


Fig 6: Historic Public Spaces (drawn by the author)

At the end of the middle ages, the eastern marketplace was a result of the successful penetration of the city with merchandise, the market and the merchants. It marks the

[89] Oechsling and Eisenman, *Die Formale Grundlegung Der Modernen Architektur*, 91–93.
[90] Miles, *A Companion to Greek Architecture*, 304.
[91] Le Corbusier, *Towards a New Architecture*, 153–56.
[92] Vitruvius and Granger, *Vitruvius: On Architecture: Book 1-5*, 1:255.
[93] Palladio and Lücke, *Die Vier Bücher Zur Architektur*, 263, 267.
[94] Hammond, *Towards a Church Architecture*, 98–99.
[95] Sennett, *The Fall of Public Man*, 60.

beginning of the transformation from the political city towards a merchant city. The exchange of goods established commercial transposition as urban function. The European cathedral with its belfry and the town hall with its tower are located around the market and are a symbol landmark for liberty.[96] Beside serving as the Mediaeval marketplace, the cathedral squares connected the sacral interior of the building with its imbedded surrounding city. The expression of integration of the inside and the outside got further expressed by deep funnel-formed portals. In contrast, the cathedrals in England are located more conservatively within a precinct, which divides the indoor and outdoor space consciously in two qualitatively different domains.[97]

The origin of the Renaissance square is seen to date back to the reintroduction of the arcaded two-story streets, by way of Venice from the Byzantium. One of the early examples is the Piazza Ducale (1493-95) Vigevano. The tall 'Tower of Bramante' is part of the Castello Sforzesco di Vigevano, which is the dominating landmark of the surrounding and stands slightly apart from the arcaded public square. It overlooks the law buildings and the tower of the Cattedrale dei SS. Ambrogio e Carlo, which is located on the short side of the urban space. The form of the piazza is an enclosed courtyard, which can be entered through open arcs to the street facing the cathedral. The used architectonic vocabulary, which is also evident in the stoa and agora, allow the hypothesis that one success of good public space or gathering place is the simplicity of its elements.[98] Charles Fourier was one of the leading social reformers around the time of the French Revolution and worked on social emancipated concepts, in particular on the arcadelike 'rue corridor, or street-gallery, which is located one level above ground floor. His grand social experiment combined different urban spaces and generated the idea of an architectural interior fusing architecture and civic space.[99]

In the 18th century, the growth of international trading increased rapidly and it caused an enormous change of the urban fabric of Paris and London, which were major ports of Europe. Serving for centuries as a meeting ground, the multi-use square eroded to a place as monument to itself. Increased trade had a great effect on overseas shipping and commercial distribution, but also changed the demographics. Physical and social changes were fostered by trade created jobs in the financial, commercial and bureaucratic sectors. Migration, rural exodus and status breaks between generations changed the centers of the conurbation and the whole economic structure of the city. The density in the city caused the economic structures to establish around it.[100] While this phenomenon had been underway during the 19th century, it revealed an enormous increase intensification in the decades after World War II. The suburban residential growth in the periphery of especially American cities

[96] Lefebvre, *The Urban Revolution*, 7–8.
[97] Norberg-Schulz, *Genius Loci: Towards a Phenomenology of Architecture*, 176.
[98] Giedion, *Space, Time and Architecture: The Growth of a New Tradition*, 48–52.
[99] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 18–19.
[100] Sennett, *The Fall of Public Man*, 56–57.

like New York or Los Angeles increased radically. The mobilization of the man on the street with the first affordable cars insured accessibility. These mushrooming 'crystallization points' were followed by the residential growth. The relatively new form of retail organization in shopping centers provided easy access to downtown department stores in the suburban belt. The prototype of the modern shopping mall is embossed by the progressive vision of the Austrian Architect Victor Gruen. The declared goal was to recreate a vibrant, pedestrian-oriented and multi-use area as nodal point of social life within a climate-controlled volume. His project Southdale Center (1956) in Minnesota is meant to be the first multi-level shopping mall. It was highly influenced by the Galleria Vittorio Emanuele in Milan (1865-67), which was originally used as exhibition hall, and the Parisian arcades. Already at that time, Victor Gruen disclosed the Faustian discrepancy of public interests and private property provision of public place.[101] He understood the complex forces underlying urban development and renewal with an unusual political view combined of socialist idealism and capitalist pragmatism.[102]
The Knoxville Center shows the attempt to turn the mall into a contemporary community center by taking public services to the people. Public authorities, a police station and the city hall of the local and county government of Knoxville, Tennessee, was integrated in the complex. This edge city concept, "City Hall at the Mall" or "Main Street USA", reflect the transformation of the spatial structure of postmodern American lifestyle.[103] Due to the extreme climate in some Asian cities like Tokyo, Singapore and Hong Kong the majority of social and leisure activity is happening inside and adapted the existing model to the "event shopping mall".[104]

2.3.2 Precursor of Layered Public Space

Strategies of three-dimensional urbanism on the scale of the whole city can already be found in the 4th century settled ancient Berber city Ghadames in the Sahara Desert of Libya. In the 7th century, with the conversion of the local community to the Islam, the urban fabric evolves to a gender-segregated multilevel city. While male public interaction and storage occupied on the lower level, the interconnected rooftops created a separated private and controlled domain for women. This bi-level gender separation is a specific created urban morphology obeying the Sharia law and can also be found in other Islamic cities in East Africa and the Middle East.[105] In the 19th century, as European cities grew in density, radical city transformations by representatives like Baron von Hausmann (1809-1891) in Paris took place. In addition to the engineering of utilities and sanitation systems, the separation of pedestrian walkways from motorized multi-lines became one of the key strategies. Henri

[101] Kohn, *Brave New Neighborhoods: The Privatization of Public Space*, 59–60.
[102] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 97.
[103] Kohn, *Brave New Neighborhoods: The Privatization of Public Space*, 60.
[104] Xue, *Hong Kong Architecture 1945-2015: From Colonial to Global*, 127–28.
[105] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 143–46.

Jules Borie and Jules-Antoine Moilin criticized with their social utopias the broad boulevards and the loss of intimacy. They rather enhanced the new scheme of interconnected multilevel urban spaces and social interior developed by Charles Fourier. In their understanding, the multilevel urbanism is an antidote to the emerging cosmopolitan city. The concepts of Eugène Hénard (1849-1923) are less proposing an interiorization of the city, but rather a renovation of the existing urban structures. The urban imbalance was investigated less by social utopian schemes like in early revolutionary movements, but rather shifted towards a detailed analysis and site-specific problem strategies. Hénard combined Hausmann's pattern, flows, and devices with the results of his statistical study of traffic, and its impact on the city for his design methodology. For visual representation of his pioneering work he illustrated the first traffic-flow diagrams for Paris. At the first international conference on urban design, the "Town Planning Conference" in London, Hénard showed an illustrative section, which was a juxtaposition of the house typologies of the 19th and the 20th century.[106]

The old traditional idea of the road being on the same level with the ground in its original condition needs to be reconsidered. As a first principle, the pedestrian walkways and the motorized multi-lines need to be artificially constructed one level above the existing level. As a consequence, a space capable of containing all the installations for any kind of urban services is established and presupposes the neighboring houses to have an additional floor below street level. Any kind of cables, wires and service tubes shouldn't coexist with pedestrians, but should be put under the ground. A public transit-oriented transport system, the "Metropolitan Railway", is a necessity from the standpoint of both economy and speedy transmission. For this system, the traffic tunnels of the railway in Chicago and not the subway stations operating in great depth are seen as prototype. This arrangement would articulate an urban path as basically two street level on top of each other. An upper level for pedestrian and local vehicular traffic is situated on top of a lower level supporting heavy traffic, goods transport, and Metropolitan Railway. In further considerations, this concept leads to the many-storied street, which would coexist with the common many-storied houses and establishes the three-dimensional urban thinking. The 'City of the Future' should have a historic heart with public amenities surrounded by a girdle of lofty towers and permit readily to new transformation processes.[107]

The vertiginous city concepts of Harvey Willey Corbett, Hugh Ferris and Raymond Hood seize the suggestions of Hénard. The stratification of transportation on several mode-separated layers enables a constant motion and reaches a high efficiency. However, the spectacular scale and dizzying height becomes rather a cliché of visionary urbanism than a practical concept made possible by new technical innovations. In the 1920s, the futuristic

[106] Yoos and James, 20–24.
[107] Hénard, "The Cities of the Future," 357–67.

ideas of American representatives and the perception of the European avant-gardists merged by an international feedback loop to the vertical oriented city. The illustrations of skyscrapers by Antonio Sant'Elia accelerated the process of always striving higher verticality.[108] Even though Sant'Elia left behind almost no completed works of architecture, his Futurist visions crucially influenced realized projects of especially the modern architects Helmut Jahn and John Portman.[109]

The International Congress of Modern Architecture (CIAM) contributed significantly to the fact that multilevel cities were promoted since the 1930s. It was an annual meeting of 28 European architects and urban planners and was more a think tank, which was initiated by Le Corbusier. His three-dimensional urban concepts use pedestrian movement on ground level and connecting elevated pedestrian bridges that form a connected podium deck level, while vehicular traffic is placed near the ground. As a consequence, the vehicular traffic is shifted either above or below the pedestrian levels. His urban studies refer to elements of the unrealized visions of Fourier, the social utopia developed in the 18th century and the experimental multilayering of the Soviet Union.[110] Even though Corbusier's urbanism visions never got beyond the status of proposals, with their highly international character they had strong influence on the redesign of cities with different cultural and socio-economic values around the globe including most famously Sao Paulo, Rio de Janeiro, Buenos Aires, Barcelona, Genoa or Stockholm. It is a proclamation of centralization providing the socio-economic benefits of density, while also thinking of environmental sustainability. In many ways, it can be also seen as an alternative to the decentralized city propagandized by Frank Lloyd Wright. Characterized by a low density, the popularity of the car as individual means of transport was key to insure people flows. Through an evolutionary process, Corbusier advocated the compact city of tall buildings as an urban strategy for the emerging modern society with his urban plan "Ville Contemporaine" (Contemporary City) first in 1922. Using just 3 different types of buildings, it was designed to accommodate 3 million habitants. In 1933, Corbusier published the "Ville Radieuse" (Radiant City) for 1.5 million people. 12 % of the ground area are used for the footprints of the tall buildings, what keeps 88% of urban ground unbuilt and makes it usable for greening and public spaces with certain amenities to promote an urban socialization. Later revisions of his ideas put the regional planning into the focus of his studies to the 'super-density-city'. To allow the practical implementation, he hazarded the consequence, what he called "urban surgeries". This meant the demolition of entire urban blocks, neighborhoods and even the local context. Tall buildings of 50m height should theoretically enable the accommodation of 1000 people per hectare. His rationalistic and oversimplified architectural typologies and urban design approach was heavily criticized

[108] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 24, 27.
[109] Goldberger, "Architecture: Antonio Sant'Elia," 24.
[110] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 44, 46.

by the CIAM, because the major weaknesses like daylight conditions or a natural ventilation strategy do not get addressed by Corbusier's urban models. The doctrine of separating working, living and leisure activities is causing mono-functional urban neighborhoods. Positive is seen the separation of motorized and pedestrian traffic as written in the Charter of Athena.[111]

The failure of Corbusier to reconcile the scale and mass of tower clusters and find an appropriate new system of different layers of concentrated public activities almost appears as intended. It is believed, that he hasn't even tried seriously to ever solve it to be put into practice. He argues that "the street wears us out, it is almost disgusting" and questions "Why, then, does it still exist?". This argumentation is well received by the representatives of CIAM, especially Ludwig Hilberseimer.[112] However, Corbusier's multilevel intentions clearly need to be distinguished from the "catwalk-like" ideas of the elevated city from members of the CIAM. Due to the different approaches of how to think the multilevel form of the future metropolis, subgroups like the Team 10, which challenged the orthodoxy of CIAM's approach, and the Modern Architectural Research (MARS) Group, a grouping of architects with a post-revolutionary socialist background, were established. The studies of Kenneth Frampton identified that the British Modernism was highly influenced by Russian Constructivism. Multilevel cities were further developed in North America and significantly put to perfection in Asian cities.[113]

In the 1950s, the approach of CIAM members, in particular Alison and Peter Smithson, was first put into practice in the United Kingdom in the post-war time of World War II. The Golden Lane project (1952) in London is a prototype of the association of the street as social mediator for humanity. Robert Venturi harshly criticized the trial to achieve a sense of community with "pedestrian balconies" for user engagement as social naivety of Modernism. In 1968, his community town planning "South Street" in cooperation with Denise Scott Brown has the objective to stop a crosstown expressway through South Street in Philadelphia. However, both strategies almost identically argue a certain sense of identification of the participants within the area as key intervention to establish the development of a modern society.[114] Brown further argues that the urban manifestation of the megastructure as symbols-in-space has a less negative impact on the urban fabric than the urban sprawl as forms-in-space. The Habitat Expo 67 of Moshe Safdie is an example of the functionalistic approach of the megastructure, but also reveals the distortion of a normal city building process which has difficulties to adapt to the new scale.[115] Public interests got protected by

[111] Carla and Goncalves, *The Environmental Performance of Tall Buildings*, 29–31.
[112] Safdie, *The City After the Automobile: An Architect's Vision*, 17–18.
[113] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 46, 63, 65.
[114] Rice, *Interior Urbanism: Architecture, John Portman and Downtown America*, 108–9.
[115] Venturi, Brown, and Izenour, *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form*, 117–19, 127.

zoning ordinance that allows skybridge construction and defines the “investor prerogative” of developers.[116] To accommodate the increasing motorized traffic fostered by the densification of the towns, Colin Buchanan suggested a separation of the urban motor way into an “expressway” for the general traffic and a “busway” for the local, public related traffic. The core of this network should be the “shopping city”, which offers communication interchange in shopping and leisure-oriented areas combined with pubs and activity abilities on multiple levels.[117]

The international significance of the CIAM was the result of the involvement into the CIAM 8 in 1951 of leading representatives of the United States and in particular members of the Metabolism of Japan, like Kenzo Tange. In contrast to the work of Richard Buckminster Fuller, who propagandized the classic notion of interiorization of the city by megastructures, Tange saw the “city as a process”. Therefore, he pushed the idea of synthesizing the interior with exterior space by adding infrastructure to form a dynamic entity.[118] In 1960, he published the housing Plan for Tokyo, which builds upon the ideas of Corbusier’s Plan Obus in Algiers (1932). Instead of using a linear megastructure, it is based on a series of giant floating A-frames in the bay, which were piled up to multilevel structures. The idea is based on the heroic idea of providing a centralized planned infrastructure as core combined with individually owned houses on so called “artificial” ground. The basic concept of “permanence and transience” of the Metabolists can be found in similar manner in the maxim of the Smithsons’ “fixed and transient”, or Archigram’s canon “control and choice”.[119] Through projects like the Nakagin Capsule Tower of 1972 by Kisho Kurokawa, the Metabolism got a face to the broad public. By achieving the volitional high density, critics compare it with projects of the Brutalist movement and they see it as inhumane, while supporters celebrate it as human habitation following the fundamental law of nature. These experiments evolved from techno-centric ideologies together with utopian ideas to the Metabolist principles of Fumihiko Maki. He describes the megastructure as man-made feature of the future landscape.[120]

Before 1949, due to the colonial forces, but also Japanese, influences, the urban development of modern China was predominated by Western powers. During the time of Chinese industrialization, the growth of population and economic activity strengthened the assertiveness of Mainland China. To keep control, the western countries enforced that the most relevant economic areas got let for rent to establish the Treaty Port System (TPS). From the Chinese perspective, the concept “On New Democracy” by Mao Tse-tung, which was published 1940, argues that capitalist influences started after China’s transformation

[116] Rice, *Interior Urbanism: Architecture, John Portman and Downtown America*, 58.
[117] Hughes, “Hospital-City,” 280.
[118] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 61, 125.
[119] Lyster, *Learning from Logistics: How Networks Change Our Cities*, 70–71.
[120] Schröpfer, “The Dense and Green Paradigm,” 16–17.

process from a feudal over a semi-colonial to a semi-feudal society.[121] This historical background is the headstone for the strong influence of British multilevel urbanism projects, like the Pedway and Golden Line, to be adapted in Asian cities, most recently in the Free Trade Zones Singapore (1919) and Hong Kong (1849), as well as Shenzhen, one of the first Special Economic Zones in the 1980s. In 1963, the fist elevated footbridges were constructed in Hong Kong. Since than it evolved to a network spanning over almost the entire CBD including a various of multilevel circulation strategies. The planning department of Hong Kong pushed the “on-demand planning” and is pioneer in using data-mapping techniques for their problem solutions. This includes the use of deck-access plazas and podiums, as well as flyover bridges, open air foot bridges, high bridge networks, interiorized walkways and the image forming Central Escalators. The three-dimensional complexity of the city is further fostered by building construction on the steep natural topography and generates a unique urban fabric. In the 1980s, the city expanded beyond the waterfront by land reclamation to meet the demands of its twenty-first century claims. In this sense, the transformation process of Hong Kong is significantly subjected by the conceptual approach of the Metabolism and constitutes the soul of this modern metropolis.[122]

2.3.3 Layered Public Space as new Paradigm

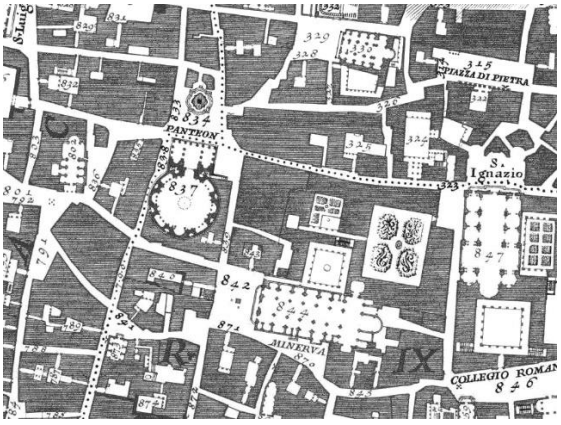


Fig 7: Nolli-Plan (Nolli, 1748)

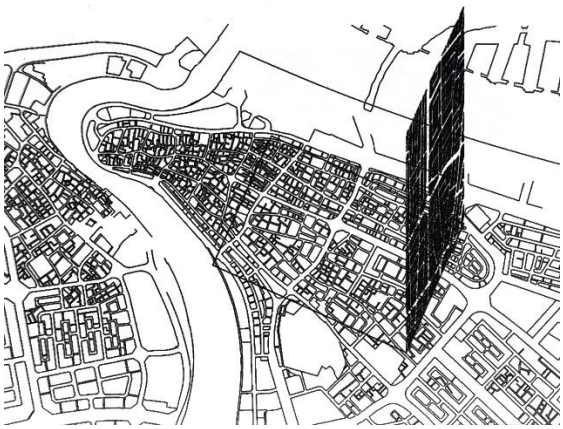


Fig 8: Dubai Renaissance Concept Diagram (Holl, 2014, p.257, edited by the author)

The synergy of tower and public space is the main subject of Rem Koolhaas’ book “Delirious New York”. It promotes the skyscraper as the frontier that is enabling the human to reach for the sky. From an urban perspective, the fundamental breakthroughs of the reproduction of the world is the annexation of the tower and its consideration not as a vertical object on a

[121] Shai, *The Fate of British and French Firms in China, 1949-54: Imperialism Imprisoned*, 7, 8.
[122] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 66–67, 113–15, 166.

horizontal plane, but as a “glorious whole”.[123]

Almost a decade later, Koolhaas proposed to “kill the skyscraper”. In this article, he explains the underlying problems of vertically extruding a two-dimensional form and providing public program exclusively on the base levels.[124] The discrepancy of the relationship of the tower and the ground are the result of the two contrary desired properties of “continuity and connectivity” or “delimitation and partition” of space usage. Of further significance are the dualities of “public and private” and “exterior and interior”. For two dimensional problems of urbanity the figure-ground map gained prominence in the 16th century. This standard display method uses black filled forms, which are representing the buildings, on white ground. To illustrate also the publicly accessible spaces within the buildings, in the map of Rome (Fig 7) in 1746, Giambattista Nolli left also these areas white, as if they are open ground.[125] Venturi and Brown later tried to raise awareness of the immense spaces of the casinos and lobbies of Las Vegas by using exactly the same strategy. In contrast to a conventional land-use map of Las Vegas, their plan, better known as Las Vegas Strip, exhibits the solid-to-void ratio.[126]

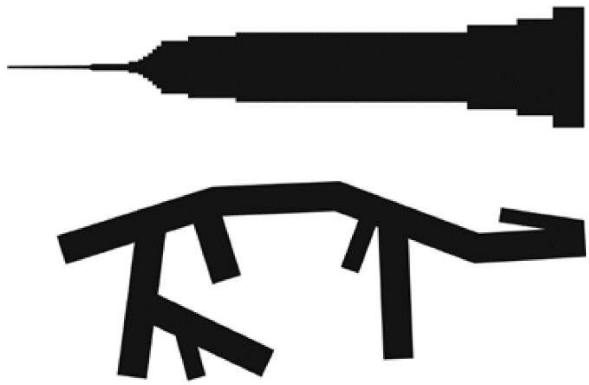


Fig 9: Horizontal Skyscraper (Holl, 2009, p.169)

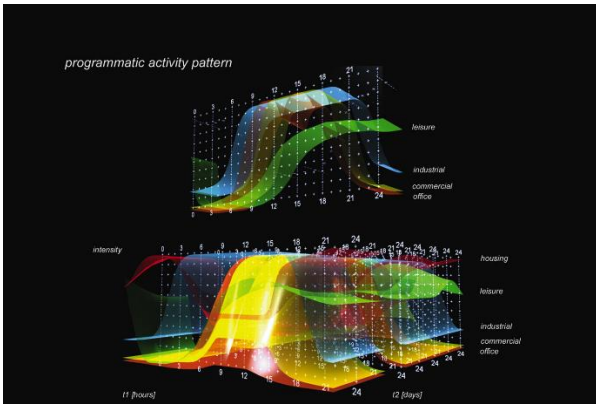


Fig 10: Time/Program Diagram, IFCCA Entry (UNStudio, 1997)

The mono-functional high-rise building is the configurational concept based on Modernist planning ideas. The daily cycles of peaks and troughs of human interaction has huge differences between rush-hour, working time, night, weekend and national holiday. The consequence of promoting the segregation of functionality into several homogenous urban regions fostered CBDs, which are working as concentrated nodes. In the last decade of the past century, to overcome the crisis of the tall building as monofunctional object, different functions got vertically stacked and defined the mixed-use tower concept.[127] In 1976, the

[123] Koolhaas, *Delirious New York: A Retroactive Manifesto for Manhattan*, 82.
[124] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 230.
[125] Hensel and Turko, *Grounds and Envelopes: Reshaping Architecture and the Built Environment*, 23–24.
[126] Venturi, Brown, and Izenour, *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form*, 18–19.
[127] Samant and Menon, “Exploring New Paradigms in High-Density Vertical Hybrids,” 111.

Urban Land Institute (ULI) published a report that determined MXDs as one of the most important innovation in urban land use since the emergence of the modern shopping mall typology in the immediate post period of World War II. One reason for the success was the sophisticated understanding of the interdependency of financial instruments, land development and architectural effects. However, a critical view reveals that MXD of the early period noted also a mentionable amount of failures due to the impermanence of external conditions. In the 1970s, to prevent the collapse of American downtowns, the approach of this public-private partnerships was reconsidered.[128] Around the same time period, the movement of the individual got prime attention. Focus of the analysis was to track people's movement to generate time-space dependent life paths. This analog agent-based method analyzes individual biographies according to their daily social lifestyle and measured the "friction of distance" (Fig 12).[129]

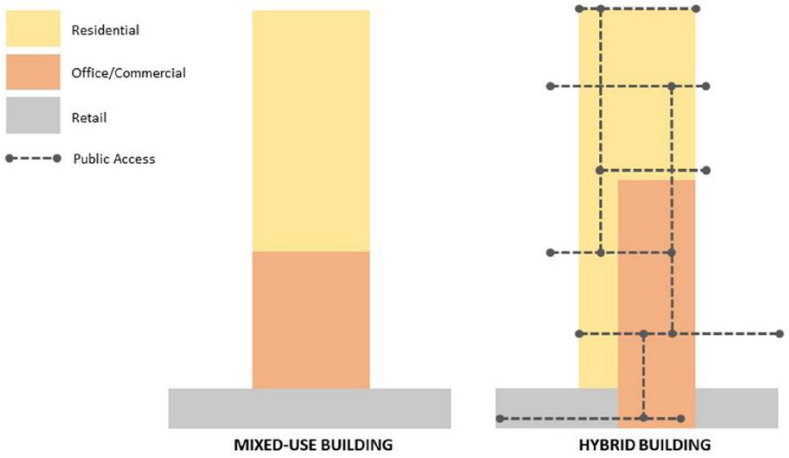


Fig 11: Differences between Mixed-Use and Hybrid Building (Samant and Menon, 2018, p. 112)

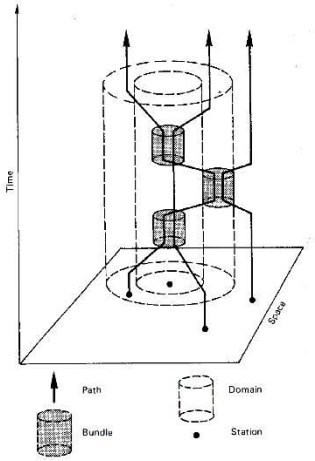


Fig 12: Space Paths according to Hägerstrand (Harvey, 1991, p.212)

For the IFCCA Entry in 1997, (Fig 10) UNStudio developed diagrams, that visualized program, time and location of the West Side of Manhattan within one diagram. The result of this time-based planning strategy, called "Deep Planning", shows the dynamic performance of the urban site, rather than illustrating a figure-ground condition. It is seen as one of the more successful approaches to detach from ideas of Modernism. It aimed for a strategy that establishes a flow-based system that analyzes the shared values of different building typologies, rather than shifting building volumes around.[130] Consequently, today's buildings need to include public areas into the internal infrastructure to connect the vertical stacked spaces to a city-wide network of movement by implementing transit integration. In contrast to the mixed-use building, which promotes the stacking of various programs within their built

[128] Rice, *Interior Urbanism: Architecture, John Portman and Downtown America*, 38–43.
[129] Harvey, *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change*, 211–12.
[130] Lyster, *Learning from Logistics: How Networks Change Our Cities*, 106–8.

form, the upcoming “vertical hybrid” (Fig 11) integrates “the social dimension of users”. The highly complex intertwined program is in close exchange with the urban surrounding and fosters an interconnectivity between programs rather than just promoting a mutually synergetic space usage.[131] As a further specification, it is necessary to differentiate between a “hybrid” in its true sense and a “social condenser”. A social condenser is a programmed and communally used service area for local residents and employees that is isolated from the urban fabric. In contrast, a hybrid building provides publicly accessible space for everyone within the privatized objects.[132] The tendential change of buildings away from being discrete networks to become collaging networks affects the performance, qualities and identity of our built environment. This hybridization is a transformation process to a new form of synthesis that is blurring conventional limits.[133]

> *“Hybrid buildings cannot be classified according to typology as the very essence of the hybrid seeks to eschew categorization. The hybrid is the result of a spat with tradition, a two-fingered salute to typology.”*[134]
> Steven Holl

To implement the porosity of a grown urban fabric into the monolithic functional logic of the high-rise building to allow an evolution towards the vertical city concept, the modern skyscraper needs to be revised to a hybrid tank. Rem Koolhaas illustrates this figurative with his diagram for the 2006 “Dubai Renaissance” tower competition (Fig 8). By cutting out a square of the urban floorplan and rotating it vertically, a slab like multifunctional building is designed. It is intended to become a catalyst for the city life, offering 3 publicly accessible levels programmed as a business forum, a spa wellness area and an observation deck.[135] A counter strategy represents the Horizontal Skyscraper (Vanke Center, Fig 9) of Steven Hall Architects. Due to the 35-meter height limit, the concept of the development is based on the idea of rotating the building mass of the Empire State Building vertically to the ground and hover its volume above a public tropical landscape. That way, it generates the largest possible green open space on the ground floor and integrates living, shopping, hotel, sport and administrative facilities bundled in sections within one giant urban hub.[136]

> *“A modern urban hub may irrigate and connect the city through its porosity, multiple usages, and multi-level public spaces, providing a vibrant variety of environmentally*

[131] Samant and Menon, “Exploring New Paradigms in High-Density Vertical Hybrids,” 111–12.
[132] Holl, *This Is Hybrid: An Analysis of Mixed-Use Buildings*, 50.
[133] van Berkel, Bos, and Roberts, *Knowledge Matters*, 13.
[134] Holl, *This Is Hybrid: An Analysis of Mixed-Use Buildings*, 41.
[135] Holl, 254–57.
[136] Holl, *Urbanism: Working with Doubt*, 169.

tuned spaces in the heart of the city." [137]
Keith Griffiths

Within a single high-rise building that has one environmental protecting skin, it is possible to stack complimentary and symbiotic usages. Once skybridges enable circulation of public flows on multiple levels, the need to go down to the ground floor for transfer is superfluous. Clustering towers is a response to the urgent need of densification to increase the capacity of our existing urban infrastructure.[138] Even though the Petronas Towers' skybridge prior needs to be seen mainly as symbolic gateway, its potential was widely recognized and revealed commercial and urbanistic benefits. Especially in Asia and in particular in Hong Kong this new understanding of urbanism strengthened the cooperation of private developers and government. While the 24-hour public accessibly and secured passageways through developments is provided by the developer, the government allows an additional amount of floor area. These incentives are trendsetting ideas and are the prerequisite to allow the constitution of Layered Public Space as practical problem solution.[139]

3. Theory Approach

3.1 Layered Public Space within Multi-Dimensional Tower Clusters

"One way to establish lines of comparison might be to distinguish vertically oriented from horizontally oriented projects. The vertical involves the idea of the skyline not only expressed on the outside but also inverted to structure the interior into a complex urban interior…. On the other hand, the horizontal involves the ground as an urban material and the idea of ground manipulation to establish a new urban condition."[140]
Zaha Hadid

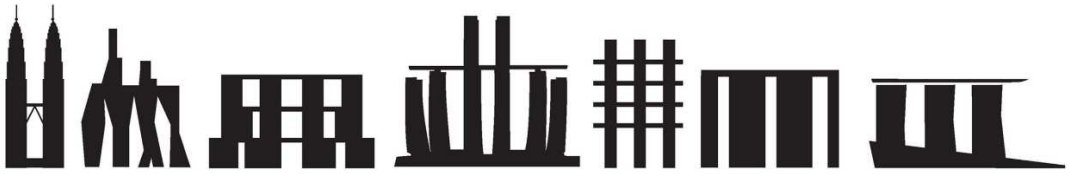


Fig 13: re-thinking the tower block (Lubin, 2019,p.20)

In 1988, Moshe Safdie entitled in his editorial article for The New York Times arguing that

[137] Griffiths, "City Hubs," 80–81.
[138] Griffiths, 78–82.
[139] Robinson and Wood, "Beyond Icons: Developing Horizontally in the Vertical Realm," 83–84.
[140] Mostafavi, "A Conversation with Zaha Hadid," 6.

"skyscrapers shouldn't look down on humanity".[141] The idea of multi-leveling to increase the fraction of recreational space within the city is in its logic not a new idea but can be already be found in Leonardo da Vinci's sketches in the 16th century.[142] To meet the demands of Layered Public Space within Multi-Dimensional Tower Clusters in a practical sense, first, one might have to examine the sustainability of cities and consequently the role of tall buildings within the urban network. Developers, architects, urban planners, policy makers, politics and authorities of any kind need to think sustainability not as static value but rather as comprehensive value that is the result of the pareto optimality of environmental preservation, social equality and well-being.[143] Since the millennium, rising community aspiration, population growth and densification are testing current models to its limits. Therefore, current trends like the increasing globalization and the rapid innovations in information and communication technologies (ICTs) represent significant trends in the global economy.[144] The increase of telecommunication flows is closing the geographical distance of cities from each other and allows them to grow beyond its physical boundaries.[145] This technological upswing enabled especially city states of Asia to turn into global players in economic niches. In 2001, the Malay government declared the Multimedia Super Corridor (MSC), which is a federal territory and meant the newly developed city of Putrajaya to become the country's commercial and financial center to make Malaysia competitive in an era of digital information economy.[146] It would be a catastrophic failure to conclude that a 24-hour accessibility from one point to each other point of the world and even beyond to habitable artificial satellites like the ISS is independent from the provision of physical platforms. To meet the demands of tomorrow the physical and digital spheres need to be developed parallel towards an augmented reality (AR). As mentioned in the definition of the pareto efficiency, beside economic considerations, social and greening activities are important measurements that eloquently visualize the enabled progress of cities and densification.[147] The social component to ensure a vibrant habitation can be reintegrated into high-dense urban environments by elevated public amenities of different levels of privacy. This would start a process where individual blocks are getting clustered to a network that is operating as micro-urbanism. Crowd control measurement systems ensure safety and monitors user flows.[148] Exemplary is the mainly residential project Pinnachle@Duxton, which is integrating a publicly accessible open deck on ground floor, from residents accessible communal skybridges and a thematic

[141] Lubin, "The Evolution of the SkyPark Since the Marina Bay Sands," 20.
[142] Fairhurst, "Going Under to Stay on Top," 73.
[143] Newman, "Sustainability and Cities: The Role of Tall Buildings in This New Global Agenda," 75–76.
[144] bin Haji Awang, "The Cyber Cities of Malaysia: Realising the Vision," 249.
[145] Lyster, *Learning from Logistics: How Networks Change Our Cities*, 28–29.
[146] bin Haji Awang, "The Cyber Cities of Malaysia: Realising the Vision," 249.
[147] Watts, "Tall Building Economics," 58.
[148] Cho, Heng, and Trivic, *Re-Framing Urban Space: Urban Design for Emerging Hybrid and High-Density Conditions*, 8–9.

programmed semi-public sky deck with greening insures interaction between visitors and residents. When transferring the same principles to a mixed-use tower these layers of publicness need further classification and differentiation. In the following chapter, the model of Layered Public Space tries to define the shift of the “hybrid building” to the Ole Scheeren embossed term “hybrid fabric” to describe the alternative spatial configuration of the vertical stacking of different programs.[149]

3.2 Spatial Stratification of the Public Space

The ongoing densification process, climate variability, change of human needs and reintegration of nature into the built environment responds in a hybridization of the urban fabric and blurs building blocks. Especially in the hot climate zones, the fragmentation of built form already proved to be a key problem solution to improve future interpersonal collaboration and interaction.[150]

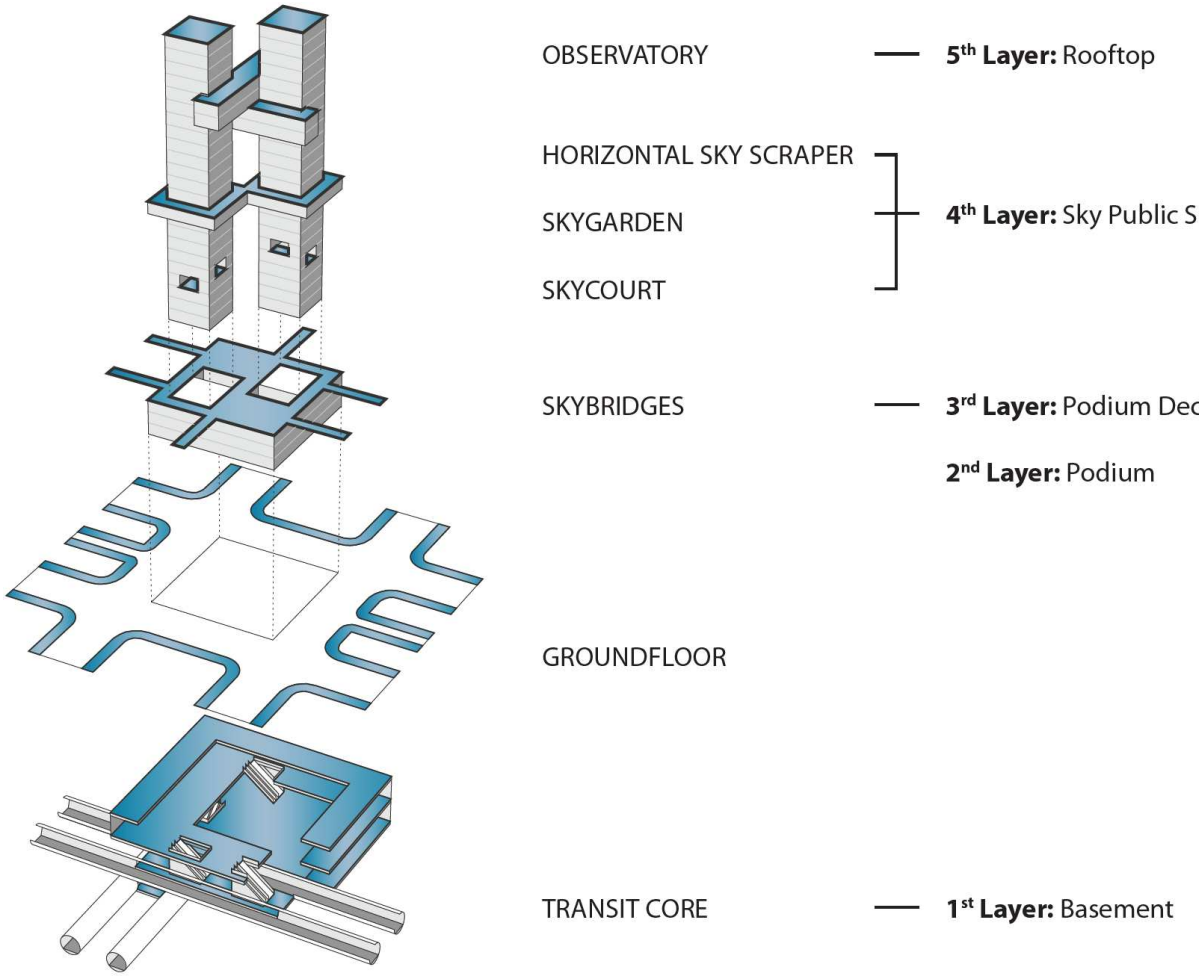


Fig 14: Layered Public Space (LPS) (by the author)

[149] Samant and Menon, “Exploring New Paradigms in High-Density Vertical Hybrids,” 115.
[150] Samant and Menon, 118–19.

3.2.1 1st Layer: Basement and Transit Orientated Core

For this exemplification, this layer is assembled by all floor levels that do not have access to vertical natural illumination but only can be exposed with sun light by roof windows. By this definition we get a dynamic system that is independent from the interpretation of the ground plan.

Feasibility studies of Arup are examining cave developments in Hongkong to hollow out the limestone terrain. This would generate additional underground space and the boulder can be reused for the landfill strategy.[151] Unconventional architectural solutions are not per se successful but need to be understood as feasible and mature ideas. Vanke is one of the big real estate developers in the People's Republic of China that places a lot attention on advanced design and sustainable building systems. They have internal architecture research centers, that also work as operational laboratories to test new building environments.[152] One of these buildings is the Liuxiandong-Plot A4+B2 of Vanke Design Community. It is located in the Dashahe Innovation Zone in Shenzhen. Even though there are no towers on site, it is highly affected by the surrounding high-rise buildings and reacts on them with a vacillated connecting skybridge for major pedestrian streams. The sloping plot from the north to 3,7 meters higher in the south offered the designing architect (FCHA) to propose a concept, where the major building mass was put below a continuous green carpet directly starting on street level in the north. This green public space maintains a balance between openness and environmental qualitative underground office space.[153]

Fig 15: Liuxiandong-Plot A4+B2 Landscape (Chen, 2019)

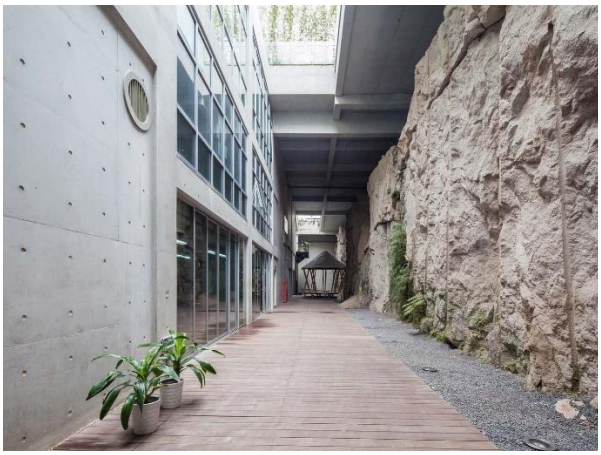


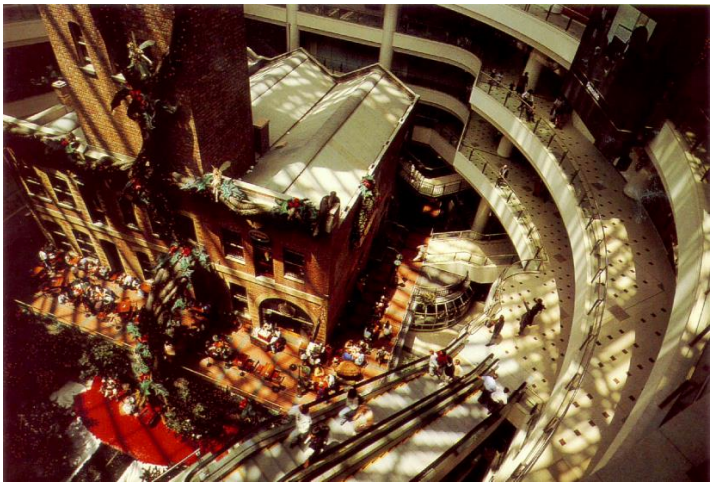
Fig 16: Liuxiandong-Plot A4+B2 Basement (Chen, 2019)

[151] Lyster, *Learning from Logistics: How Networks Change Our Cities*, 170.
[152] Wang and Song, *Creativity in China*, 20–23.
[153] Chen, "Liuxiandong-Plot A4+B2 of Vanke Design Community / FCHA."

Despite the need to address the feeling “of being a mole” when staying in the underground, the move to “go under to stay on top” is an active way to counteract subaerial congestion. This additional below ground sub-surface provides spaces with a number of natural properties which require more effort when tried to be achieved above ground. Due to the energy storing mass of the earth, energy can be saved, soundproof properties are achievable and in times where every centimeter of the surface of the earth can be spied on, rooms with special privacy and security can be integrated. This natural secret service defense would meet the demands of many “life-support systems”, data centers and storage facilities. That way extended underground area can help to solve problems that are causing public concern. Exemplary in that sense is the functional multi-level design of an aircraft carrier where except the “island”, which is the control tower, nuclear reactor, storage rooms, men’s quarters, hangar, weaponry and tactical rooms are stacked on top without having a single window. To receive the ground floor from major infrastructure, public transport systems got pushed underground and more and more connected to the surrounded urban network providing concentrated nodes. In these areas, the density reaches a critical stage. A “two-level circulation” segregates pedestrian flows from vehicular traffic.[154] However in some American cities like Dallas in the 1980s, a critical mass of pedestrian flows simply didn’t preexist and caused the “Second-Story City Syndrome” described by Terry Jill Lassar. This caused the erosion of the street life on ground level and even generated a certain degree of segregation in terms of class and race. In contrast, Asian metropolis do have pedestrian frequencies that make the multi-dimensional thinking of urban problems a necessity.[155]
The strategy of maximizing the amount of residential, business and leisure space to CBDs above a public transport station within a walkable distance is defined as Transit-Orientated Development (TOD). The inherent public space works as connecting node of horizontal transport and vertical interaction. This insures a certain level of compactivity and economic growth-orientation. Peter Calthorpe describes this model as preservation strategy of the sensitive habitat by creating public neighborhoods in building orientated environments. Simultaneously, pedestrian-friendly street networks guarantee public interchange between local destinations.[156] In the early 1970s during economic take off, the authorities in Hong Kong worked out a long-term city planning strategy to recover from the impact of the Second World War. This integrated the urban processes of the former satellite cities located on the northern and southern side of the Victoria Harbor to Kowloon. Critical needs to be seen that just laying-out a metro network does not satisfy human needs. In the last century, due to pace and coordination issues of new developments a lot of mistakes were made in the manufacturing of industrial towns. This resulted in a social segregation and an explosion of

[154] Fairhurst, “Going Under to Stay on Top,” 71–76.
[155] Terranova, “Ultramodern Underground Dallas: Vincent Ponte’s Pedestrian-Ways Systematic Solution to the Declining Downtown,” 27.
[156] Calthorpe, *The Next American Metropolis: Ecology, Community and the American Dream*, 43.

housing cost. However, urban renewal has already been started by the way by the Land Development Council to enhance the role of Hong Kong as global player for business, finance, information, tourism, entrepot activities and manufacturing. Within the walkable distance of the outer, old or over densified metro stations, TODs started to thin-out and restructure the surrounding of the essential nodes and provide social and commercial facilities.[157]



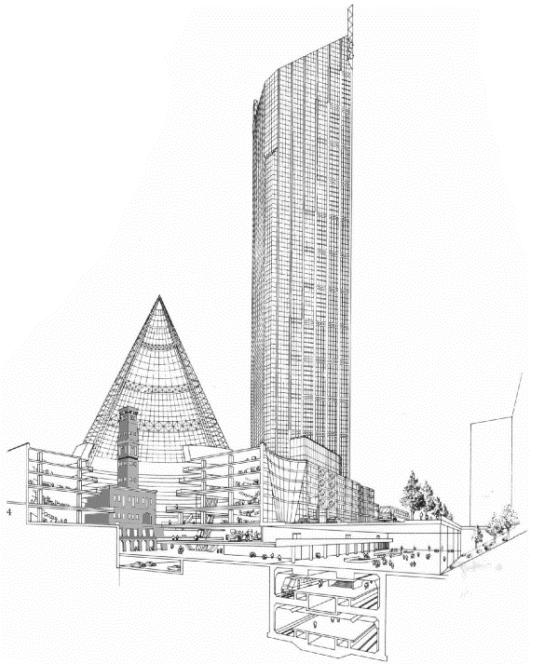


Fig 17: Melbourne Central (Kurokawa, 1999, p.145, p.144) edited by the author

An exceptional example of combining economic growth with a preservation strategy of historic values is the project of the Japanese Metabolist Kisho Kurokawa Melbourne Central Station in the heart of the main CBD. On top of an underground railway station is a mall complex with various office, retail and multi-use entertainment facilities with a tower on top. Before this development was built, there was a lead shot manufacturer with a tower located. Due to its landmark qualities and recognition factor Kurokawa decided to place the vertical anchor atrium of the shopping center around this historic icon and protected it under a glass cone. The past and the present, as well as conserving exterior urban qualities by interiorization are evident in a symbiotic relationship. Due to a certain altitude difference between the boundaries of the lot, the illumination exclusively comes from the coned roof window. Today the historic building is located in an underground atmosphere. A critical view, arguing that the building does not receive a respectful frame to still work as a landmark is not completely unfounded. Another famous example of underground area reclamation in a historic urban context, but without a noteworthy landmark in terms of height, is the extension and reconstruction of the Louvre in Paris by the Chinese American architect I.M. Pei.[158]

[157] Wong, "Recent Infrastructure Developments in Hong Kong - the Background, Current and Future Developments," 1–19.
[158] Kurokawa, *Kisho Kurokawa: Selected and Current Works*, 152–68.

3.2.2 2nd Layer: Podium

In previous chapters the podium is already declared as the tank for amenities, parking space and commercial, leisure and activity usage. In Modernism time, especially in Chicago and New York, the majority of tall buildings were standing alone objects, which in further consequence caused the shaded forest like pedestrian atmospheres on street level. In Asian cities like Tokyo, Hong Kong or Shanghai, entire finance high-rise districts were conceptualized completely from scratch by masterplans and were put into practice within a few decades.[159] This requires a conscious manipulation of the neighborhoods of tall buildings, giving the tower an active placemaking role by incorporate socio-economic dynamics and activities. Due to the massive speed, in the past, the focus was rather on a working public transport system and real estate developments than on the sustainable articulation of the urban fabric. One of the key responsibilities of the base of a high-rise building is the “human-scale”. This is not a subjective measurement but is getting examined with micro-scale analysis (Fig 18).[160]

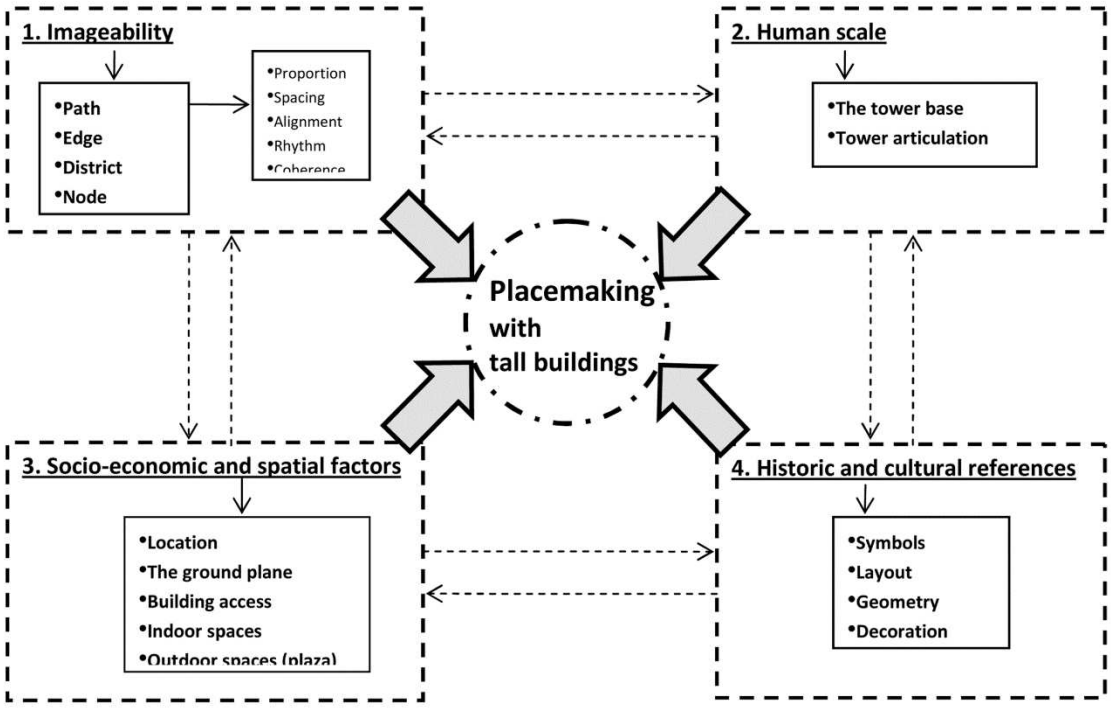


Fig 18: Micro-Scale Analysis (Al-Kodmany, 2013, p.156)

The vertically fast-growing cities in India, Vietnam, Latin America, Thailand, China and newly Africa are located in the subtropical climatic zone and demand new forms of development for an “ecological age”. A general body of common podiums are quite blocky servicing zones

[159] Carla and Goncalves, *The Environmental Performance of Tall Buildings*, 27–28.
[160] Al-Kodmany, “Placemaking in the High-Rise City: Architectural and Urban Design Analyses,” 153–60.

and beside the economic factors highly important for the MEP infrastructure. This all-embracing covering generates deep plan spaces and needs a great deal of energy to supply the building with lighting and air-conditioning. The street level of city centers are the hottest areas of metropolitan regions. To prevent the podiums to turn into heat islands, shade and wind penetration is getting actively supported by performance-based design methods. That way, the podium turns into a porous organism with urban verandas and green spines, which blur the boundary conditions of street, podium and tower.[161]

In China, the shifting meanings of skyscrapers get expressed by unconventional podium designs like the Shenzhen Stock Exchange and CCTV building. However, one might not forget that the extra amount of steel, energy, pollution, research and troubleshooting to practically being able to realize these buildings is enormous. The saving rates in the long run might never compensate this additional environmental stress in comparison to a conventional building. Therefore, these buildings need to be seen as impressive benchmarks that show what potentials the public meaning of skyscraper has, but should not be equated with achievements of sustainability.[162]

3.2.3 3rd Layer: Podium Deck

To ensure a balance between natural landscape and cityscape, an imageable skyline is crucial to integrate the high rise building in an appropriate way. Therefore, the three elements of background, foreground and topographic profile need to be examined, to work out this relationship.[163] Especially in cities like Shanghai, where urban greening is extremely rare, small greenings on the rooftop enables the human being to escape from the hustle and bustle of the street life. Cities like Hong Kong and Singapore are pioneers of vertical greening and they are global role models.[164]

The prototype of the idea of an elevated park that is also used for urban farming can already be found as the Hanging Gardens of Babylon in the Ancient World, built around 600 BC.[165] This concept was adopted by Thompson for his amusement Park, the “Luna Park”, at Coney Island in 1906. It layers elements of the Japanese garden on top of arcades. In a way, an artificial green carpet plane is superimposed on its original surface.[166] Fundamentals of this concept are similar to the strategies in elongated and elevated pedestrian deck access schemes as the Pedway in London or the High Line in New York, but in a more functional way.[167] The element “roof garden”, together with the pilotis (free standing columns), the free

[161] Stalker, “Beyond the Podium: Urban Spaces for Tall Buildings in a Subtropical City,” 172–74.
[162] Gianotten, Koolhaas, and Chan, “The Public Meaning of Skyscrapers: Shenzhen Stock Exchange and CCTV,” 57–61.
[163] Al-Kodmany, *Understanding Tall Buildings: A Theory of Placemaking*, 45.
[164] Stalker, “Beyond the Podium: Urban Spaces for Tall Buildings in a Subtropical City,” 174.
[165] Al-Kodmany, *Eco-Towers: Sustainable Cities in the Sky*, 306.
[166] Koolhaas, *Delirious New York: A Retroactive Manifesto for Manhattan*, 43.
[167] Yoos and James, *Parallel Cities: The Multilevel Metropolis*, 68, 164.

plan, the strip window and the free façade constitutes the 'Five Points of a new Architecture' of Corbusier.[168] This vocabulary was first put into practice in his villas, where the Villa Savoie (1929-31) is exemplary for the first-floor, the roof top being programmed as hanging garden (jardin suspendu).[169] The inclusion of greening into our built environment helps to prevent re-radiation and reduces effort needed to counteract the climatic effects on the structure. Horizontally and vertically planted planes help to cool the wall surfaces up to 12 centigrade down. When a tree canopy on top is included, the sunlight gets intercepted by around 80% and enables a humid outdoor experience even during day hours. Furthermore, it breaks wind-peeks and works as natural acoustic buffer.[170]

The idea of Hiroshi Nakamura for his design of the Tokyo Plaza Omotesando Harajuku was to extend the natural canopy of the trees onto the terraces and in peripheral places of the development. In times of the internet shopping, malls do have the potential to become the vocal point of communal interaction, that is getting combined with commercial and marketing strategies. Public outdoor working spaces with access to electricity are grouped around the major roof window on the roof deck (Fig 20). The integration of greening enables the visitor to have a different physical experience depending on season and time of the day.[171]

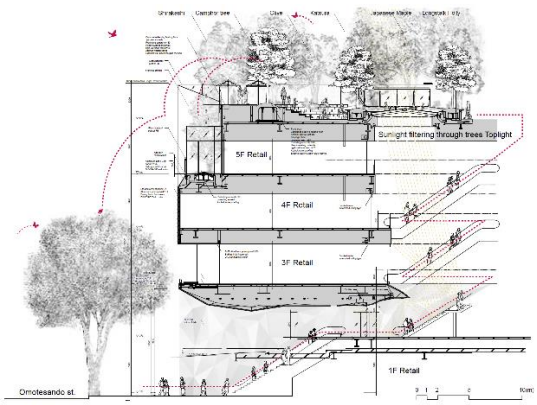


Fig 19: Omotesando Harajuku Section (Nakamura, 2013, pS.99)

Fig 20: Omotesando Harajuku Podium Deck (Nakamura, 2013, p.100)

When towers are not just connected, but part of the development, the Shanghai Greenland Center by Nikken Sekkei is exemplary for a green urban valley complex with a "street landscape park" on multiple levels. The concept of the "urban farm" tries to merge nature into human spaces which is oppositional to the long propagandized gated community developments. Urban corridors structure the pedestrian movement and they connect the metro entrances and the bus terminal within a walkable distance with the urban cores and office entrances. In addition, the involvement of the public transport infrastructure defines the

[168] Sbriglio, *Le Corbusier: The Villa Savoye*, 128.
[169] Frampton, *Modern Architecture: A Critical History*, 157–58, 227.
[170] Pomeroy, *The Skycourt and Skygarden: Greening the Urban Habitat*, 52–53.
[171] Nakamura, "Tokyo Plaza Omotesando Harajuku," 97–101.

development as a TOD project.[172]

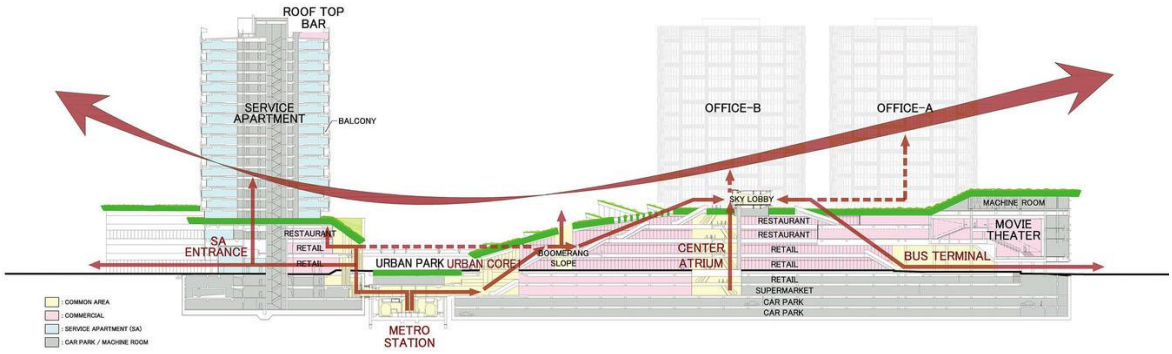


Fig 21: Environment Section and Flow Diagram of Shanghai Greenland Center (Sekkei, 2013)

The green roof of the Hangzhou International Expo Center lets the visitor almost forget being on top of a multistory building by covering almost the complete roof of 19.7 hectare. It is meant to be the biggest urban mega complex in China and hosted the G20 Summit in 2016. The building of superlatives is programmed with conference, exhibition, dining, traveling, logistic, storage, hotel, commercial and office space. Problematic is that the building is located on the south bank of Qiantang River, which is an entire region not yet being completed. Related to the podium like building, its towers are too small to reach a critical mass of local people, except in times of exceptional circumstances, to make use of all its facilities including the rooftop park. The building is by far ahead of its time and a final estimation to state its local success won't be able before the surrounding area has fully developed.[173] It is another example, like the green deck on top of the flying podium of the Shenzhen Stock Exchange, that needs a critical judgment. The podium roof garden should be open to the broad public without the need of paying any visitor fees or having to have a swipe card. More exclusive or communal areas offering true privacy or equipment, which is expensive in its maintenance like pools or SPA-areas, should be in so-called "sky spaces", which are located much higher in the layout of the development to underline its exclusivity with a reasonable city view.

3.2.4 4th Layer: Sky Spaces

The monofunctional office high-rise building of the beginning of the 20th century achieved an important position as "distinguished space" in downtowns. In a time, where high-rise buildings are every growing in height and dynamic behavior, horizontal stiffness becomes an evident problem. It is necessary to address structural safety, to ensure the needs of the occupants and to affect the level of servicing ability needed. Therefore, architectural,

[172] González, "Shanghai Greenland Center / Nikken Sekkei."
[173] Lomholt, "Hangzhou International Expo Center in the Zhejiang Province."

structural and mechanical design approaches need to come together to an interdisciplinary collaboration to ensure a state-of-the-art functional performance. The architect should not just focus on the architectural design itself, but already in an early stage of a project should take structural and aerodynamic issues into consideration.[174]

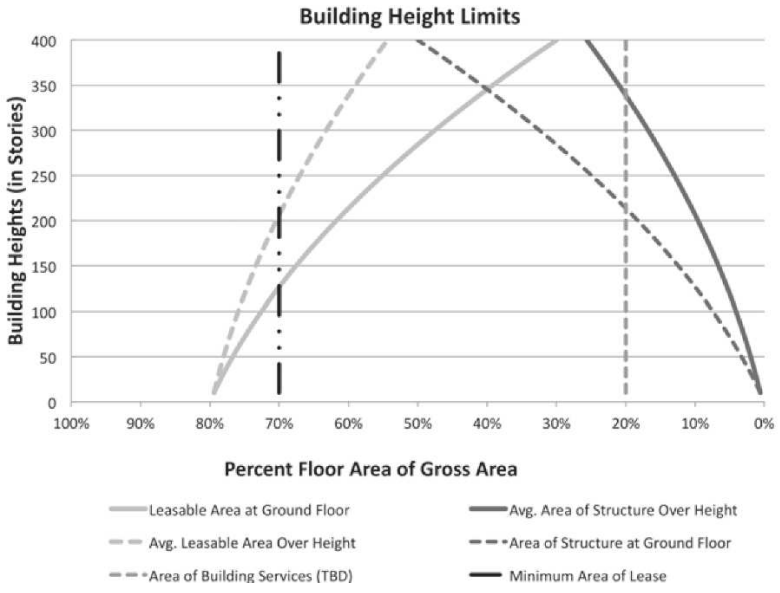


Fig 22: Relationship of Building Height to Floor Area (Sarkisian, 2016, p.36)

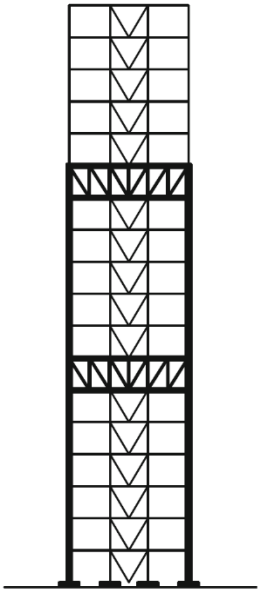


Fig 23: Strengthened Core-Tube Frame (Lin and Huang, 2016, p.228)

Over the years, the vertical structure frame, shear wall, exterior diagrid and core tube systems were combined to hybrids. To strengthen the whole system, in certain intervals the outer tube gets stiffened by belt trusses and connected to the core with shear walls or outrigger systems.[175] Elevator systems working with single cab elevators are also just efficient up to 45 floors, which requires the introduction of sky lobbies to divide the tower in 45-story or less modules. Double deck and express elevators are necessary to ensure an efficient accessibility throughout the whole tower.[176] Once the express elevators are also double deck elevators, dual lobbies are required as well. While in the WTC, the sky lobby was a transitional space with a vestibule, the modern sky lobby like in the CTF Finance Centre in Hangzhou appears rather as library used as a shared workspace. The areas are programmed with bookcases, tables, breakout spaces and enables the lobby to turn as well into a café space, outdoor terrace or fitness center. The blending of different uses with each other are inexorably converging to the concept of “the city within a building”.[177]
The different functionalities that come along with the nature of mixed-use buildings also

[174] Günel and Ilgin, *Tall Buildings: Structural Systems and Aerodynamic Form*, 1–3.
[175] Lin and Huang, *Comparative Design of Structures: Concepts and Methodologies*, 212–28.
[176] Sarkisian, *Designing Tall Buildings: Structure as Architecture*, 36.
[177] Bagley, “The Mixed-Use Supertall and the Hybridization of Program,” 68–73.

require a certain flexibility of the HVAC system. The co-location of MEP and refugee floors, used in case of an evacuation, to minimize the loss of valuable floor is key for an efficient service strategy. To address the pressure problem in pipes coming along with the nature of gravity, water is stored and made available to the floors below. HVAC units get also decentralized into these service levels.[178] Considering the above-mentioned factors and analysis of existing buildings, the 12 to 15 story packages between the service levels is a reasonable compromise for an efficient zoning strategy.[179] In the high-rise industry, the minimization of loss of sellable space is crucial for the developer to insure the project's funding. The incorporation of public or communal sky-spaces always needs a smart argumentation that comes along with a mature concept including structural, accessibility, service and efficiency parameters. These areas can occur in form of a sky lobby, skybridge, sky garden, green pocket or a hybrid combining several of these typologies.
Therefore, to achieve an economic reasonable return on investment (ROI) new values of human capital need to be incorporated into the calculation. The basic formula measures the amount of return on a particular investment as percentage by subtracting the current value of an investment from its costs and this difference gets divided by the costs of the investment. This very straight forward calculation gets influenced by transaction cost, taxes, time, inflation and opportunity cost. In the early 2000s, conventional financial accounts got revised due to the growing demand of social and environmental metrics. The updated model, the Social Return on Investment (SROI) reflects the new factors into its valuation.[180] This gives developers a reasonable argumentation to think of extended sky lobbies programmed with amenities to provide vertically integrated communal spaces throughout the whole tower without the necessity of descending to the ground. The expanded ROI calculation allowed the visionary signature design of the Shanghai Tower and the concept of using sky lobbies "community squares". Its success can be reflected in the increasing productivity of 4,8% compared to a conventional building.[181] The vertical superimposition of building segments alternately with sky lobbies fostered numerous independent of the street level appearing plaza. This multifunctional approach transformed the traditional building typology into an enjoyable humane community complex incorporating spatial, image and functional cultural aspects.[182]

[178] Ho, *Arup's Tall Buildings in Asia: Stories Behind the Storeys*, 71–74.
[179] Xia, Poon, and Mass, "Case Study: Shanghai Tower," 16.
[180] Chen, "Return on Investment (ROI)."
[181] Gu, "Shanghai Tower: Building a Green, Vertical City in the Heart of Shanghai," 56–58.
[182] Gu, "Shanghai Tower: Re-Thinking the Vertical City," 29, 32.

Fig 24: Community Square, Shanghai Tower (Gensler, 2015)

Fig 25: Skybridge, Sky Habitat (Hendricks, 2016)

When thinking beyond the standing alone tower, the modern idea of connecting towers with each other has several parallels of the pioneering bridge design concepts of the last century. This approach is dealing with the related issues of flow and connectivity on an almost similar scale. In the past, suspension bridges enabled cities to sprawl over the natural boundary of the riverbank and are key elements in many cities.

Moshe Safdie uses the concept of "outdoor pedestrian streets", which he first put into practice in his project "habitat 67" of the Expo in Montreal in 1967, for his joined twin tower project Sky Habitat in Singapore. Due to the extreme climate conditions, open spaces are frequently appreciated at night and they enjoy great local popularity. The Sky Habitat is a private condominium complex including "social infrastructure" in form of three garden bridges and is a tower system that is looking beyond the traditional tower-on-podium typology.[183] The design decision to form an atrium in the middle of the building and articulate the building to a convergent silhouette by stepping back the stacked residential units to offer each unit better daylight conditions, caused the introduction of a transfer truss on level 14. Level 26 and 38 offer similar support conditions as level 14 and each of them possess a skybridge as communal area, which makes the provided amenities accessible to the inhabitants of both towers.[184] The bridges themselves are prefabricated and made out of networked welded, built-up box steel members. As assemblage, they formed 4.5-meter-tall and 30-meter-long trusses. On site, these elements where just lifted into place, which insured the maximum level of achievable safety. Due to the state regulatory of Singapore's Urban Redevelopment Authority the open-to-sky terrace spaces are exempted from the gross floor area (GFA). The big advantage of these sky bridges is the ability to serve more than just one building and provide the communal gardens, terraces and the 40m pool to a larger user group, what increases fluctuation and interaction. This way of programming forms a true neighborhood by spending time together with your cohabitants.[185] Other examples, where the skybridge itself is the major meeting point laid open to the community is the American Copper Building in

[183] Lubin, "The Evolution of the SkyPark Since the Marina Bay Sands," 24.
[184] "Sky Habitat Resolves Design Challenges," 14–16.
[185] Lubin, "Humanizing the Megascale," 14–15.

New York City or the Reflections at Keppel Bay in Singapore.[186]
After the collapse of the World Trade Center, structural system and evacuation route improvements pushed the safety of tall buildings. Part of new requirements are refugee floors in numerous cities like Hong Kong, where every 25th floor a refugee room is required. Depending on the plot area ratio, this can lower the efficiency of a tower, especially when multiple of the floors are getting lost as dead space during regular operation. To maximize the commercial floor space, the idea of using skybridges came along. The advantage would offer a downwards, as well as an upwards escape route and would enable the victims to get away much faster from damaged building components. The Petronas Towers got intensively reviewed and have in principal the ability of this alternative escape route. Simulations showed that the evacuation time can be significantly reduced.[187]

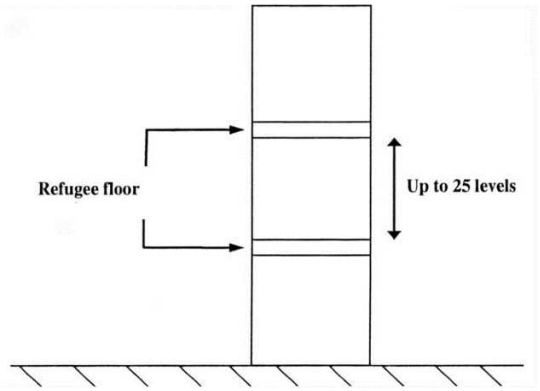


Fig 26: Refugee Floors (Wood, 2005, p.118)

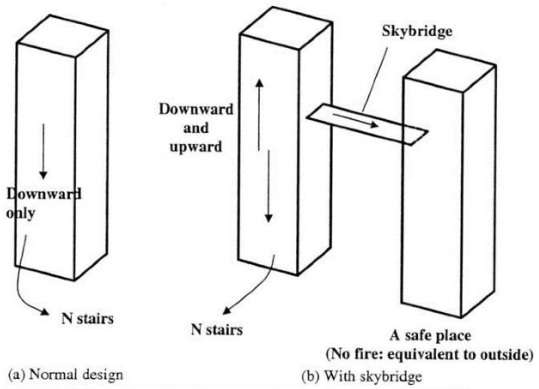


Fig 27: evacuation in high-rise building (Wood, 2005, p.120)

3.2.5 5th Layer: Skyplane

A rooftop-like condition can almost be reproduced in sky spaces, except the vertical illumination and the possibility of a 360-degree panorama. The accessible, walk-on-able structures under the open sky, like rooftop, roofdeck or skypark, are defined as “skyplane”. These platforms can extend over the perimeters of an individual building and can merge with adjacent buildings allowing an all-embracing circulation.[188]
In 1952, Le Corbusier proved the practicality of his ‘Five Points of a new Architecture’ in the scale of a living machine, the Unité d’Habitation in Marseille. Corbusier pointed out that the critical mass of stacked residential units made it affordable and reasonable to turn the roof into a roof terrace for all different kinds of user groups. To him, the extraordinary view in 56 meters above ground should not be disposed to cats and sparrows. The roof is ahead of its

[186] Robinson and Wood, “Beyond Icons: Developing Horizontally in the Vertical Realm,” 83; Warerkar, “Touring the Massive Skybridge Connecting SHoP’s American Copper Buildings.”
[187] Wood, Chow, and McGrail, “The Skybridge as an Evacuation Option for Tall Buildings in High-Rise Cities in the Far East,” 114–20.
[188] Wood and Safarik, “Skybridges: A History and a View to the Near Future,” 2.

time and offers a running track of 300 meters, a gym, a day nursery and pavilions with additional amenities.[189]

This idea was later translated into the "City in a Garden" strategy that became key element of the social housing concept for large green estate put into practice by the Housing Development Board (HDB), the statutory board for public housing. In contrast to the Western colder climate zones, in Singapore, shaded collective open-accessible or semi-public spaces are favored vocal point of social interaction. The Singaporean condominium is a social housing typology, which is a hybrid of a resort and an apartment complex for the middle- and upper-class. The tower clusters which are connected at the top evolved to the "shelf typology" with iconic representatives. From a critical point of view, it is a vertical form of a gated community with a high standard of DCS.[190] The Reflections at Keppel Bay in Singapore is not accessible to the public and protected by a fence. The Pinnacle@Duxtan is an example of a combination of the emerging hybrid urban space typologies. Due to population growth, the plot ratio of the development is 3 times higher than the average gross plot ratio (GPR) of social housing in Singapore.[191] To meet the demands of LUSH and GPR the building provides an open to the public elevated ground deck, communal sky bridges for residents on the 26th floor and a semi-public skypark on the 50th floor.[192] The segregation with security turnstiles was necessary to fulfill the use restrictions and extensive house rules. Nevertheless, the architectural approach how to deal with public visitor flows, as well as its practical implementation by qualitative administration and policy execution, is seminal for further developments and the manipulation of the human scale.[193]

When going back in time, the Rockefeller Centre is truly an urban composition of mixed-use blocks that merge seamless into the cityscape. It's rooftop, "Top of the Rock" is origin of some of the most iconic pictures of New York City.[194]

A practical and modern example of the ongoing evolution towards the vision of a "vertical city" is the Shard in London offering a middle level public piazza, which is in fact a network of several floors connected to a sky lobby and an observation deck as a triple-height viewing gallery.[195] On the other side of the River Thames is the highly criticized Tower 20 Fenchurch Street, which is satirized as "walkie talkie" and causes cars to melt due to its parabolic shape. Of major interest of this analysis is the rooftop of the building, which is a public sky garden programmed with 3 restaurants and bars. While the solar issues are evident, the critic

[189] Le Corbusier et al., *Der Modulor*, 148–51.
[190] Christiaanse, "Green Urbanism: Models of a Dense and Green Urban Context," 73–74.
[191] Cho, Heng, and Trivic, *Re-Framing Urban Space: Urban Design for Emerging Hybrid and High-Density Conditions*, 8.
[192] Samant and Menon, "Exploring New Paradigms in High-Density Vertical Hybrids," 115.
[193] Safarik, "The Other Side of Tall Buildings: The Urban Habitat," 22.
[194] Carla and Goncalves, *The Environmental Performance of Tall Buildings*, xxi.
[195] Sellar, "Developing an Icon - The Story of the Shard," 138–411.

of “feeling like in an airport terminal” is rather personal and of little scientific value.[196] Problematic is the contrasting juxtaposition of a colossal staircase as viewing platform and an almost jungle like slope, which gives the intellectual observer less the impression of a well-defined greening space, but rather the appearance of an overloaded artificial landscape. The Visitor Management Plan grants limited to one hour free of charge dwell time access during the Public Access Hours (10am to 6pm on weekdays and 11am to 9pm on weekend). During closure periods, just people who made reservations in a restaurant can access the sky garden. The whole area can also be closed within core hours for events like weddings or wine and cheese parties.[197] The idea of balancing commercial and public interests in that way is creditable, but in its actual implementation it is highly complex and doesn’t really allow a spontaneous visit. Due to security reasons it is required to book a slot-time 3 days in advance.[198]

A certain level of Disneyfication causes a social and political impact on profit-oriented developments.[199] The Marina Bay Sands Integrated Resort is a major icon of Singapore and expression of globalization and a temple of the commerce and entertainment industry. The skypark of 1.2 hectare is longer than the Eiffel Tower height and accommodates an observation deck, garden spaces, a 150-meter-long infinity swimming pool, restaurants and a jogging path. It can host up to 3 900 people and its LUSH includes beside numerous other plants 250 trees of up to 8 meters in height.[200] Due to the omission of residents or employees and the presumed ability to meet financial obligations, the Marina Bay Sands is neither truly public nor communally used and remains exclusively a commercially used real estate. The building does not focus in the same way as Pinnacle@Duxtan on social ecology factors, but is rather a profit-oriented building with an elaborated business model and in that sense, it meets its expectations to the same extent.

For further clarification, the Gate Towers in Abu Dhabi have a similar setup of three towers and a horizontal connection at the top. In contrast to the Marina Bay Sands, it is rather a hybrid of office space and luxury residential apartments and has less similarities with the skypark concept, nor it is evident as skyplane.[201]

3.3 Cross-Comparative Interview Study

The purpose of this research analysis was to evaluate the idea of LPS with experts of the field from all around the globe, to have their different opinions according to their background, education and practical experience. The following comparison of the 3 interviews revealed

[196] Dangerfield, “‘It’s Not What We Were Promised.’”
[197] Odlinger, “Agenda Document for Planning and Transportation Committee,” 183–84.
[198] Dangerfield, “‘It’s Not What We Were Promised.’”
[199] Kohn, *Brave New Neighborhoods: The Privatization of Public Space*, 65.
[200] Safdie, “Case Study: Marina Bay Sands, Singapore,” 12–17.
[201] Singh, Elsouefi, and Brannan, “Case Study: Gate Towers, Abu Dhabi,” 13–14.

certain agreements, but also criticism of existing projects and helped to find key criteria that the LPS-model would have to bear in mind.
The interviewed practicing architects are from China, USA and Europe.
Hongxi Yang was born and raised in China and today she is an Associate of Pelli Clarke Pelli Architects in New York City, USA. Garett Hwang was born and raised in the USA and today she is the Director of UNStudio Hong Kong. The final interview was with Hannes Pfau who was born and raised in Austria, Europe. Today he is Partner of UNStudio operating mainly in Shanghai and Hong Kong and he is responsible for the Asian market.
The meetings were in August and September of 2018 and were executed in Hangzhou, Hong Kong and Shanghai respectively. All interviews where documented by voice record and side notes, before being put into a written form that was sent to each participant to give them the possibility to review.

For good comparison and academic relevance, the interview was carefully arranged as a structured questionnaire-based interview. The interviews started with some basic personal questions to get some information about each background before getting to the 12 main questions. The average time for one interview was about 40 minutes.

3 Groups of Questions:

1-2 fundamental/basic questions to narrow down the topic
3-9 one question for each defined layer of public space (LPS)
10-12 future potentials and personal opinion

3.3.1 Framework and Questions

The three questionnaires can be found in the appendix. This chapter distillates the findings of all three interviewees and they get reflected in a joined paragraph.

Entrance Questions:

1. Your office is well known for large mixed-use developments including high-rise buildings. What do you see as the major drivers of these projects and how can the general public benefit from them?

Pfau starts with outlining the change of people's modern lifestyle and the drivers of our society. The transformation away from monofunctional districts to mixed-use buildings change our built environment and how we as humans behave using it and made us think of the 24 hours usability. The architect is not exemptional as he also belongs to the service industry and produces no pollution or noise while operating.
Hwang explains the offices approach of large-scale development concepts, which is based

on programmatic and circulation ideas to structure the different functionality of the building according to the needs of the different user groups. This interconnection of people helps to activate the site and consequently its urban surrounding. In contrast, Yang outlined the financial status of the developer or even the whole nation, including local policy and urban planning criteria, as the essential drivers of their projects.
When looking on actual projects like the Raffles City in Hangzhou by UNStudio and the Petronas Towers in Malaya by Pelli Clarke Pelli architects, these different strategies result in different articulations, however, conjoin the thought of the public image, landmark quality and skyline definition. Both projects are not just giant towers. The Raffles City in Hangzhou is so different in shape and approach to its neighboring blocky towers, that it works as a catalyst for the new business district, while the Petronas Towers are even meant to work as a “light house to the society” and became a “cultural element” for the whole state of Malaysia.

2. The “three-dimensional city” concepts of the last century are highly controversial ideas, while modern “neighborhood in the sky” concepts are put into practice. What is your opinion of the contemporary situation?

All respondents narrowed down the question to two main boundary conditions: management & security by Yang, constraints, density & space by Hwang and, usability & freeing the ground by Pfau.
Yang points out that authorities in China just recently, within the last two years, set up a new guideline that declares closed gated communities were no longer as desirable. While current built form is tried to be reinterpreted to still achieve a certain kind of security feeling that people are used to, the sky lobby, sky garden implementation is creating the asked for gated communal areas throughout the tower. Bit by bit the public could be integrated into these spaces by new technologies like Face ID or generally spoken, artificial intelligence.
Hwang speaks of the commercial vision of the same concept by flipping the commercial street vertically until markets are coming up. This approach is highly dependent upon consumer behavior and therefore working for instance in Hong Kong, but people in Shanghai are not really used to pencil towers with one shop on each floor. It is an idea that is closely connected to the vertical city concepts of the early Metabolists. Pfau also made this connection and draw the attention on the visions of Kenzo Tange, who designed a new building typology with the purpose of using space more efficiently. outlines the advantage of “creating neighborhoods in the sky” on the office’s project the “Scott Tower”. By putting the communal areas, amenities and shared facilities on different levels of the tower the inhabitants have the ability “to bump into each other” and invite people without actually having to bring them to your apartment. In that sense these places become essential semi-public spaces. In addition, it also reduces the lot coverage and frees the ground floor.

Layered Public Space (LPS) Questions:

3. Basement: Metro stations turn into complete transit centers. Can you make a suggestion of how the demands of (public) transport will change in the near future?

Metro stations are nodes with a high fluctuation rate where people get pumped through. Pfau mentioned Montreal and how they deal with local weather. Due to extreme climate conditions the underground is a complete network. Once this amount of underground infrastructure is installed and accepted by the people there are no limitations not just for shopping but also cultural and leisure facilities. Independently Yang also sees a blurring process of different programs like museum or library with the other contents including the transportation system. This strategy was key element of the concept for Transbay Transit center in San Francisco. When providing accessible space in the underground, problem solutions for the crucial problems lighting and ventilation need to be given. For this project we insured natural lighting via “light columns”. The building links surrounding towers to the transit station and creates the rare situation of a city garden with an amphitheater directly within the urban context of the local main office CBD. It also tries to counteract the “dead town effect” in a nonresidential district.
Hwang analytically breaks down the problem to the main boundary conditions logistics and efficiency. Especially these days it’s no longer about shopping but about lifestyle and how everything is defined by it and retail is no exception. Hong Kong is also a good example where several transport systems like metro, high-speed rail, ferry and airport functionality are intentionally grouped together underground. This layout offers new possibility but critically seen also does not necessarily bring different user groups more together. Pfau sees the main problem of current developments that they are driven by developers where economic interests are the driving forces and less by policy makers. Future developments need to think of the long run which goes beyond probably the next 20 years.

4. Ground floor: By shifting the major pedestrian routes above and below the ground, what is the future of the ground floor and how can it be protected from being completely engrossed by infrastructure?

All respondents agree on the fact that the ground is not damaged by infrastructure mainly for the individual traffic, even though most planners try to push the entire infrastructure above or below ground.
Pfau mentioned that in the 80s, it was kind of on vogue to push individual traffic out of the city center and to establish inner urban pedestrian zones in European cities. For sure, this doesn’t always work. As long the public transportation system does not offer the convenience of individual traveling, we must deal with the coexistence of private traffic. He rather questions what we define as ground floor nowadays and how to guarantee accessibility on

various levels giving several floors similar commercial value and ground floor character. Additionally, the terrain varying quite fast in terms of altitude like in Chongqing also changes the ruleset for the ground floor. Once a building has two entrances on opposite sides and they enter in different floors, what is now your ground floor? Once you entered the building this definition gets less a problem.
Yang also points out the super connectivity of multi-layered public space and how the ground floor blurs, because the definition is rather defined by program than the ground itself.
To explain the difference of the more western cultural pedestrian district idea and how to deal with pedestrian qualities in Asia, Hwang mentioned their project Theatre for Hong Kong Cultural Quarter in Kowloon. Its entire district is on the beach on claimed unrigged soil. Foster made the masterplan and designed the site in a way that all buildings sit on a basement that holds the high-speed rail and all car traffic. This causes a radical rethinking of certain typological boundaries that come with a theatre. To have track access to the main stage to bring equipment, it is located 12 meters below ground. The ground floor will be articulated as green oasis where just self-driving buses and EVA vehicles will ensure pedestrian flexibility.

5. Podium: Mixed-use tower clusters almost always rest on a shared podium. What are the future potentials of this part?

Pfau illustrates the definition of an urban podium by the example of Medieval Rome, which can be argued to rest on a podium with water supply, sewer and heating functionality. Also, the City of New York works as if the whole city would rest on a giant podium. The major benefit of a podium is that when several towers sit on one podium, it creates a network of multiple developments. In times where cities claim more and more space, we face more and more shortages for leisure areas and cultivatable land we need to reintegrate planting into the urban context. These reasons are followed by radiation emission reduced by greening. This will radically change the appearance of our buildings in the near future. Hwang also proposes that podiums no longer will be just giant blocks and appear kind of like a black box but break up into a network of little volumes. This offers completely new design concepts like the Canyon Project in Japan, which is still a podium but with a strong visual vis a vis connection. Function wise, the podium is becoming less a traditional shopping mall but turns more into event and social facilities with a food course. The podium problem is a very Asian thing, because in the United States they do not have this big podium culture.
Yang points out that also the Chinese fire regulation is quite different to the American pendant and recently changed, which affected the “tower sitting on top of a podium scheme” completely. Now a certain amount facade must go all the way down to ground floor. This enables the facade to touch the ground in one undisturbed vertical motion, which is an important landmark quality. When looking at the Petronas Towers or Shanghai Tower, you

notice, that a landmark tower is never sitting on a podium. For one of her projects, the developer even demanded that his tower is isolated from everything any other built structure. This might turn out to be another trend.

6. Podium Deck: The majority of Asian cities have an open space and greening problem. What potentials do these places have to become an area-wide artificial landscape within the city?

In the Asian culture, there is a strong idea and mentality of the garden. However, Hwang is doubting that just providing an artificial landscape on top of a building is getting to be appreciated by inhabitants that much. To make podium decks work, the need to be mixed with commercial facilities and F&B elements. Due to the focus on developments in the tropical climate, Pfau would not necessarily call the greening of the urban landscape artificial, because in this region the nature tries to wring back terrain and even growth on pure concrete is possible. In contrast of fighting against nature we should use this phenomenon to meet the demands of additional open space. The same attention we give the roof and the horizontal greening we should also give the facade and hanging green concepts. It is scientifically proven that vertical green is 6 to 7 times more efficient than horizontal green. When adding water features, this value even rises by 5-6 times of the rehab time using just greenery. The modern human spends most of the time in interior spaces. We really need to bring back nature into the everyday lifestyle. That way people get in contact with our natural environment and gives the next generation the ability to understand by personal experience nature and thereby generate a certain awareness why it is so important to conservator it. Beside that the podium deck should take its role for the tower and technical spaces seriously and therefore a logical configuration of technical and open spaces is crucial.
Yang sees big accessibility and Scale issues. Major pedestrian streams enter the building directly from the underground, so these generated places are a bit cut off the two daily main roots. Major possibilities for getting used would be lunch break and after office hours when the sun went down.
Of high interest was the development Liuxiandong-Plot A4+B2 of Vanke Design Community mentioned by Hwang. Here the whole building is sunken down below ground and covered by a porous green roof, which is quite deductive and really used by the people, because it is really integrated into their everyday paths.

7. Public Space in the Sky: Linkage strategies of different public space levels, which are really far away from the ground, remain a major weakness. How can these public spaces be further integrated in our everyday routes?

To Pfau, the most difficult parameters are ownership and policies. Both need to be insured

by the facility management and security staff. Its also about how you can motivate people to go up there. In most cases these sky spaces are semi-public spaces and you must disburse a fee. That's not ideal but better than having restricted places.
Together with other reputable offices, they proposed to a reconstruct strategy for the site of 9/11. A series of towers which were leaning into each other created several publicly accessible levels which functioned almost like a street in the sky because you could walk through the series of towers without having to go down to ground floor. Hwang also points out that the connectivity of the public is key to give people an actual reason why you are up there. The mixed-use developments, which consist out of multiple towers and connecting bridges generates a stack of different programs and helps to generate spaces. This causes the interface to disperse vertically and creates connecting nodes within a development, for instance the sky lobby of a hotel on the 50th floor.
Yang is again mentioning the Chinese fire code, which requires a refugee room every 15 meters. These floors also offer space for the MEP and they are in close relation with the established sky lobby system. However, most truly public flows will stay below 24 meters, which basically are the 5 to 6 floors of a regular podium.

8. Public Space in the Sky: The two signature developments, Marina Bay Sands (Singapore) and Shanghai Tower (China), both provide a number of public space layers. What are, in your opinion, the strengths and weaknesses of these two different understandings of public space?

While Yang compared the passage of the podium of Marina Bay Sands with the green atriums of the Shanghai Tower, Hwang and Pfau compared the sky park of Marina Bay Sands with the green atriums of the Shanghai Tower.
At Marina Bay Sands, Yang sees the public restricted to go through a set of connected atriums in the basement. When leaving the individual hotel room, you can look down onto the people passing through the canyon, however either way you have a view to the inside. Conceptually similar it the sky lobby of the hotel of the Jin MaoTower. Both have a security issue in terms of getting hit from something that gets dropped.
Marina Bay Sands is essentially a hotel and the park deck basically belong to the hotel accept a little piece is used as observatory. Therefore, it can be argued to be a semi-public space. Marina Bay Sands also reveals that in Asian projects, everything is about the top, a certain "cool-factor".
In the Shanghai Tower the atriums that are winding up the tower and make use of the fact that, the higher you go up the further you can see and therefore have the ability to become an address of the tower's community. Due to the restriction of accessibility to members of the tower or people with visitor card, even though you don't have to pay to get there, it needs to be understood still as semi-public space. Conceptually it is a nice approach, but the load of

structural elements ruins the atrium qualities and the double skin greenhouse effect problem is also noticeable when entering these voids.
To really make these sky spaces accessible to the broad public, the idea of mixed-use program needs to be pushed even further to avoid zones with “dead program”. Pfau argues that common office towers are active from 06:00 to 21:00 on five of seven days of the week. When having the possibility to make use of the unused time, it would create places with higher social safety and higher efficiency.

9. Rooftop: Previously, the top of a major high-rise development was mainly occupied by facilities for tourism. What are the duties of this part of the skyscraper in the future?

Already today, towers are facing the problem that when every tower of a CBD has an observation deck, they are sharing the visitors, but don’t really increase the number of visitors anymore. Sky walks, sky diving events and even astronomy observation decks are conceivable.
Hwang mentioned a new form of sky tourism in Stockholm. They have set fall wires all the way from one roof to another and the people can experience the city from the perspective of a bird. In contrast, in Singapore the roof deck is commonly used as club house. Pfau explains that the roof is a little bit overrated since there are possibilities to generate almost rooftop conditions on almost any other floor of the tower, for instance in form of a “green pocket”.
Yang analytically points out the requirements of the fire regulations, that modern super tall towers are required to have a helipad on the top as additional evacuation possibility. MEP facilities also need 8 meters of clear height above them and would be quite difficult to be relocated to somewhere else. A trend nowadays is that the top is less programmed with an observation deck, but other more public functionality like art galleries or event locations.

Future related Questions

10. Publicness: Already today public space is not always public to everyone, but restricted to closed societies. How can certain strategies ensure a balance of social stratification within multidimensional tower cluster?

To all interviewees a balanced social stratification is the crux of the matter, but in the past problems of comparable scope got solved as well. Hwang draws the comparison of the publicness of a tower with the public beach problem in New York City in the 60s and 70s. Public busses didn’t reach the beaches which immediately cut off the lower economic bracket of the society. The only people who could go there were those who could afford a car. This filtering of people happens when you have to go through another program before

you enter the public zones. Beside all social consciousness, even when public access and connectivity is ensured, the problem of society self-segregation is still a naturally occurring issue. Especially here in Hong Kong, people draw a lot of invisible class lines. Pfau sees the differentiation of the social structure also closely connected with land use and distribution of space. Nowadays, the publicness is becoming more and more of interest to developers, rule makers, advertisers of competitions and policy makers. Yang explains that a landmark tower that is articulated as vertical city and truly serving the community has to be the developers vision themselves, because they need to have a certain humbleness to pay so much tribute to society. Prior focus should be given to the security issue that integrating public functionality becomes also an actual benefit for the developer and justifies bringing people to the upper floors. This can be insured by new trends in the facility management and the upcoming integration virtual intelligence into our buildings. Face-ID is just the beginning.

11. The human scale defines the evolution of our cities and buildings. The high-rise building gives the city its volume, but how can tower clusters meet the needs of humanity?

There is an ongoing trend of retail shops to reorient to the exterior. Hwang mentioned that in the US the typical shopping malls are kind of disappearing. Podiums in Asia also start to implement this small shop frontage kind of feeling within them. This breaking up of volumes also happens with the towers and blurs the giant scale. In the past several projects, like our project Hangzhou Raffles City creates an identity of the tower by breaking up the facade. The rule of thumb in this case seems to be, “the bigger you go, the smaller we have to go too but the user never changes size”.
In contrast, even though landscape and sky gardens are tried to be implemented, according to Yang’s interpretation, the high-rise tower is mostly driven by the economy of the society and less the human-scale. Pfau sees daylight conditions and natural ventilation as vital components of our built environment that need to be secured, but this doesn’t mean that we have to bring a certain dimension like the human scale back into certain spaces. It has more to do with how we design towers and with perception. New developments are defined by masses and building off set regulations. In these in-between spaces of different projects, the generation of volumes is not necessarily allowed. This is where Pfau believes policy makers failed greatly.

12. The sky is the limit: Can you outline your vision of the concept of layered public space at the end of this century?

According to Hwang’s opinion, the idea of layering public space does not necessarily need to be understood in a literally sense and has to go vertical but should define different qualities.

The definition of inhabited space will blur and will intertwine working and living environments even more. People are already starting to value green more than in the past, what could also increase the importance of public parks in Asia, like in the US or Europe. A vertical example would be the floating green element of Ole Shereen's tower in Vietnam.
The change of our built environment is always an evolution that adapts and reacts according to certain changes in society, nature and behavior. According to Yang The boundary between different public programs is less of an issue, but we should think of multi-functional space in a way we think of a smart phone. You can still have a phone call, but with the app store it turns into a far more powerful tool.
New technologies will be even more intuitive than the state-of-the-art face-id systems and the security issue will no longer be an issue, but probably the personal privacy. As shown with futuristic seeming features like the hololens from Microsoft integrate a new dimension to the reality. In changes everything when you can sit at the window and get some buildings closer or even turn on an x-ray mode by a certain hand gesture or even just by your thoughts. It is by far more flexible and can be changed by a simple software update.
Great potential relies on the spine which is a crucial part of the circulation. Horizontal escalators will change the way we think of how user flows are navigating through the building. The wellness factor is essential to argue why integrating landscape into our buildings and is standard in LEED.
Pfau sums up that we as architects have to be aware of our responsibility to create a built environment that fosters communication throughout our society and offer opportunities to improve our mutual social understanding.

3.3.2 Conclusion:

Talking to the three practical architects Hongxi Yang, Garett Hwang and Hannes Pfau really opened up the author's mind and explained the connections of undergoing process in the state-of-the-art building industry. To the respondents, up to this point, the topic of modern LPS and its close connection with mixed-use buildings is not well examined from the academic perspective except representatives like Steven Holl and Antony Wood. In the practical field, offices like Woha, Safdie Architects, Portman and others have their in-house science teams working on these crucial queries of the 21st century.
Major differences between the opinions of the three interviewees was the definition of publicness. Also, from personal experience in China, when looking at the "WeChat"-behavior it is noticeable that these technologies make the need of a transportation card, a housekey, cash money and many other things completely obsolete. But in the future, are we still in a public area when we get access to a certain space, because long before entering the zone the facial recognition system registered us, and did not step into our way to make us go somewhere else? Europeans tend to see this development more critical while in Asian

countries less worries are noticeable.

They also made the author aware that in the building industry, a new building goes through a long process before being put into practice. Depending on its scale a huge team with diverse people, interests, background and goals are working on it. Even if the architect sees the building as “his design” it belongs to the developer. Therefore, it’s the developer’s “vision” and in the end he is the one telling the way to go. Beside ownership and design intention, policy makers ensure spatial planning goals of the city, interests of the public and safety. Only when these three components are working closely, respectful and interactive with each other, the project is forearmed for future challenges regarding climate change, population growth and infrastructure reorganization.

In the field of economics, the performance wheel of sustainability describes similar phenomena. The relations of social, environmental and economic issues first need to be understood and balanced in order to reach cost, time and floor area efficiency.

Economic/Management	**Social/Lifestyle**	**Environmental**
- Security - Circulation/Program - Logistics/Efficiency - Connectivity - Interface/Dispersal - Individual Transport	- “cool” Factor - Social Consciousness - Acceptance of Mixed-Use - Class Orientated Program - Problem: Social Self - Segregation/ Balancing - Street Scape Effect - Failure of Human Scale	- Daylight Conditions - Natural Ventilation - Climate Change - Accessibility of Green - Outside Environment - Wellness

Table 1: Assignable Factors of Layered Public Space (by the author)

4. Case Study

To elaborate the manifold usages of public space, the nature of the LPS model gets further investigated by the analysis of 5 cases, which are all located in Asia. The projects are: Shibuya Hikarie (Tokyo, Japan), The Orchard Residences & ION Orchard (Singapore), Beijing Yintai Center (Beijing, China), Tencent Seafront (Shenzhen, China) and Raffles City Chongqing (Chongqing, China).

The chosen cases are big scale developments and vary in scale and number of towers from one to eight clustered high-rise buildings. The buildings may possess several different forms of public space but were assigned to one specific LPS- layer representing it. When several layers exist, the relationship of these different areas and how they are connected with each other is of high interest. The construction of all buildings ended in this decade except Beijing Yintai Center, which was completed in 2008.

The public areas of these buildings are definitely representative and heading towards the right direction. A true publicness in its original sense to be achieved vertically is the declared goal of future projects and developers start to see its potentials and relevance.

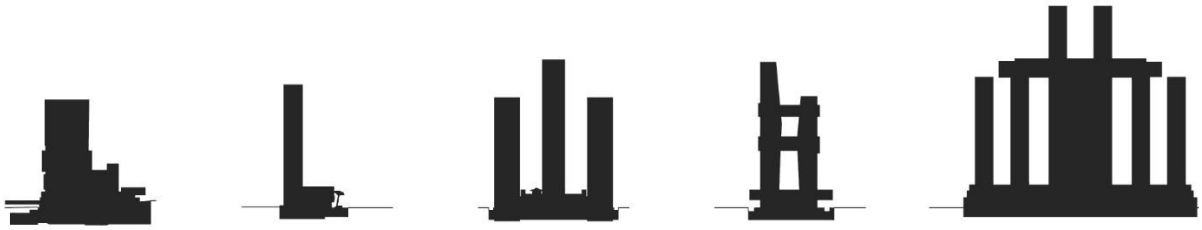


Fig 28: Case Study Size Comparison (drawn by the author)

4.1 Case Study Methodology

To evaluate criteria of the selected cases, the analysis approach relies on qualitative and quantitative parameters and orients on the analysis of respected research experts of the field.

The overall introduction page of each case bases on conditioning of the case study of the book “This is Hybrid” by Steven Holl and “The Skycourt and Skygarden” by Jason Pomeroy. These studies rely on a programmatic section and not on an axonometry, which illustrates the functionality of a tall buildings much easier and on point.

The qualitative approach is based on the investigation strategy of Joana Carla and Soares Goncalves whose major interest was the environmental performance of tall buildings related to human productivity and comfort. This part of the analysis is not meant to be tested against certain benchmarks but points out local priorities of each case. These main analyzed properties are the urban context, the ground conditions and environmental impact, the

wellbeing, the energy and environment, and the environmental identity.[202] For the quantitative approach the rating method used by Patrick Bingham-Hall to analyze the social and ecological performance of high-density buildings was chosen. Major elaborated parameters are the Green Plot Ratio (GPR), Community Plot Ratio (CPR), Civic Generosity Index (CGI) and Ecosystem Contribution Index (ECI).[203]

Qualitative Criteria[204]

The analyzed building properties of Joana Carla and Soares Goncalves are differentiated by sub criteria shown int the table below:

Urban Context:	Ground Conditions & Environmental Impact	Wellbeing	Energy & Environment	Environmental Identity
• Urban Form and Skyline • Infrastructure and Mobility • Building Function versus local socio-economic Structure	• Solar Access, Daylight Availability and Open Space • Pollution Dispersal • Quality of Public Space and Pedestrian Comfort	• Thermal Comfort • Daylight and Visual Comfort • View, Social Interaction and Privacy • Acoustic Comfort	• Architectural Features • Adaptability to Future Changes	• Architectural Expression

Table 2: Qualitative Criteria (Carla and Goncalves, edited by the author)

Quantitative Criteria[205]

Green Plot Ratio (GPR)

Leaf Area includes all kind of greened surfaces no matter vertical or horizonal.

$$GPR = \frac{\text{Total Leaf Area of Greenery within the Site}}{\text{Development Site area}}$$

[202] Carla and Goncalves, *The Environmental Performance of Tall Buildings*, 222.
[203] Bingham-Hall, *Garden City, Mega City, Rethinking Cities for the Age of Global Warming*, 206–7.
[204] Carla and Goncalves, *The Environmental Performance of Tall Buildings*, 223–26.
[205] Bingham-Hall, *Garden City, Mega City, Rethinking Cities for the Age of Global Warming*, 206–9.

Community Plot Ratio (CPR)

Community space includes fully public areas, semi-private communal spaces, care centers, library and cultural areas. Additionally, 25% of retail areas, which represents the relaxing areas and walking passages open to visitors at all time.

$$CPR = \frac{\text{Total Community Space within the Site}}{\text{Development Site Area}}$$

Civic Generosity Index (CGI): 100%

each criterion gets represented by 20%

1. criteria: ground level shelter, services and amenities
2. criteria: ground level accessibility and activity
3. criteria: visual pleasure provided by horizontal and vertical landscaping
4. criteria: public access to spaces and facilities within the building
5. criteria: spatial engagement and connection with an urban network

Ecosystem Contribution Index (ECI):

20% resourcing a basic urban habitat for insects and birds

40% resourcing a diverse planting habitat

60% resourcing a vertically and horizontally inter-connected greening

80% resourcing a multi-dimensional inter-connected greening to be habitable by insects and birds throughout the year

100% resourcing a natural habitat that functions as wildlife sanctuary within a wider network

4.2 1st Layer: Shibuya Hikarie (Shibuya 2-chome 21 Area Development)

City, Country	Tokyo, Japan
Address	2-18-3, Iidabashi, Chiyoda-ku
Proposed, Construction-Period	2007 2009 - 2012
Building Function	office, exhibition, retail
Structure	steel
Architect	Nikken Sekkei Ltd, Tokyu Architects & Engineers, Inc.

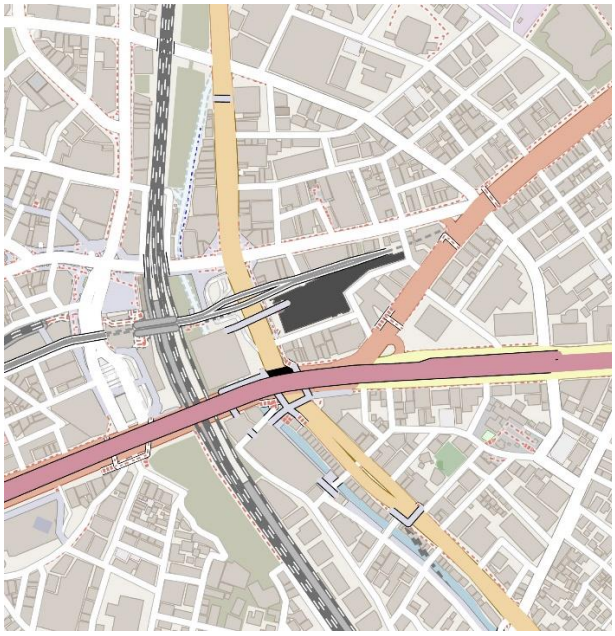


Fig 29: Shibuya Hikarie Site Plan (source: openstreetmap.org, edited by the author)

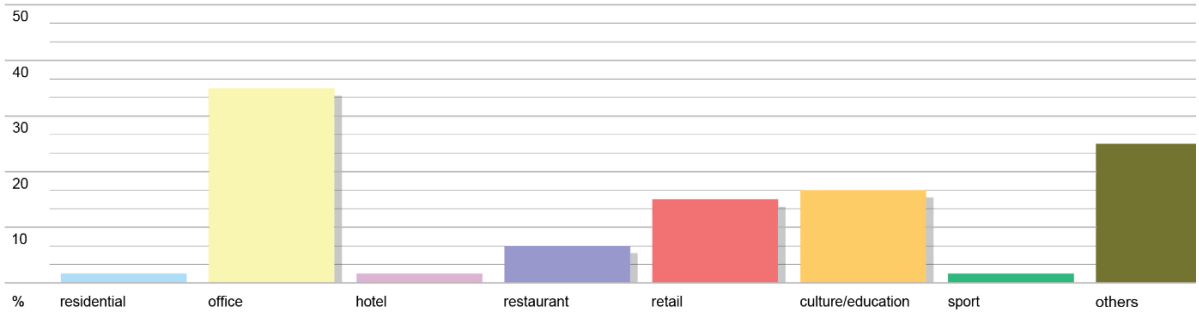


Fig 30: Shibuya Hikarie Uses Distribution (source: drawn and calculated by the author, details in Appendix)

Tower GFA	114 546 sqm
Height Overall	182.5 m
Tower Function	office, exhibition, retail
Floors Above Ground	34
Floor Below Ground	4
Elevators	41
Apartments	-
Parking Spaces	419

Table 3: Shibuya Hikarie Properties (source: skyscrapercenter.com, edited by the author)

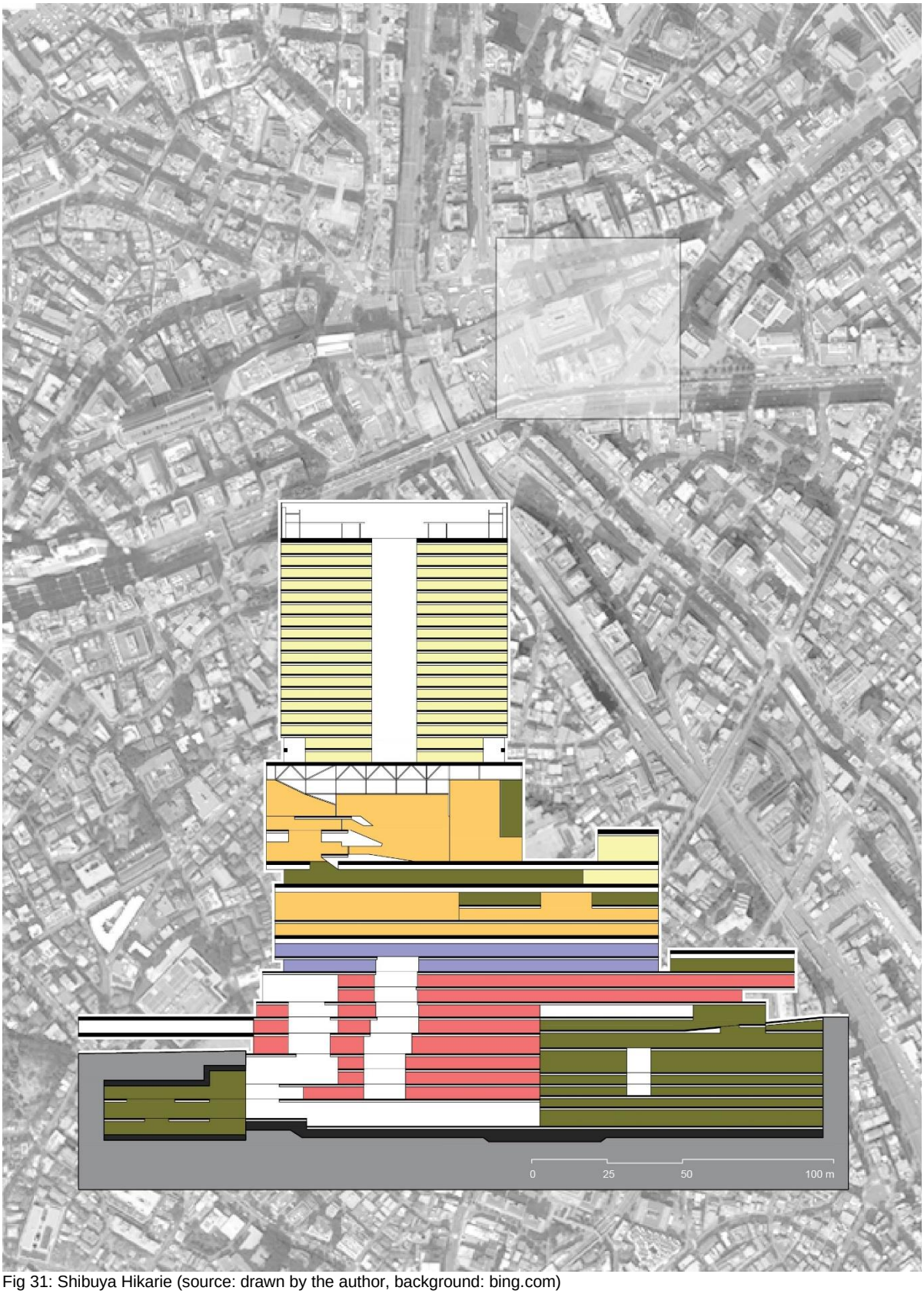


Fig 31: Shibuya Hikarie (source: drawn by the author, background: bing.com)

Qualitative Criteria

Urban Context:

- **Urban Form and Skyline**

  The tower is situated in the center of the Shibuya Station and part of its CBD. It is articulated as a new super high-rise landmark of "stacked diversity". The different usages are articulated by the subdivision of the tower into independent sections that are hovering above each other by inserting common-used decks and sky lobbies with green outdoor spaces in between. That way, the building becomes a strong synergy of different spaces and is breaking down the big volume into a rather vis-à-vis articulation.[206]

- **Infrastructure and Mobility**

  The Tower is directly connected to the Shibuya Station district in the underground and also by a skybridge. It is a neuralgic subway hub with TOD character and Japanese influences. In this specific case, the urban core spreads over several underground and above ground levels. In 2013, the Tokyo Toyoko Line was forced deep into the underground, which changed the dynamic of the transferring passengers completely. At the moment the whole Shibuya Station is undergoing a radical redevelopment process, adding numerous new buildings to the area. Shibuya's redevelopment is estimated to be completed in 2027.[207]

Public Transport Infrastructure:

JR East:	**Subways:**
- JR Yamanote Line (north-south)	- Tokyo Metro Ginza Line
- JR Sikyo line and the Shonan-Shinjuku (southern but within a walkable distance)	- Tokyo Metro Hanzomon Line
	- Tokyo Metro Fukutoshin Line
Private Railways:	
- Keio Inokashira Line (terminus)	
- Tokyo Den-en-toshi Line	
- Tokyo Toyoko Line	

- **Building Function versus local socio-economic Structure**

  In total, the lower 14 floors (11 above and 3 below ground) of the tower are accessible to the overall public and are mainly occupied by retail shopping. Gastronomy, including food shops, restaurants and cafes can be found on floors -2 to -3, as well as on floors 6 to 11. On floor 8, event and conference spaces are located to hold fashion shows and part time art exhibitions. Additionally, the tower is also the address of the Tokyo Theatre Orb

[206] CTBUH, "The Skyscraper Center, Shibuya Hikarie," 1.
[207] Hornyak, "Shibuya Station Area Redevelopment Plan – Shibuya Station."

staging musicals and entertainment events. The Tower is meant to become a visual and social vocal point throughout the CBD.[208]

Ground Conditions and Environmental Impact:

- **Solar Access, Daylight Availability and Open Space**
  The public part of the tower has, except in the common-used decks and sky lobbies, almost exclusively solar access on the west facade and the very western part of the south facade. All the other facade square meters are covered and shield the building from solar radiation. This way, at night the west facade almost appears like a stack of window frames and show the different functionality, like the big theatre lobby.
- **Pollution Dispersal**
  The extensive greening of the sky lobbies is a nice feature for the local people but has miner impact to counteract air pollution. However, the tower design affected its imbedded surrounding by advanced environmental performances, like natural ventilation. 30% of the CBD is covered in green.[209]
- **Quality of Public Space and Pedestrian Comfort**
  By shifting facilities for movement into the underground, it tried to improve the vitalization of the entire city of Shibuya and surrounding area by creating a high-quality livable space.[210]

Wellbeing:

- **Thermal Comfort**
  Beside the tower's orientation to the east, conspicuous is that the glass facade of the sky lobbies steps back from the perimeter. This allows several outdoor areas and also minimizes the solar radiation on these publicly used levels.
- **Daylight and Visual Comfort**
  The transport systems are not directly within the building, but connect by an urban core (an atrium that serves as a vertical axis). This interior void also brings light into the basement.
- **View, Social Interaction and Privacy**
  The Tower stands in one of the miner valleys of the hilly ground. Major view is to the east onto the rail tracks and much smaller buildings, where the Cerulean Tower is the closest vertical object.
  Once the revitalization of the CBD is finished, the east facade will face the projected

[208] Hornyak, "Shopping in Shibuya – Shibuya Station."
[209] Hikarie, "渋谷ヒカリエ/Shibuya Hikarie."
[210] Hikarie.

Shibuya Station District Tower.[211] This would have a negative impact on the daylight and visual qualities of all public facilities within the tower.

Energy and Environment:

- **Architectural Features**
  The Tokyo Theatre Orb has a big Hall A and a smaller Hall B that have a capacity of 1004 and 301 respectively.[212] The main theatre room Hall A requires a big open void and does not allow a conventional tower center core layout. Instead it was decided to shift vertical movement and shafts to the north and south perimeter of the tower. While the core in the south is exclusively operating the public floors, the north core is going all the way up to the top of the tower. This enables open office floors with clear view to three sides.
- **Adaptability to Future Changes**
  Due to open floor plan layout throughout all different sections of the tower, the overall adaptivity results in multi-purpose usage ability during regular operation.
  Outstanding is the theatre room Hall A for musicals, which was also specifically designed to work as fashion show location. Due to the flat floor and a big repertoire of facilities for lightning, multimedia and furniture, it can be spoken rather of a multi-purpose hall than a theatre hall

Environmental Identity:

- **Architectural Expression**
  To even reflect the landmark qualities in its name is based on the Japanese expression “hikarie”, which means “towards the light”. The golden color underlines this as a visual statement as well.[213]
  The publicly accessible 11 above ground floors and the 3 underground floors are articulated as part of the tower. Due to the reason that they not noteworthy extend over the perimeter of the upper floors, it would not be appropriate to speak of a tower on top of a podium, but rather a porous tower.

[211] Hornyak, “Shibuya Station Area Redevelopment Plan – Shibuya Station.”
[212] 達也, “Amazon Fashion Week Tokyo, 2019 Autumn/Winter,” 22.
[213] Hikarie, “渋谷ヒカリエ/Shibuya Hikarie.”

Quantitative Criteria

Green Plot Ratio (GPR)	**22**	**%**
Community Plot Ratio (CPR)	**430**	**%**
Civic Generosity Index (CGI)	**90**	**%**
Ecosystem Contribution Index (ECI):	**20**	**%**

Table 4: Shibuya Hikarie Qantitative Criteria (source: calculated by the author, details in Appendix)

24-Hour Scenario:

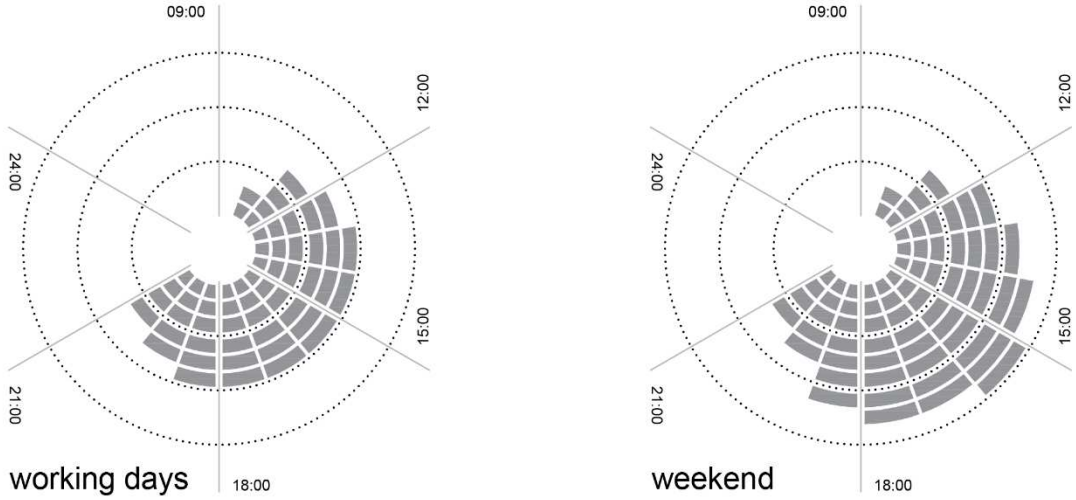


Fig 32: Shibuya Hikarie 24-Hour Scenario (source: google rush-hour traffic ticker, drawn by the author)

4.3 2nd Layer: The Orchard Residences & ION Orchard

City, Country	Singapore, Singapore
Address	238 Orchard Boulevard
Proposed, Construction-Period	2005 2006 - 2010
Building Function	residential, retail
Structure	concrete
Architect	Benoy, RSP Architects Planners & Engineers

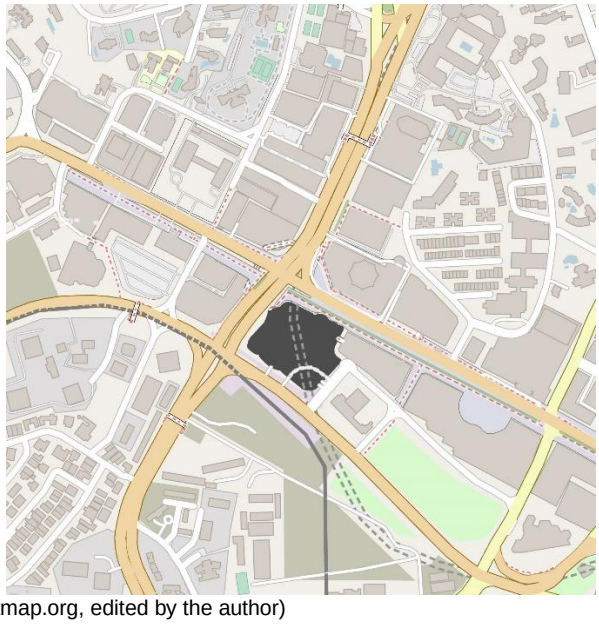


Fig 33: ION Orchard & Residence Site Plan (source: openstreetmap.org, edited by the author)

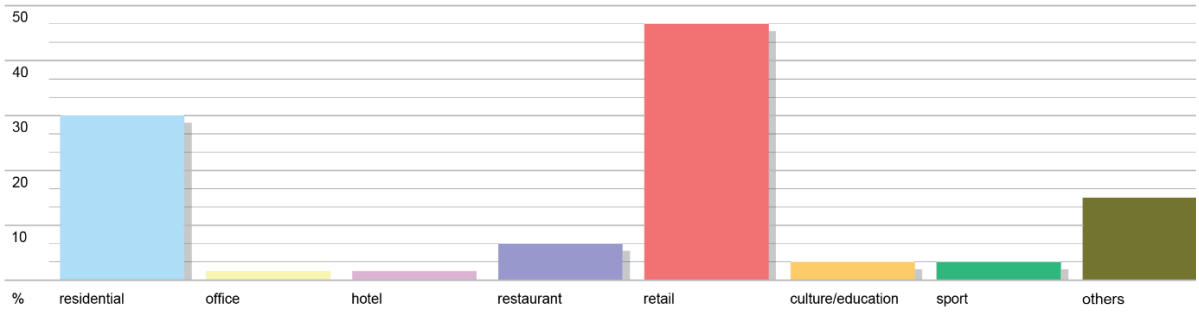


Fig 34: ION Orchard & Residence Uses Distribution (source: drawn and calculated by the author, details in Appendix)

Tower GFA	38 240 sqm
Shopping Mall GFA	64 000 sqm
Tower Function	residential
Height Overall	210.9 m
Floors Above Ground	56
Floor Below Ground	4
Elevators	10
Apartments	175
Parking Spaces	484

Table 5: ION Orchard & Residence Properties (source: skyscrapercenter.com, edited by the author)

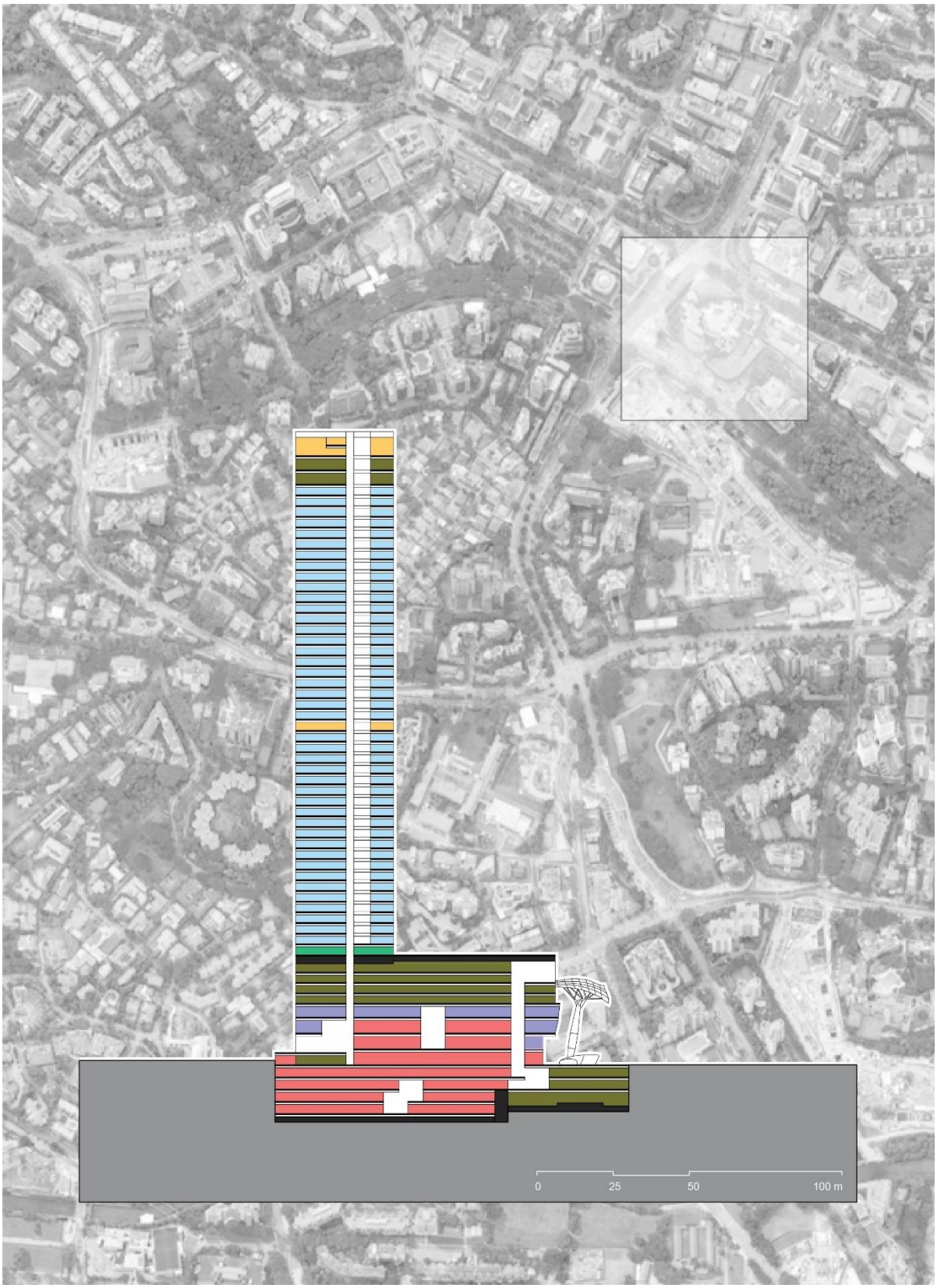


Fig 35: ION Orchard & Residence (source: drawn by the author, background: bing.com)

Qualitative Criteria

Urban Context:

- **Urban Form and Skyline**
  The Orchard Residence is a high-end residential condominium in prime location. Conceptually, above ground level the development consists of a podium block and a skinny residential tower.
- **Infrastructure and Mobility**
  The building sits on top of the Orchard MRT Station, which is one of the busiest stations of the Singaporean network. Currently it is a station for the North South Line, but in 2021 it will become an interchange station with the Thomson-East Coast Line.
- **Building Function versus local socio-economic Structure**
  The ION Orchard is using a marketing strategy that puts the towers name into the focus, by branding different functions and apps with the "ION" lettering. "So, keep your I-ON us" is one of their slogans.[214]

Landmark Features[215]

ION²:
With 3066 sqm, it is meant to be the largest sheltered public square on Orchard Road. It is an outdoor space that is a natural meeting point for all different kinds of gathering. Per diem, about 200 000 pedestrians come along this neuralgic junction.

ION Sky:
The double floor observation deck on 55-56 floor is a panoramic viewing platform. Furthermore, it can also be used for runway shows, product launches, celebrity and themed parties.

ION Art:
On level 4 there is a 493 sqm arts and culture center. It is capable of holding international arts exhibitions, fashion inspired art shows and visual multi-disciplinary performances.

ION Food Hall:
On level 4 is a huge food court that underlines their international scope with gastronomic specialties from around the globe.

Orchard Central Rooftop Garden:
On top of the podium is a terrace garden that has a number of waters, sports, relaxation and greening features. It aims to generate with a tranquil environment a natural landscape to neutralize the busy surrounding cityscape.[216]

[214] ION Orchard, "Perfect 10: A Wonder-Full Decade at ION Orchard."
[215] Ling and Tan, "ION Orchard - 'Centre of Gravity' for Singapore Retail," 2–3.
[216] Tierra Design Studio Pte Ltd, "Ion Orchard."

Ground Conditions and Environmental Impact:

- **Solar Access, Daylight Availability and Open Space**
  The greenery of the development is generating a humid environment for pedestrians and is facing the harsh climate conditions. An extended artificial canopy is furthermore shielding direct sunlight from penetrating into the building and minimizes the cooling costs.
- **Pollution Dispersal**
  LUSH greening on ground floor as well as the intensive greenery on the rooftop make their contribution to counteract the effects of pollution.
- **Quality of Public Space and Pedestrian Comfort**
  Clean and open sidewalks are punctuated by LUSH greenery along Paterson Road and Orchard Boulevard. At night the shards of stainless steel are enlightened with colorful lights and changes the visitor's experience completely.[217]

Wellbeing:

- **Thermal Comfort**
  Beside the greenery and the artificial canopy, every residential unit has one and half of the units including balconies. The air movement creates a humane outdoor area to enjoy the view.
- **Daylight and Visual Comfort**
  Due to the unorthodox floorplan of the residential tower, every residential unit gets enlightened by three sides. This also enables the living room to have a visual connection to the outside.
- **View, Social Interaction and Privacy**
  The exterior plaza of the plot introduces an effective ramp-stair system that enables the building to have a fair amount of universal access points considering also the vulnerable user groups, such as elderly, children and pregnant woman.[218]

[217] Tierra Design Studio Pte Ltd.
[218] Cho, Heng, and Trivic, *Re-Framing Urban Space: Urban Design for Emerging Hybrid and High-Density Conditions*, 42.

Energy and Environment:

- **Architectural Features**

Facilities at The Orchard Residence:[219]		
guard house	tennis court	lawn & terrance
BBQ	sky lounge	jacuzzi
Business Centre	The Bar	glass house
children' playground	The Pool	children's pool
secret garden	The Spa	mediation deck
party house	spa pavillion	Win&Cigar and Yoga Room

- **Adaptability to Future Changes**

  The development is a representative example of following current market trends. This has been made possible by a new regulation that allows to consider a condominium development on plots as small as 4 000 sqm. This results in the vertical extrusion of massing as default strategy for residential typologies.[220]

Environmental Identity:

- **Architectural Expression**

  The skin-like glass and metal as second layer in front of the facade shields the interior. The trunk-like columns at the major open plaza try to make analogies to the vegetation and peelings of fruit skins to celebrate the locations heritage and its name "orchard".[221]

[219] Axon Consulting, "The Orchard Residences."
[220] Schröpfer, *Dense+Green: Innovative Building Types for Sustainable Urban Architecture*, 184.
[221] Rowe, *Emergent Architectural Territories in East Asian Cities*, 186.

Quantitative Criteria

Green Plot Ratio (GPR)	**63**	**%**
Community Plot Ratio (CPR)	**218**	**%**
Civic Generosity Index (CGI)	**90**	**%**
Ecosystem Contribution Index (ECI):	**40**	**%**

Table 6: ION Orchard & Residence Qantitative Criteria (source: calculated by the author, details in Appendix)

24-Hour Scenario:

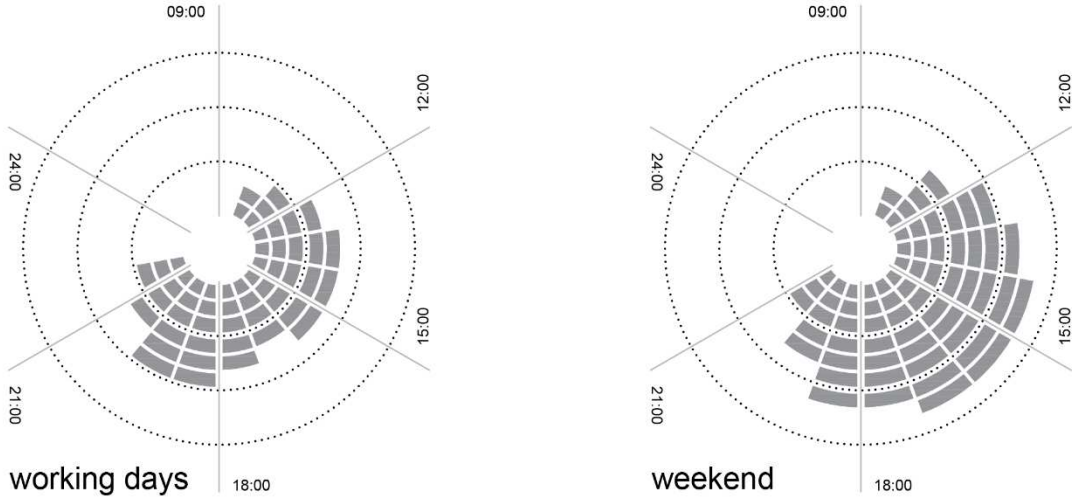


Fig 36: ION Orchard & Residence 24-Hour Scenario (source: google rush-hour traffic ticker, drawn by the author)

4.4 3rd Layer: Beijing Yintai Center

City, Country	Beijing, China
Address	2 Jianguomenwai, Chaoyang District
Proposed, Construction-Period	2001 2002 - 2008
Building Function	residential, hotel, office, retail
Structure	steel
Architect	John Portman & Associates China Electronics Engineering Design Institute

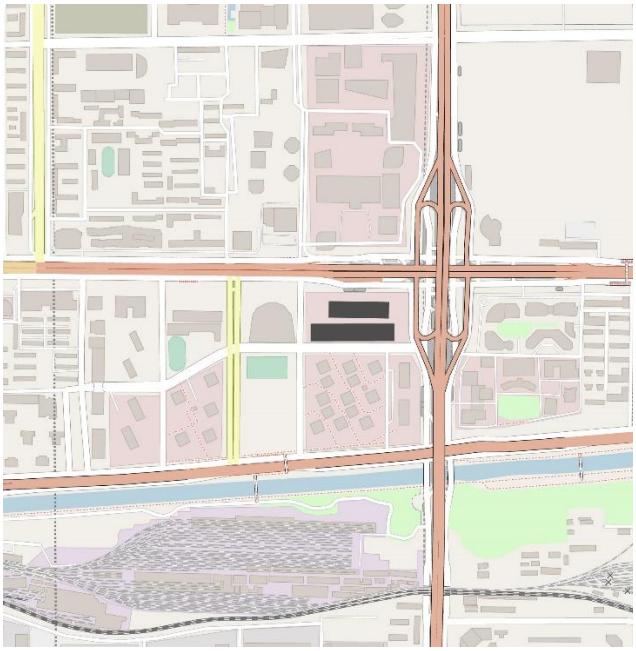


Fig 37: Beijing Yintai Center Site Plan (source: openstreetmap.org, edited by the author)

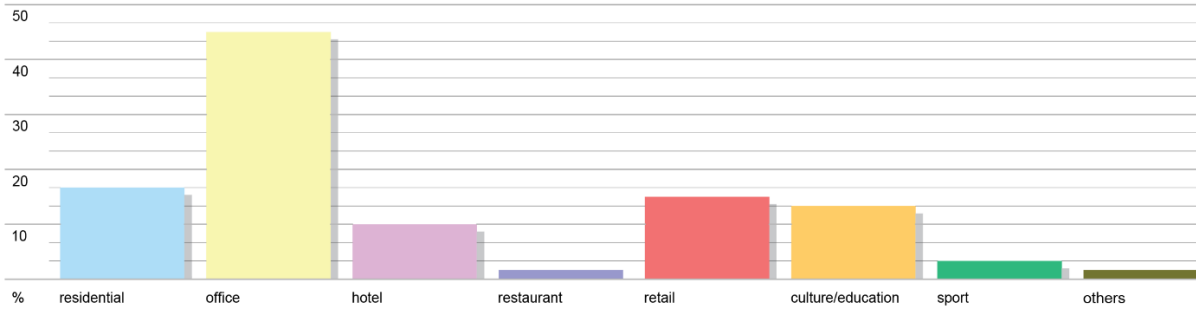


Fig 38: Beijing Yintai Center Uses Distribution (source: drawn and calculated by the author, details in Appendix)

Individual Tower	**Park Tower**	**Yintai Office Tower**	**PICC Office Tower**
Tower GFA	113 000 sqm	73 500 sqm	73 500 sqm
Tower Function	residential/hotel	office	office
Height Overall	250 m	186 m	186 m
Floors Above Ground	63	42	42
Floor Below Ground	4	4	4
Elevators	22	16	16
Parking Spaces	1 672		

Table 7: data source: www.skyscrapercenter.com

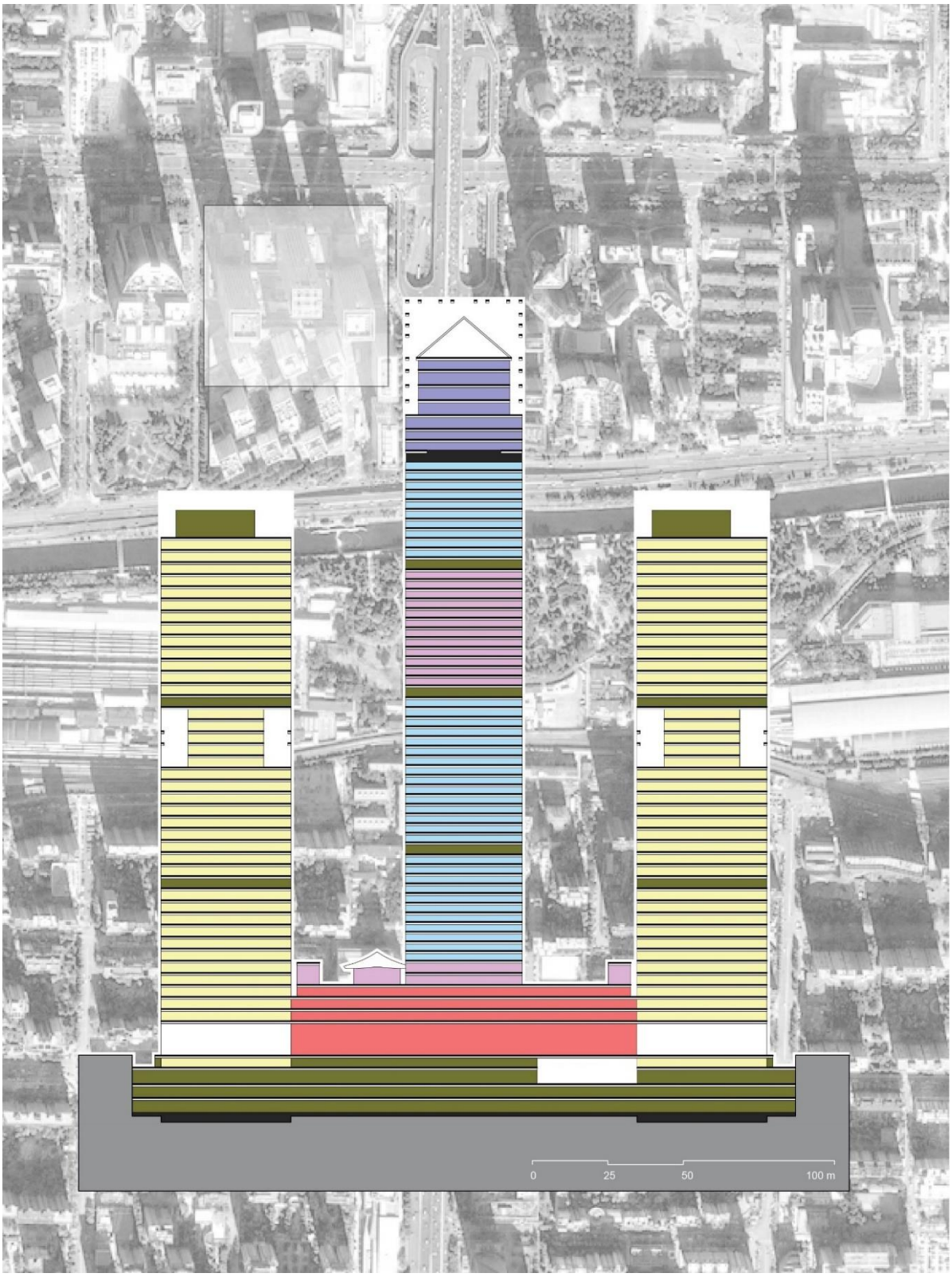


Fig 39: Beijing Yintai Center (source: drawn by the author, background: bing.com)

Qualitative Criteria

Urban Context:

- **Urban Form and Skyline**
  The tower is the tallest high-rise building along the Chang'an Avenue southern at the so called "Golden Cross" in the CBD of Beijing.[222] The towers are positioned in a triangular by shifting the tallest tower to the back of the plot to reach maximum outlook for all towers. The building benefits from Portman Architects experiences made with the Shanghai Centre, that has some similarities in terms of overall concept.[223]
- **Infrastructure and Mobility**
  The Guomao Beijing Subway Station is not directly connected to the basement of the tower cluster, but the two exits C and D are located on ground floor of the site.

subway lines

Line 1: going east-west
Line 10: going north-south

- **Building Function versus local socio-economic Structure**
  The complex is a comprehensive mixed-use project, which is combining hospitality, residential, office, retail and entertainment space. The main residential tower with the hotel is flanked by twin office towers. The top of the highest tower is programmed with some publicly accessible facilities offering a spectacular view over Beijing CBD.[224] The shopping mall in the podium states more than 50 international brands including flagship stores, offers conference rooms, catering facilities, a fitness center and recreation facilities.[225]

Ground Conditions and Environmental Impact:

- **Solar Access, Daylight Availability and Open Space**
  By using a combination of a stone curtainwall, which is already reducing the percentage of glass facade needed, and a high-performance glass curtain wall, the penetration of light and radiation gets a noteworthy reduction. Outstanding is the usage of low-e coated insulated glass on the north facade to minimize heat loss, which, in turn, caused an

[222] Beijing Yintai Property CO., Ltd, "BEIJING YINTAI CENTRE."
[223] Portman, "30 Years in China: An Architect/Developer's Perspective," 228.
[224] Portman, 229.
[225] Beijing Tourism, "The Yintai Shopping Center."

immense increase of expenses.[226]

- **Pollution Dispersal**
  Between the different building elements that are touching the ground, garden and water features are arranged and provide a human scaled and shaded environment from the harsh environmental conditions.[227]
- **Quality of Public Space and Pedestrian Comfort**
  On the ground floor an attempt has been made to shield the subway exist with trees from the super high traffic road, but in addition to its north-location, it serves more as a transitional space with little incentive to stay longer.

Wellbeing:

- **Thermal Comfort, Daylight and Visual Comfort**
  The podium deck is located and protected in between the towers and creates, with its Ancient Chinese village character, an almost private atmosphere with many niches and corners to escape from the busy events on ground floor.
- **View, Social Interaction and Privacy**
  Due to the exclusiveness of the podium deck to hotel guest and the top of the tower to well-heeled guests, the overall publicness of the project is from a critical point of view not fully given. Interesting is the Chinese Village Mockup functioning as Pavilions for the hotel guests. The value from an art history point of view is questionable, but it is one possibility to keep the ancient Chinese wood construction visible within the tower dominated city.

Energy and Environment:

- **Architectural Features**
  The concept of the whole complex is highly influenced by the “Chinese Lantern”. Translated to an exterior stone curtain wall frame combined with an interior glass pyramid structure forming the tip of the tower and gets recognizable beyond its CBD.[228]
- **Adaptability to Future Changes**
  The complex originally should have been a 4-tower high-rise cluster, but by using a special lobby-system, the architect John Portman could convince the authorities to go for a three-tower scheme.[229]

[226] Beijing Yintai Property CO., Ltd, “BEIJING YINTAI CENTRE.”
[227] Portman, “Beijing Yintai Centre | Portman Architects.”
[228] Beijing Yintai Property CO., Ltd, “BEIJING YINTAI CENTRE.”
[229] Portman III, “30 Years in China.”

Environmental Identity:

- **Architectural Expression**
  The architect John Portman really tried to combine Chinese and Western traditional cultural elements to a modern classy expression of the project. The Motto of the project is, “China can see the world and the World can learn about China”.[230]

Quantitative Criteria

Green Plot Ratio (GPR)	**38**	**%**
Community Plot Ratio (CPR)	**183**	**%**
Civic Generosity Index (CGI)	**80**	**%**
Ecosystem Contribution Index (ECI):	**60**	**%**

Table 8: Beijing Yintai Center Qantitative Criteria (source: calculated by the author, details in Appendix)

24-Hour Scenario:

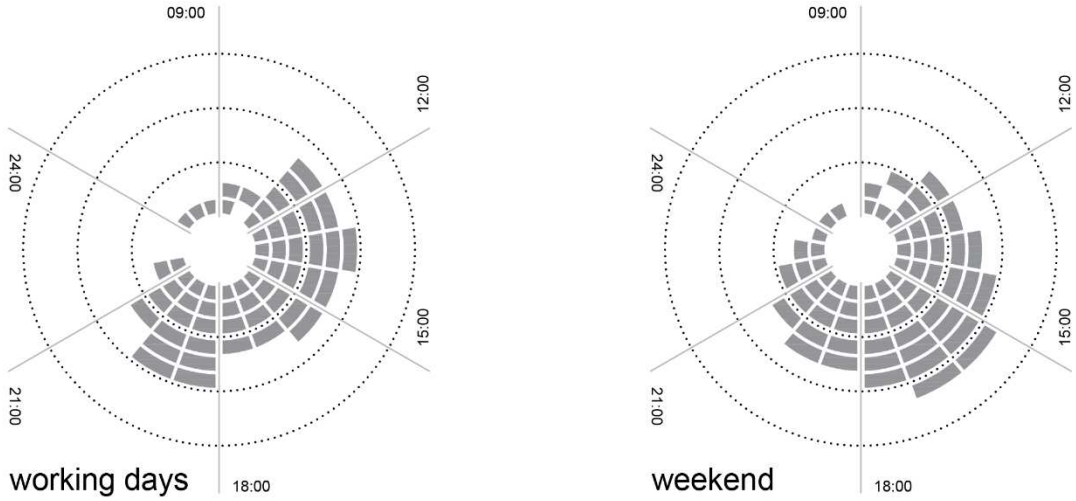


Fig 40: Beijing Yintai Center 24-Hour Scenario (source: interpolated and drawn by the author)

[230] Beijing Yintai Property CO., Ltd, “BEIJING YINTAI CENTRE.”

4.5 4th Layer: Tencent Seafront Towers (Tencent Binhai Mansion)

City, Country	Shenzhen, China
Address	Binhai Road, Nanshan District
Proposed, Construction-Period	2017 completed
Building Function	office
Structure	composite
Architect	NBBJ, Tongji A. D. (Group) Co., Ltd., Shenzhen Tongji Architects

Fig 41: Tencent Seafront Towers Site Plan (source: openstreetmap.org, edited by the author)

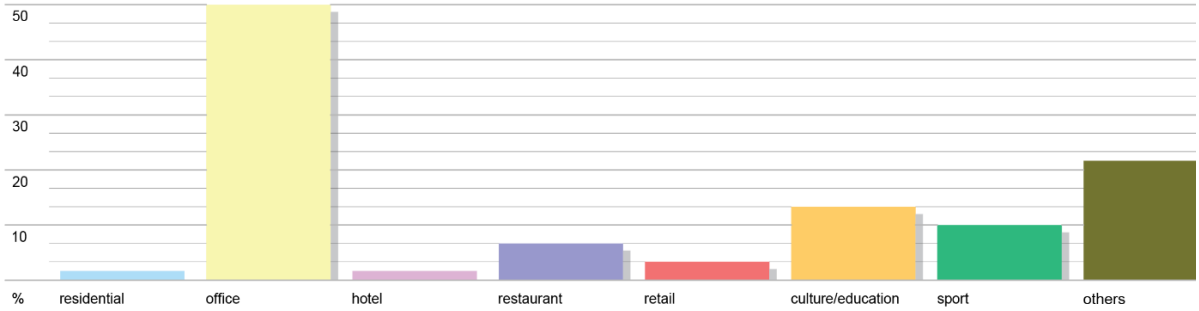


Fig 42: Tencent Seafront Towers Uses Distribution (source: drawn and calculated by the author, details in Appendix)

Individual Tower	T1	T2
Tower GFA		
Tower Function	office	office
Height Overall	245.8 m	194.8 m
Floors Above Ground	50	38
Floor Below Ground	4	4
Elevators	77	74
Parking Spaces	925	930

Table 9: Tencent Seafront Towers Properties (source: skyscrapercenter.com, edited by the author)

Fig 43: Tencent Seafront Towers (source: drawn by the author, background: google.com/maps)

Qualitative Criteria

Urban Context:

- **Urban Form and Skyline**
  To meet the demands demanded of the technology campus typology, which is traditionally located in the suburbs, within an inner urban context, the building had to go vertically. The urban form is a synergy of the single high-rise building and low-rise building cluster. The result is a scheme of two towers interconnecting each other's via elevated bridges that are programmed with vibrant spaces devoted for gathering.[231]
- **Infrastructure and Mobility**
  The building is located exactly between two subway stations what offers not the convenience to be in an environment with controlled conditions from platform to your working place. In this specific case, the walking distance would be more than one kilometer and would make additionally the use of the pedestrian bridges necessary. To close this missing link, shuttle busses pick up the people from the stations and bring then directly into the lobby of the connected towers.[232]

closest Shenzen Metro Stations

Station Houhai: Line 11 & Line 2
Station Nanshan: Line 11

- **Building Function versus local socio-economic Structure**
  The technology campus in combination with headquarter functionality is an upcoming typology and reveals its full potential when thought as vertical campus. The collaborative productivity gets redefined by distributing the amenities, that are usually in the podium, vertically. The link bridges are stimulating unity, inclusivity and have synergetic effects on the social interaction and community within the building. [233]

Ground Conditions and Environmental Impact:

- **Solar Access, Daylight Availability and Open Space**
  The ground floor is completely open and shielded from sunlight, since the first part of the reshuffled podium, the cultural link, is lifted three floors. The towers facing facades, which are intersected by the linking bridges, have numerous atriums behind the facade. Wide staircases that also offer space for group meetings connect two to three floors with each other and additionally give the tower cluster a recognizable city scape.
- **Pollution Dispersal**

[231] Ward and Wan, "The Impact of Tech Companies in Rethinking the High-Rise Workplace," 746.
[232] Saiidi, *Inside Chinese Tech Giant Tencent's Vertical Campus*.
[233] Ward and Wan, "The Impact of Tech Companies in Rethinking the High-Rise Workplace," 750–55.

The passive energy efficiency and fire safety where two key requirements of the design. A special type of insolation allows the building to “breath” and still having a low U-value. The overall energy consumption and carbon emission are reduced by 40% when compared to a conventional tower solution. This sustainability features resulted in the LEED NC Gold Certification and officially makes its contribution against the climate change.[234]

- **Quality of Public Space and Pedestrian Comfort**
  The sky bridges enhance the program of the tower complex with a large amount of sky spaces, which include a swimming pool, a basketball court with tribune, a tennis court, a rock-climbing wall, a 400-meter running track, a library and classroom. These areas should work as a medium for the employees and Tencent students to grow together to one unity.[235] The sky gardens on top of the sky bridges are meant to be cooling the whole complex and designed to be vibrant outdoor spaces, however the immense heat in Shenzhen is critically reducing the attractiveness of these outdoor spaces.

Wellbeing:

- **Thermal Comfort**
  To insure human comfortable conditions and a minimized solar heat gain during intense sun periods, the geometry of the curtain wall is broken down in small self-shading elements. The whole tower does not offer any louvers, to keep the whole building as controllable unity. The angle and size of the panels got negotiated due to cost and energy consumption.[236]
- **Daylight and Visual Comfort**
  To reduce solar radiation onto the complex, the south tower is intentionally taller than the north tower. Using this strategy, the north tower gets shielded from direct sunlight during peak hours. Besides providing indirect sun, the inner and outer relationships of the cluster result in a visual context.
- **View, Social Interaction and Privacy**
  Main office square meters of both towers are facing the three sides facades that are not looking towards the other tower. Consequently, major meeting, sport, cultural, knowledge and health-based facilities are located in the middle and are arranged in a loop. Each skybridge is articulated as a tube with two open ends that offer aligned views towards specific cutouts of the panorama of Shenzhen.

[234] Rockwool Group, “2018-19, Buildings That Reshape the Future.”
[235] Sun, “Tencent Seafront Tower: Practice on Binding Buildings,” 1310.
[236] Ward and Wan, “The Impact of Tech Companies in Rethinking the High-Rise Workplace,” 754.

Energy and Environment:

- **Architectural Features**
  The overall concept of the tower is following a combination of Tencent branding goals, which are: establishing a company image and culture, creating a gateway for visitors, foster creativity of the employees and consequently synthesize new talents for the company. The facilities to reach these goals are located in the three cultural health and knowledge linkages of the two towers. On top of the each skybridge is a green deck, which are almost inhumanly hot during the day.[237]
- **Adaptability to Future Changes**
  Major parts of the technology campus are highly adaptable to a variety of different work requirements. Free-address work environments make use of the fact that workers in general spend just 40% of their working time on their individual desk, while up to 80% of the office hours are spent as collaborative network with colleges.[238]

Environmental Identity:

- **Architectural Expression**
  The concept of the “vertical campus” is driven by its location and resulting boundaries but also by the goal to look for ways how to make working facilities more efficient and vibrant to establish social interaction. The sky lobby linkage strategy is a counter concept to the straight forward podium-tower scheme and offers new possibilities how to think a high-rise building.

[237] Ward and Ding, “Taking the Corporate Campus Vertical,” 14.
[238] Ward and Wan, “The Impact of Tech Companies in Rethinking the High-Rise Workplace,” 748.

Quantitative Criteria

Green Plot Ratio (GPR)	**61**	**%**
Community Plot Ratio (CPR)	**441**	**%**
Civic Generosity Index (CGI)	**100**	**%**
Ecosystem Contribution Index (ECI):	**80**	**%**

Table 10: Tencent Seafront Towers Qantitative Criteria (source: calculated by the author, details in Appendix)

24-Hour Scenario:

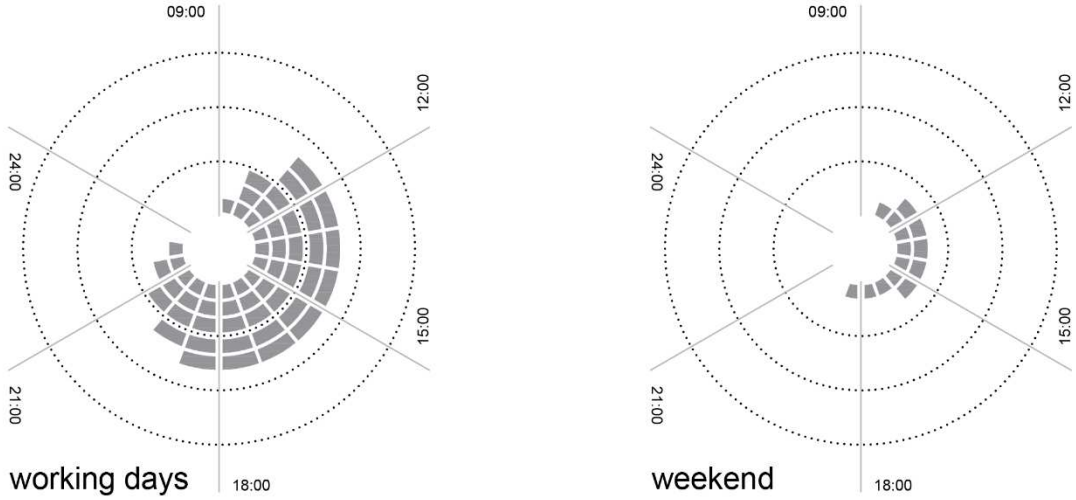


Fig 44: Tencent Seafront Towers 24-Hour Scenario (source: interpolated and drawn by the author)

4.6 5th Layer: Raffles City Chongqing

City, Country	Chongqing, China
Address	Chaotiamen, Yuzhong District
Proposed, Construction-Period	2011 2016 - 2019
Building Function	residential, office, hotel, retail
Structure	composite
Architect	Safdie Architects, Chongqing A&D Institute

Fig 45: Raffles City Chongqing Site Plan (source: openstreetmap.org, edited by the author)

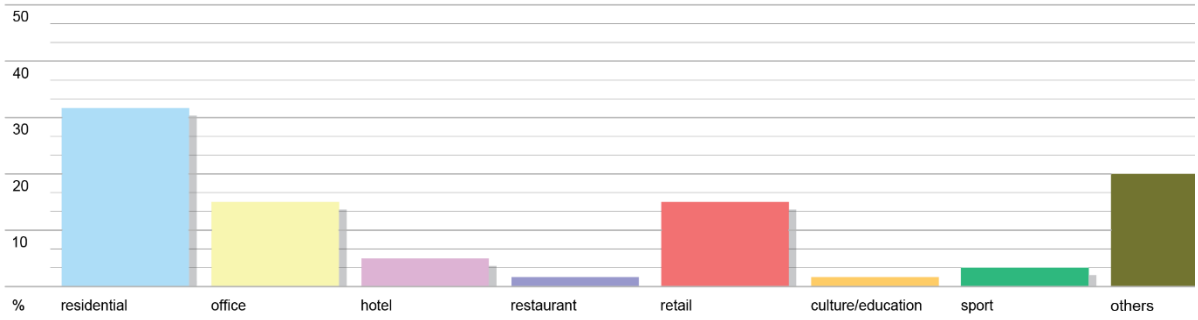


Fig 46: Raffles City Chongqing Uses Distribution (source: drawn and calculated by the author, details in Appendix)

Individual Tower	T1	T2	T3N	T3S	T4N	T4S	T5	T6
Development GFA	1 134,26 sqm							
Tower Function	residential/ retail			office/ retail	hotel/office/ retail		Residential/ retail	
Height Overall	234 m	265 m	354 m	265 m	354 m	265 m	265 m	234 m
Floors Above Ground	58	56	79	46	79	50	56	58
Floor Below Ground	3	3	3	3	3	3	3	3
Elevators								
Parking Spaces	3 300							

Table 11: Raffles City Chongqing Properties (source: skyscrapercenter.com, edited by the author)

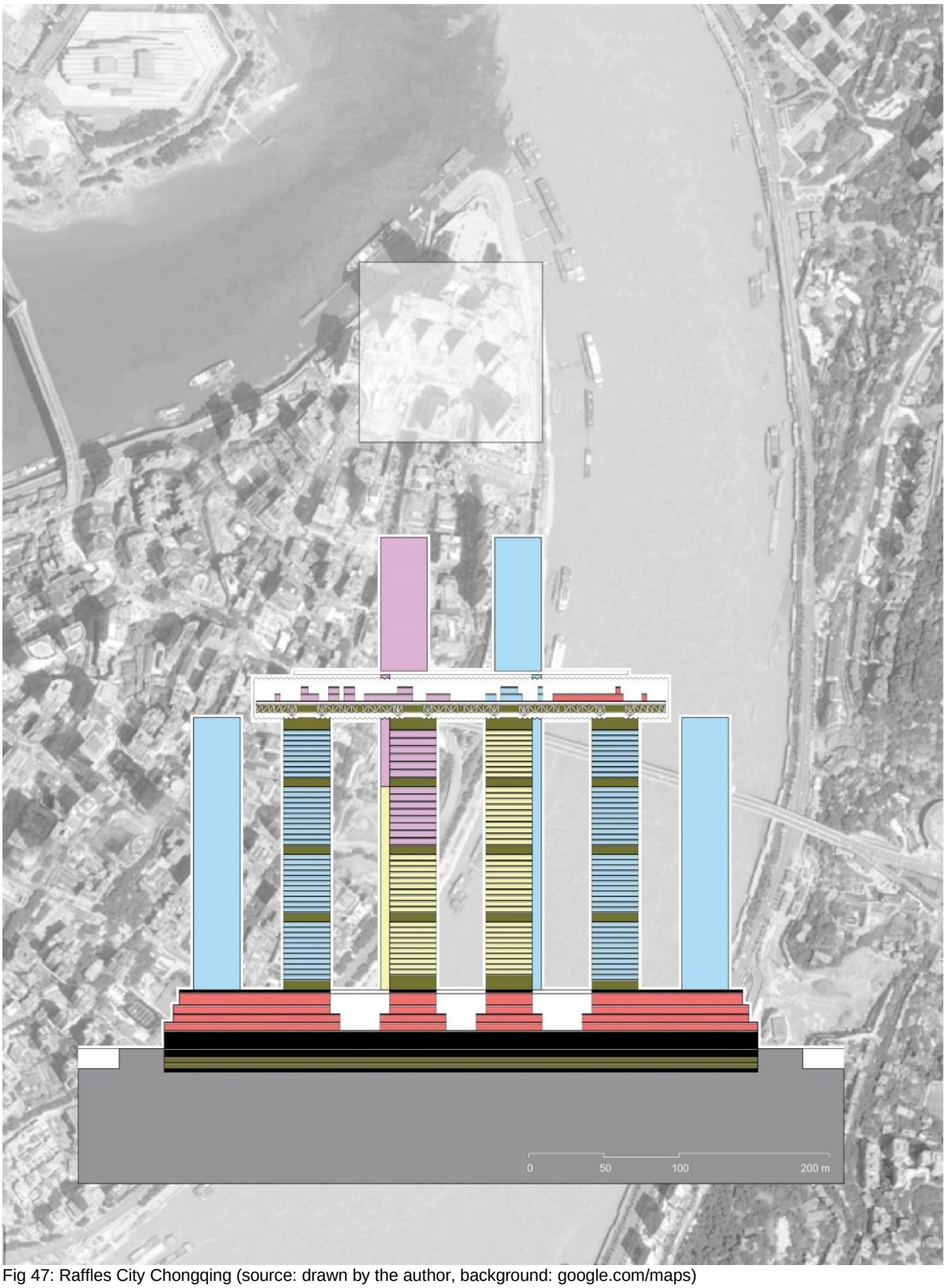


Fig 47: Raffles City Chongqing (source: drawn by the author, background: google.com/maps)

Qualitative Criteria

Urban Context:

The tower cluster is still under construction. Therefore, some criteria of the wellbeing section can just give information about the architect's concept and the personal critic of the author of this intention.

- **Urban Form and Skyline**
  The tower cluster is located on the headland formed by the junction of the Jialing River and the Yangtze River. This makes it a three-sided river-side object with representativeness already by its location. 4 of the towers are hovering a conservatory on top of them. The two tallest towers are connected via skybridges with the conservatory. Even though looking similar to the sky park concept of the Marina Bay Sands, we need to understand the conservatory as further development being more than an outlook point used as a sky garden.
- **Infrastructure and Mobility**
  Because of the project being currently under construction, current infrastructure systems are already creating a neuralgic area of the city. When completed, the project is intended to turn into a vibrant hub joining subway, subway and buses.

Chongqing Rail Transit Station: Xiaoshizi Station
Line 1(Terminus)
Line 6
Chongqing Chaotianmen Dock
Chongqing – Yichang
Buses
414, 440, 480 inter-zone line, 503

- **Building Function versus local socio-economic Structure**
  The major negative socio-economic effect of this project is the destruction of a functioning urban network making the dock to a busting wholesale market of all different kinds of goods and accessories for the everyday life.[239]
  The new podium is meant to be with a retail component of 250 000 sqm one of the biggest in the whole of China.[240] Beside the retail podium, a podium deck as a park and a hub functionality, the multidimensional tower cluster also includes also as office units and, residential and service apartments.

[239] Chongqing Guide Culture Media co.,Ltd., "Chaotianmen Square."
[240] Luong et al., "Raffles City Chongqing: A Skyscraper within a Development," 187.

Ground Conditions and Environmental Impact:

- **Solar Access, Daylight Availability and Open Space**
  Solar radiation on the buildings' surface is especially in the south of China intended to be minimized. Even though in Chongqing similar intentions were taken into consideration, the towers seem to almost touch each other and cause a massive shadow and shield the western located CBD from views to the east.
- **Pollution Dispersal**
  Because of the critical air conditions, the vertical bridging is not a sky park but a conservatory. This means that the whole sky deck is covered in a shell.

- **Quality of Public Space and Pedestrian Comfort**
  The podium deck as public square and green deck is completely open to the public and merges smoothly with the urban surrounding. A pedestrian doesn't even notice that he is actually walking on top of a roof. The conservatory offers three different zones for each of the residential, hotel and commercial user groups.

Wellbeing:

- **Thermal Comfort**
  To ensure a stable interior micro climate of the conservatory, it is protected by panels from major radiation loads. In addition, to create a stable environmental condition, its landscape is programmed with multiple pavilion-like structures and has an additional fabric canopy over neuralgic areas like the pool.[241]
- **Daylight and Visual Comfort**
  Moving towers closer to each other to use each other's shadow stands to reason, however in combination with a vertical mass, like the observatory, the shading strategy might be too much. This hyperfunction causes uncomfortable darkness in the closest floor stack where the observatory is hovering on.
- **View, Social Interaction and Privacy**
  While trying to give the observatory different functionality for hotel, residence, office-workers and tourism, the main critique is also in this project, that due to privacy and safety reasons the upper public layer is lacking publicness.

Energy and Environment:

The greening on the western facade is reducing the environmental impact of the afternoon sun onto the structure and offers a nice atmosphere on the individual balconies. The interiorized "natural" landscape within the observatory is of course not counteracting climate

[241] Huggins, "Raffles City Chongqing Conservatory: Studies For a New Bridging Building Type," 591–92.

change or reducing energy consumption.

- **Architectural Features**
  The concept of an observatory as horizontal tower on top of a cluster of towers is structurally a nightmare to ensure a stable structure that still allows each tower to move separately in the wind to reduce shear and moment forces.
  The structure of the tower was also challenging to give the slender towers a necessary amount of stiffness.
- **Adaptability to Future Changes**
  Easily adaptable are the two highest towers in the north, especially the office parts, and the observatory. Its constructed as a stack of platforms and can be programmed and even organized differently if needed.

Environmental Identity:

- **Architectural Expression**
  The aspiration of the architect Moshe Safdie and the client CapitaLand Ltd was to create a “skyscraper city” within a city.[242] Competitor Concepts were organized way more conservative and most of them focused on a 2-3 towers concept. The dynamic positioning and design of the towers should reflect the idea of a sailing boat fleet going down the river.

[242] Ho, *Arup’s Tall Buildings in Asia: Stories Behind the Storeys*, 10.

Quantitative Criteria

Green Plot Ratio (GPR)	**90**	**%**
Community Plot Ratio (CPR)	**160**	**%**
Civic Generosity Index (CGI)	**100**	**%**
Ecosystem Contribution Index (ECI):	**80**	**%**

Table 12: Raffles City Chongqing Qantitative Criteria (source: calculated by the author, details in Appendix)

24-Hour Scenario:

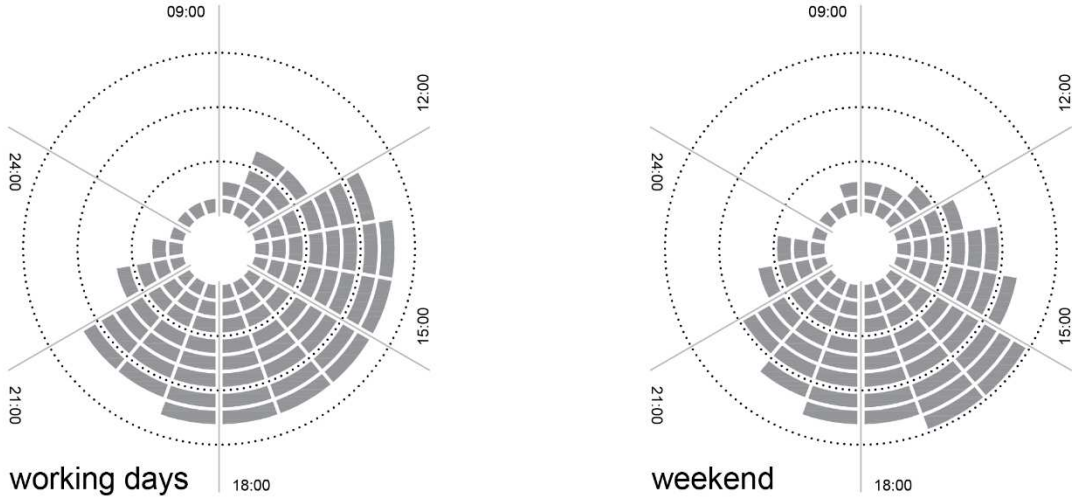


Fig 48: Raffles City Chongqing 24-Hour Scenario (source: interpolated and drawn by the author)

4.7 Case Study Assessment

In this chapter, certain parameters of all case studies get compared by a juxtaposition rather than a cross-comparative case study. This was necessary, because not ever case study uses the full set of the LPS vocabulary and would cause, as a comparative case study, a fragmented data which might then have no significance. It seems as if providing sky spaces and additional amenities on the top is in most cases not profitable. Just when operated as multipurpose building of one contractor for more or less just one diverse user group (in our case: employees and dependents of Tencent) this rule seems to be outperformed.
Examined projects are all multi-functional buildings, but one declared function area, no matter if office, residential or retail, always surpasses the following values of the different usages by twice as much.
The major problematic of current models, including this analysis, is still the summarization of communal, semi-public and public spaces. Conspicuous is this phenomenon when looking at Tencent Seafront Towers with a CPR of 441% but mostly as communal space. In Contrast, the only other case study reaching more than 400% is the Shibuya Hirakie Tower, with mostly public and semi-public areas gives the visitor ra real feeling of a public vertical city.
The results of the analysis reveal that the intensive discussions about sustainability and environmental protection have been put into practice and result in an increasing of examination and attention of civic space and greening area.

	Shibuya Hikarie	ION Orchard	Beijing Yintai Centre	Tencent Seafront T1&T2	Raffle City Chongqing
1st Layer: Transit Oriented Core	✔	✔	✔	-	✔
2nd Layer: Podium	✔	✔	✔	✔	✔
3rd Layer: Podium Deck	-	✔	✔	✔	✔
4th Layer: Sky Spaces	✔	-	-	✔	-
5th Layer: Skyplane	-	✔	✔	✔	✔

Table 13: Layered Public Space (LPS) (source: drawn and calculated by the author, details in Appendix)

	Shibuya Hikarie	ION Orchard	Beijing Yintai Centre	Tencent Seafront T1&T2	Raffle City Chongqing
office	✔	-	✔	✔	✔
exhibition	✔	-	-	✔	-
retail/restaurant	✔	✔	✔	✔	✔
residential	-	✔	✔	-	✔
hotel	-		✔	-	✔

Table 14: Building Function (source: drawn and calculated by the author, details in Appendix)

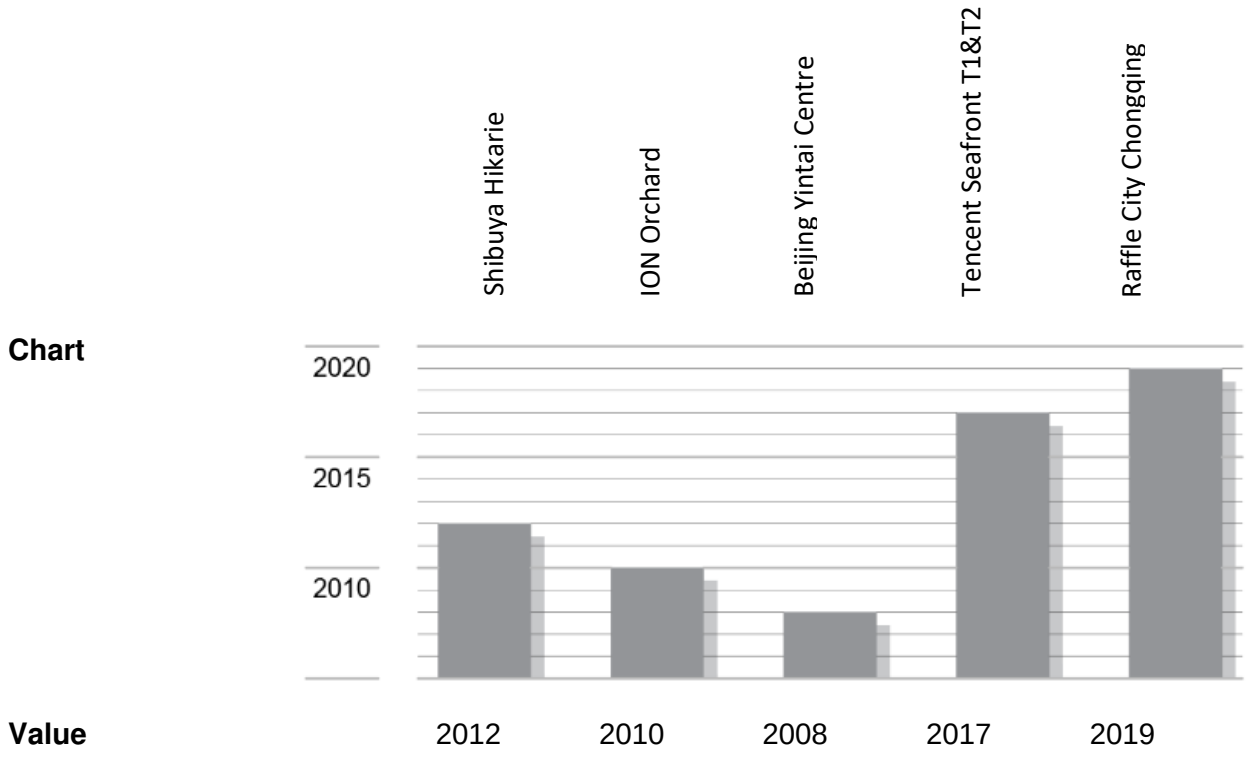


Table 15: Building Completion (source: skyscrapercenter.com)

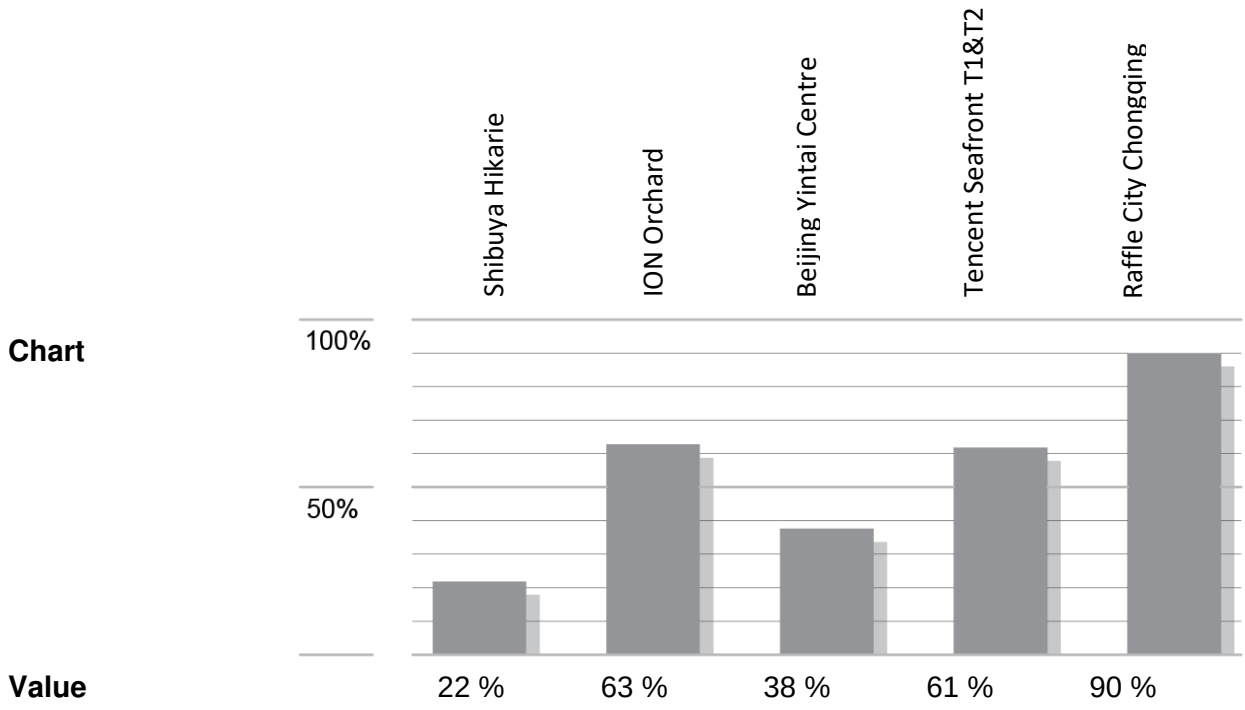


Table 16: Green Plot Ratio (source: drawn and calculated by the author, details in Appendix)

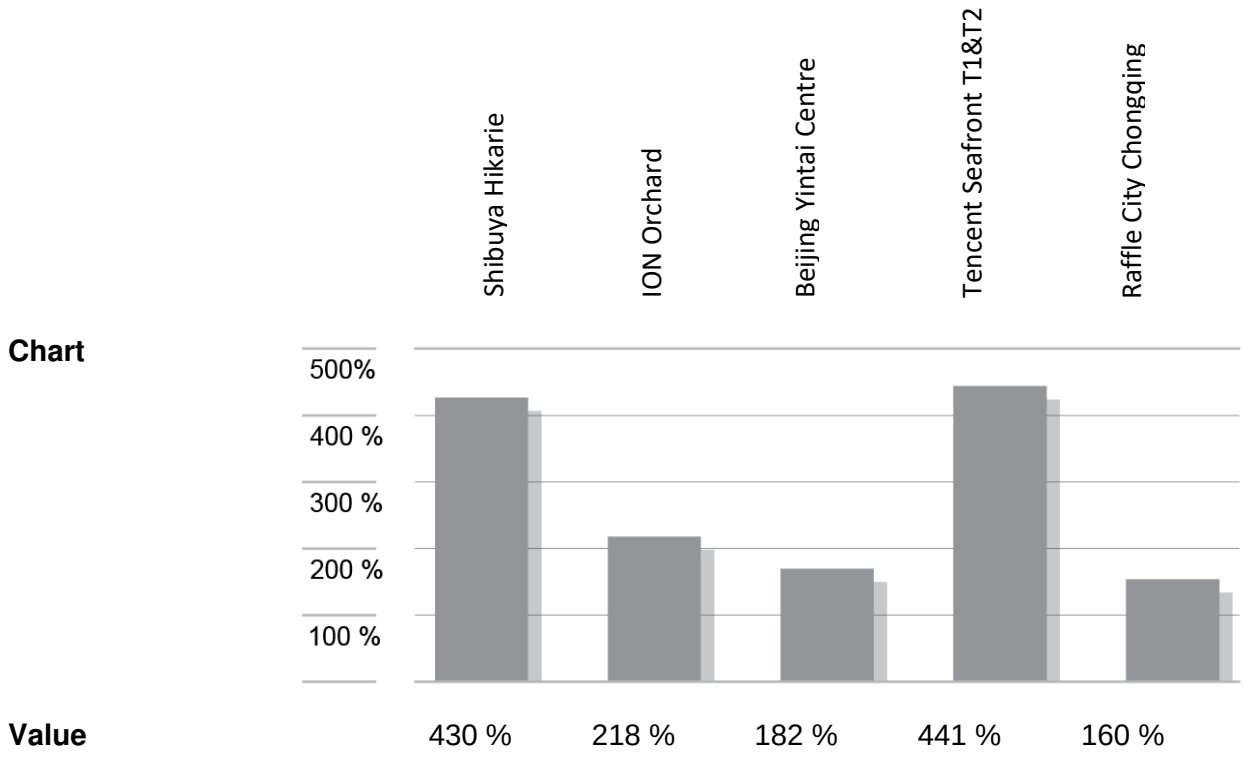


Table 17: Community Plot Ratio (source: drawn and calculated by the author, details in Appendix)

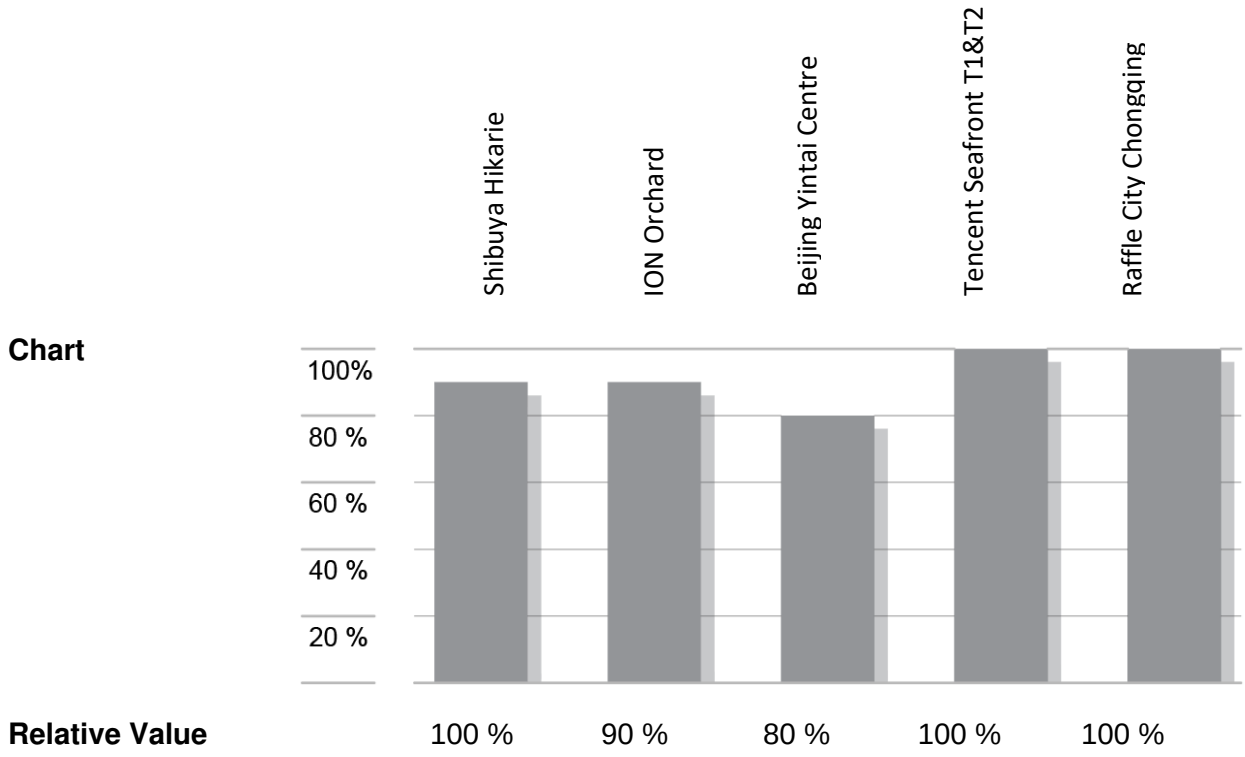


Table 18: Civic Generosity Index (source: drawn and calculated by the author, details in Appendix)

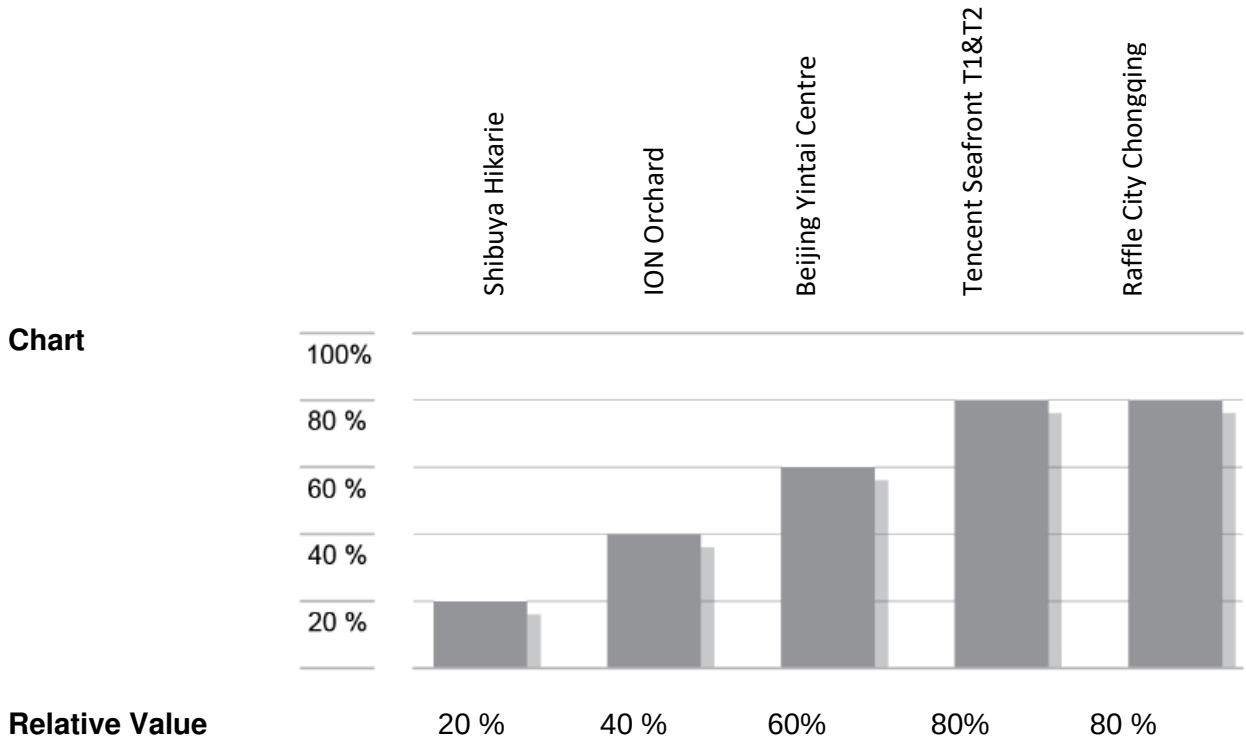


Table 19: Ecosystem Contribution Index (source: drawn and calculated by the author, details in Appendix)

5. Project on Central Green Space, Lujiazui

If not declared differently, all graphics in the following chapter were produced by the author.

5.1 Site Analysis and Local Focus

The most recent ideas for the masterplan of Lujiazui Central Area came from Perrault, Sir Rogers, Fuksas, Ito and the Shanghai Urban Planning and Design Institute.
In 1993, to open Pudong to foreign investors, it was declared as Special Economic Zone (SEZ). This economic upheaval took shape with the Oriental Pearl Tower (1994) and is an important part of Shanghai's skyline today.[243]

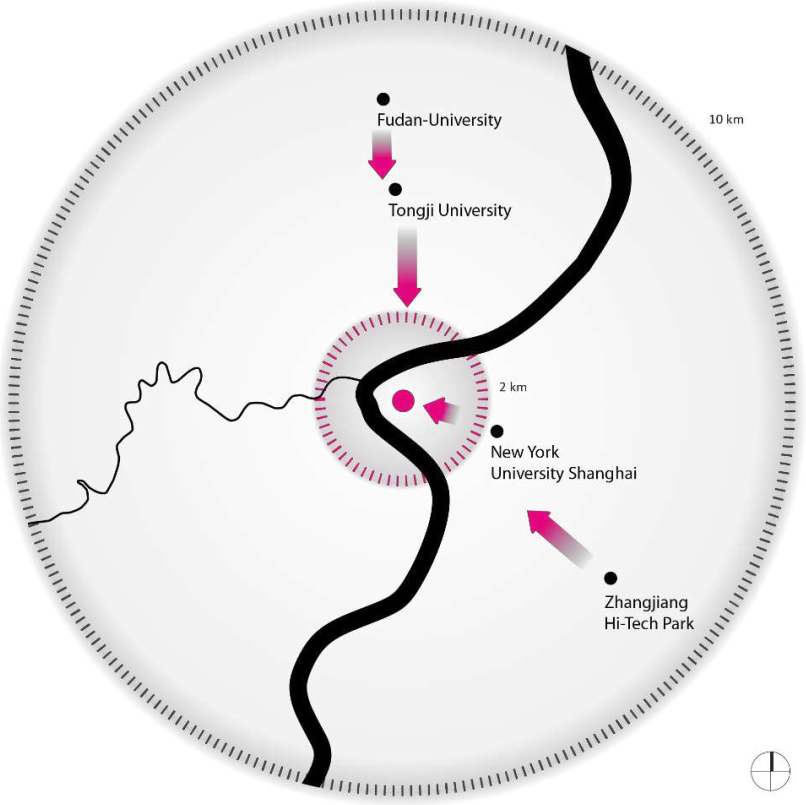


Fig 49: location of educational institutions of Shanghai

Over the last 30 years, Lujiazui faced a radical transformation and turned into the leading bank quarter. Due to its rapid growth, the existing low residential house construction got replaced by skyscrapers which broke records. In its center Central Green Space got protected. Most universities are far away from Pudong 's heart making a knowledge cross-over and a collaboration of the economics sector and educational facilities difficult. A place for joint ventures held representative next to the working locations in Pudong is still missing. By bringing these facilities directly where it is needed, public interests should always be treated equally important. The LPS-model is used to counterbalance the interests of the public and the intended Tech Campus.

[243] King and Wong, *Vertical City: Solutions to Sustainable Living*, 77.

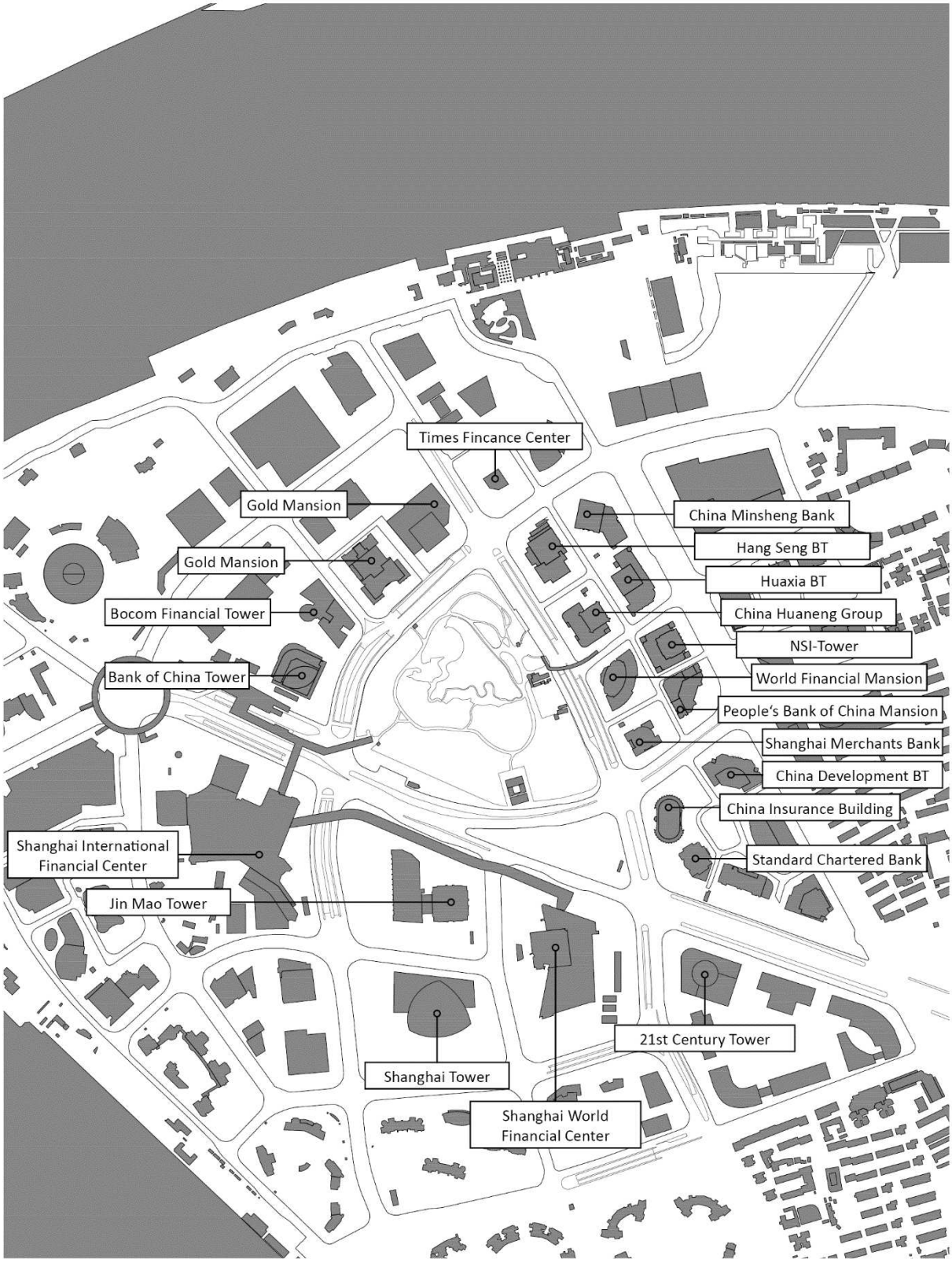


Fig 50: site plan

From the top, we can recognize bank-headquarters and the three signature towers, Jin Mao Tower, Shanghai World Financial Center and Shanghai Tower, are facing Central Green Space. At the tip of Pudong, including the Oriental Pearl Tower, more tourist and hotel related facilities are located. The Shanghai International Finance Centre has the biggest lot coverage of the plan and is the retail related vocal point throughout the region.

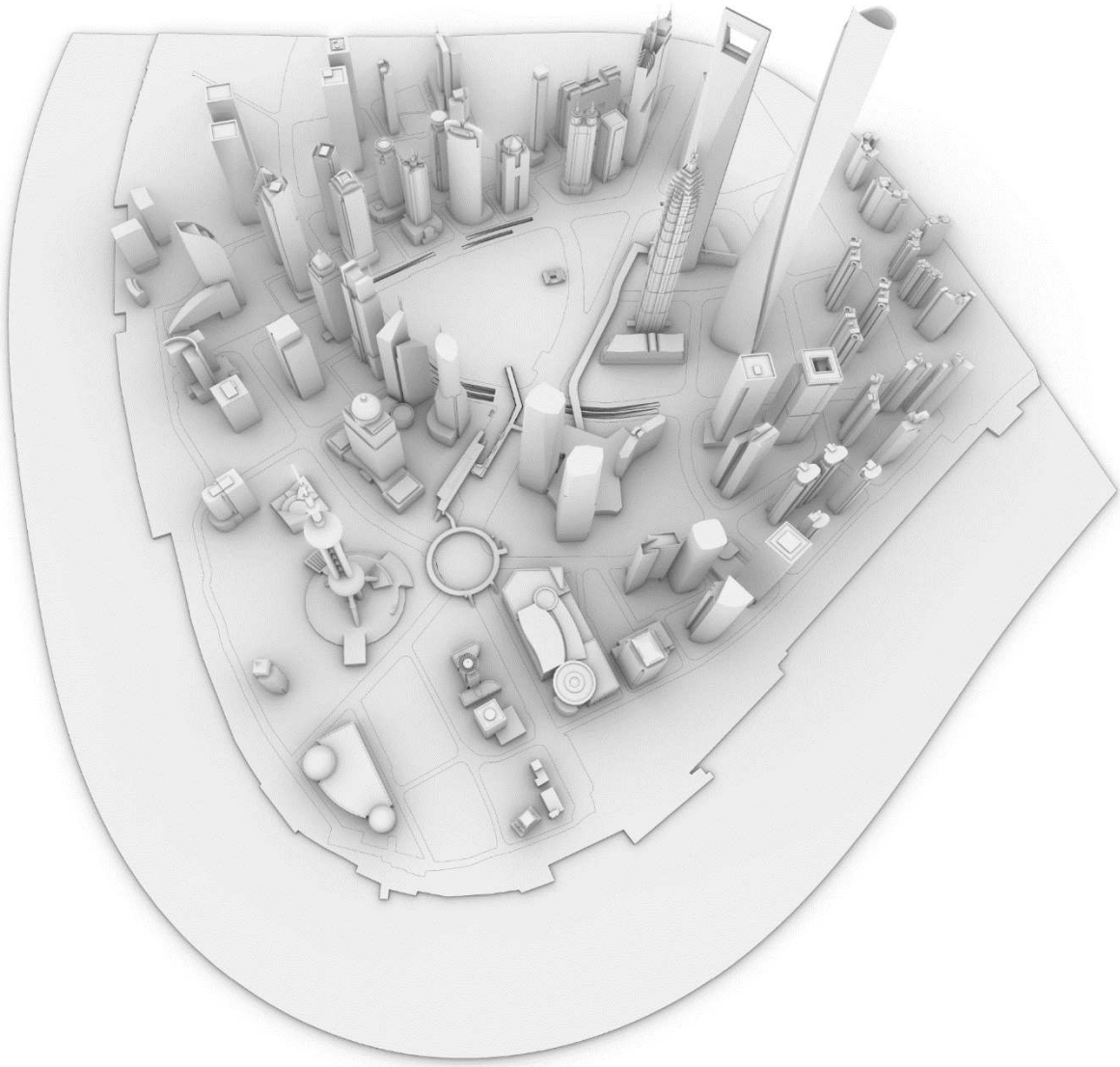


Fig 51: Lujiazui Pudong

The ground floor and even the underground of Lujiazui is dominated by car traffic. At the tip of Lujiazui the Yan'an E Road Tunnel connects Pudong with the other side of the Huangpu River. It is the node that separates the car traffic onto the Yincheng Road, the Pudong Avenue and the Century Avenue. Consequently, the pedestrian flows need to be insured above ground floor. Therefore, interventions in the past included elevated pedestrian walkways that function as kind of a „bypass".

Satellite pictures show that the grass in Central Green Space does not survive a full season but needs to be replaced each year. This makes grass not the recommended greening strategy. The right diagram shows the sky-view factor and in turn shows the tree shaded areas of Lujiazui. The south third of the park holds most of the shaded area and should be retained due to its most potential coping with the ongoing climate change.

5.2 Main Issues and Potentials

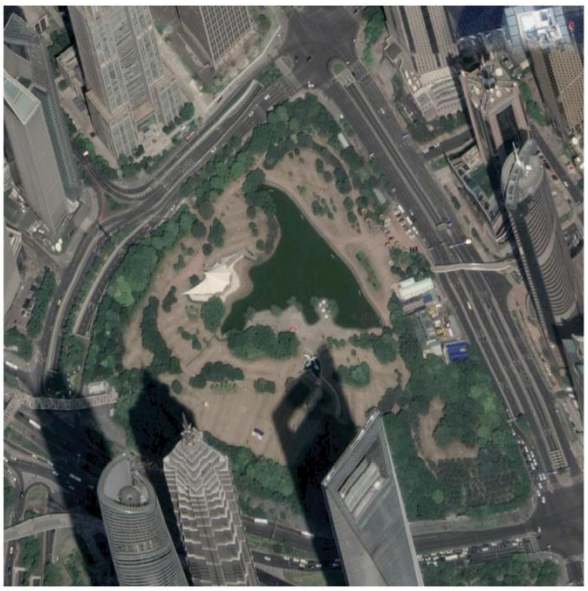


Fig 52: bird-view (google.com, 2019)

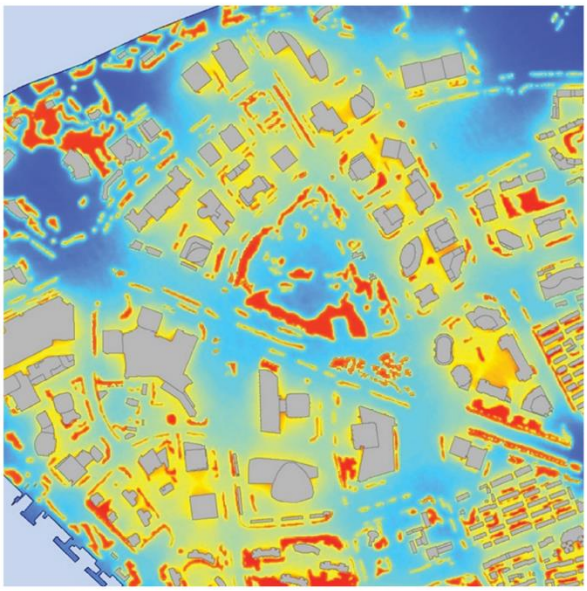


Fig 53: sky-view factor (SVF) (Yang, Chen, 2015)

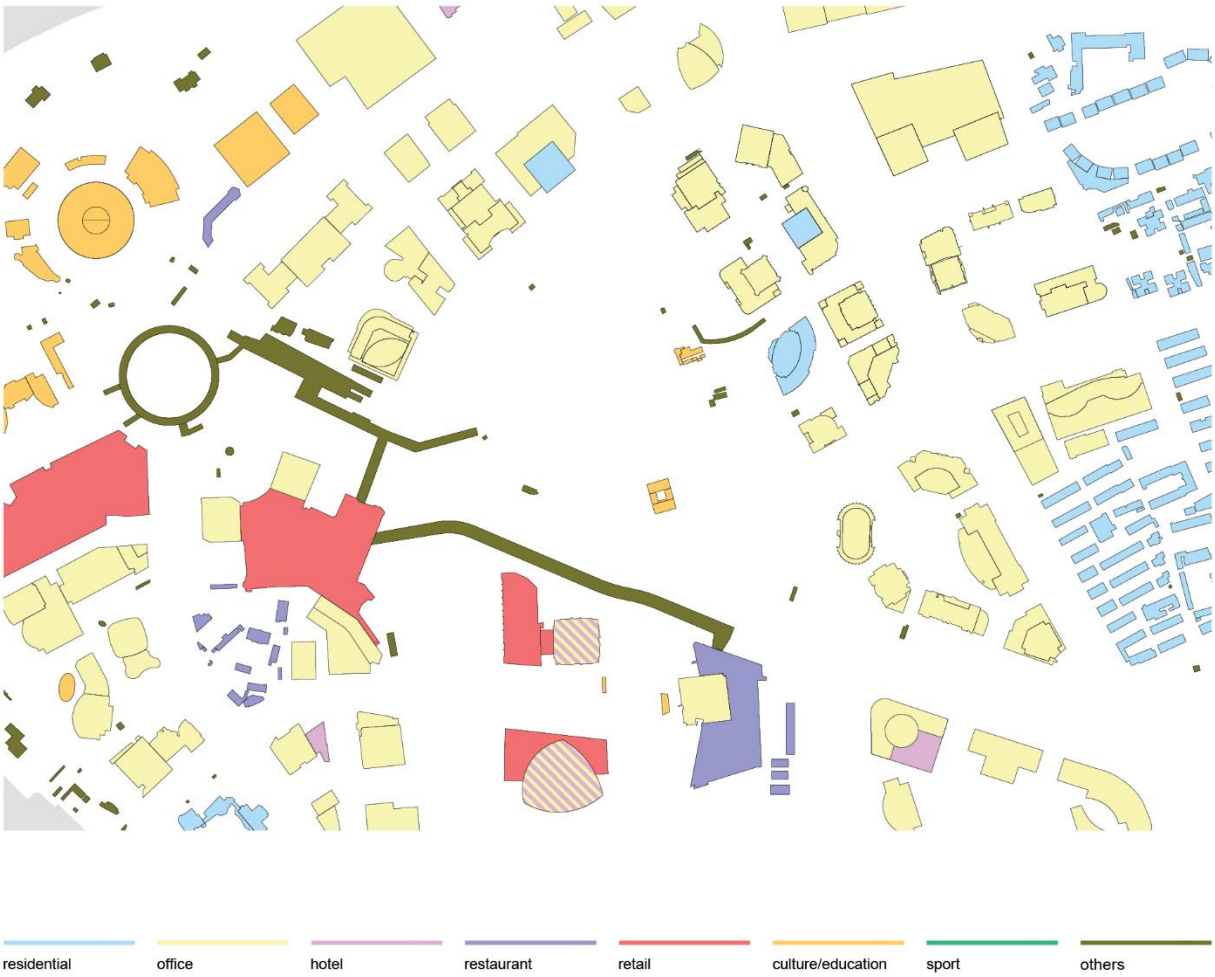


Fig 54: functional plan

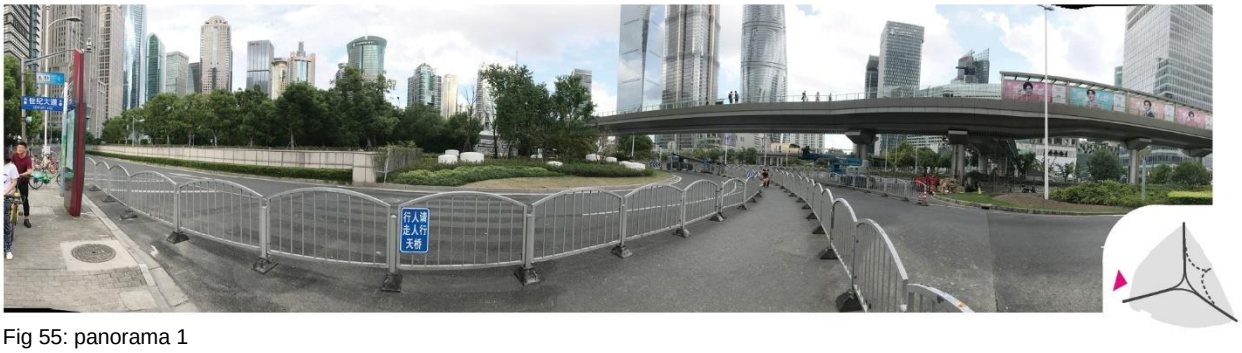


Fig 55: panorama 1

Fig 56: panorama 2

Fig 57: panorama 3

Fig 58: panorama 4

The wide streets really separate the green oasis in its center from the surrounding buildings. The urban context has no visual or physical connection with this center.

Fig 59: panorama 5

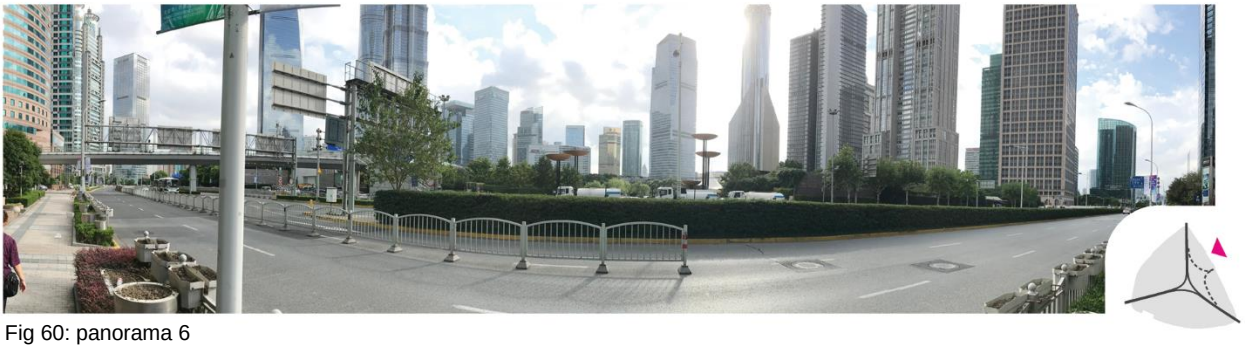


Fig 60: panorama 6

Fig 61: panorama 7

Fig 62: panorama 8

Fig 63: panorama 9

Fig 64: panorama 10

Fig 65: panorama 11

Fig 66: panorama 12

Except panorama 12, the greening strips and tree pots in combination with secondary roads are articulated in a way that they generate a green and differentiated environment. This makes it not to an ideal environment because it doesn't offer any amenities, however in this area it is not critical for the urban context.

Fig 67: panorama 13

Fig 68: panorama 14

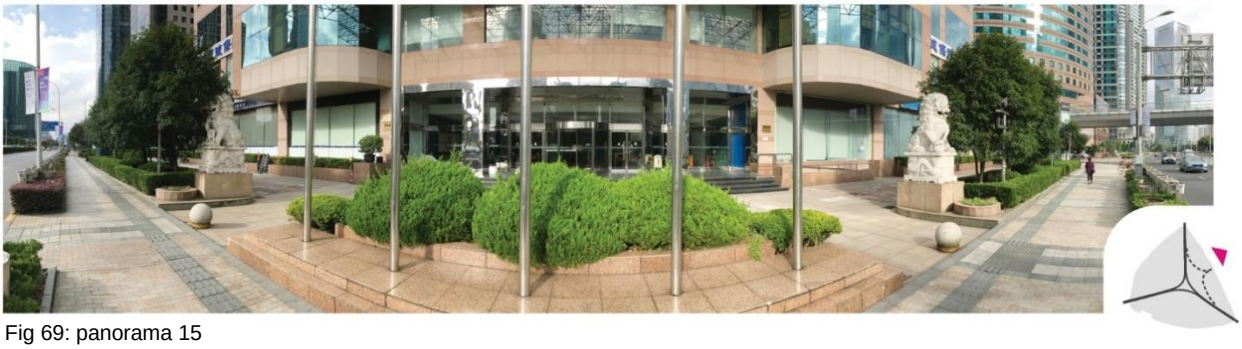


Fig 69: panorama 15

Fig 70: panorama 16

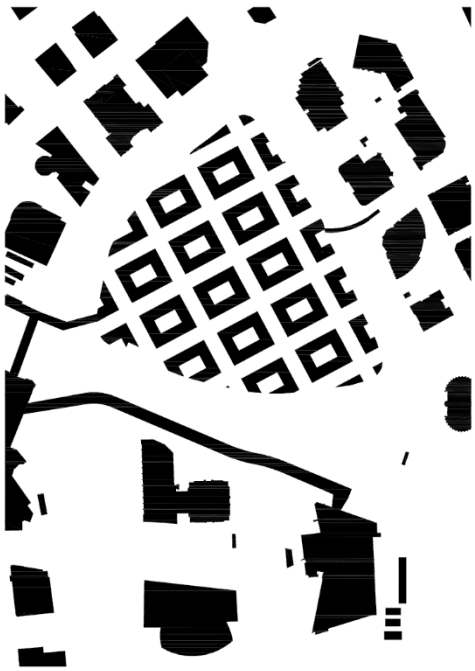
5.3 Typology Analysis: Technology Campus

The Technology Campus (TechCampus) is basically a rather new form of headquarter building that is going beyond the regular office typology. In times where the leading companies not just create products but lifestyle, also the employees need to feel the atmosphere of their company. The fast change of the professional environment makes a constant knowledge gain necessary. Therefore, greening, cultural, educational and recreational facilities get more and more integrated into our everyday routines. Most relevant companies try to sell a certain image with their building to the public.

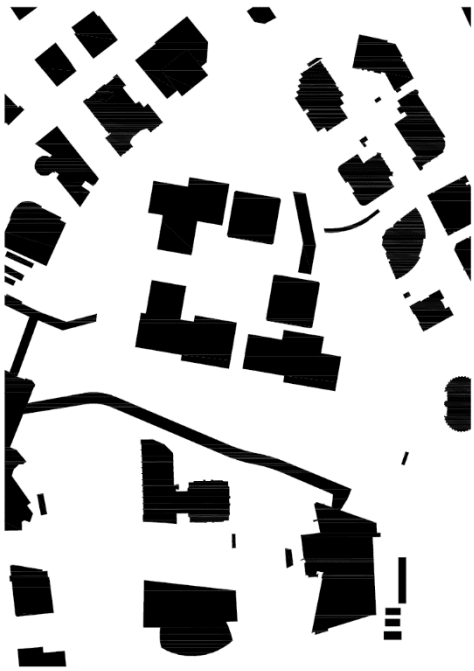
The Apple Campus in California is circular, a big UFO with no “entrance”, no beginning or end. This intended isolation is sealing-off the whole campus from the surrounding village and makes it to an almost foreign body. Paradoxically, the high classified areas with the future labs are in two boxy, rather basic building south east on the lot. While the Facebook Campus tries to give back its lot coverage to nature with a green roof, the Vanke Headquarter in Shenzhen (Horizontal Skyscraper of Steven Holl) is hovering above the green on ground floor.
Highly interesting for high-rise dominating cities is the Tencent Campus in Shenzhen (one of the chosen case studies) which is a tower pair. As we can see in Fig.72 it would fit quite well into Central Green Space, however also reveals the complete destruction of Central Green Space as green oasis.

Barcelona Block-Pattern

New York City Block-Pattern



Vienna Block-Pattern

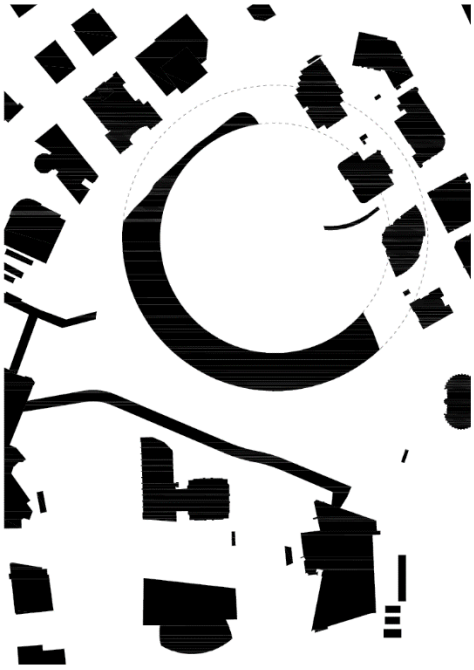


World Trade Center
Twin Tower Complex

Fig 71: city block comparison diagram

To get a feeling for the size of Central Green Space and how other metropolis forms around the world are dealing with space, four typical street patterns were put into place.

Tencent Seafront Towers (Shenzhen)



Apple Campus (California)

Facebook (California)

Vanke Headquarter (Shenzhen)

Fig 72: TechCampus comparison diagram

To get a feeling for the size of other TechCampus typologies, four different layouts get juxta positioned to Central Green Space.

5.4 Site Analysis and Local Focus

towers as standing alone
objects disconnected walkway

CURRENT

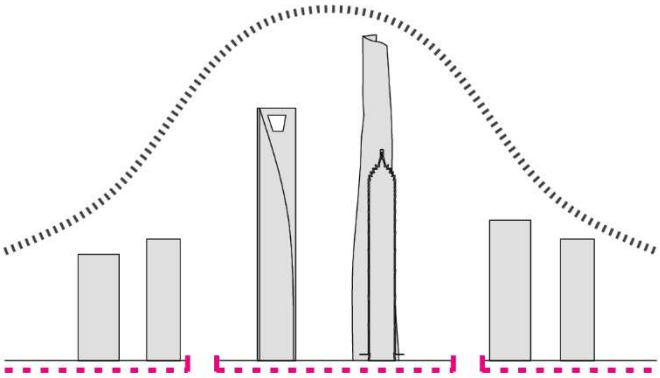


Fig 73: current layout of Lajiazui

Interestingly, in Lujiazui the dominating tower is not the typically layered out with Chinese podium-tower but covered with individual standing alone towers with major focus on the skyline and not the urban context. Aggravating are the wide high-traffic roads which are isolating not just Central Green Space but also the major super-blocks in Lujiazui.

towers as standing alone
objects disconnected walkway

OPTION 1

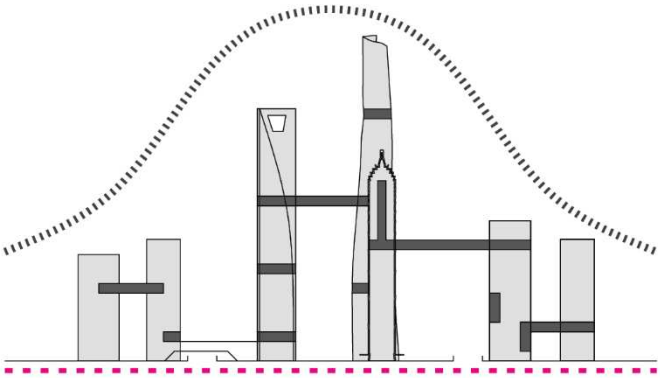


Fig 74: option 1

This option for an investigation in Lujiazui is focusing rather on the skyline. However, connecting towers in the sky does not solve the accessibility problem on ground completely. This option is ignoring the roles of gravity that force human kind to have a solid foundation first before being able to turn towards follow up criteria.

Central Green Space as plot for mega mixed-use development

catastrophic failure of public-, leisure- and greening-strategies

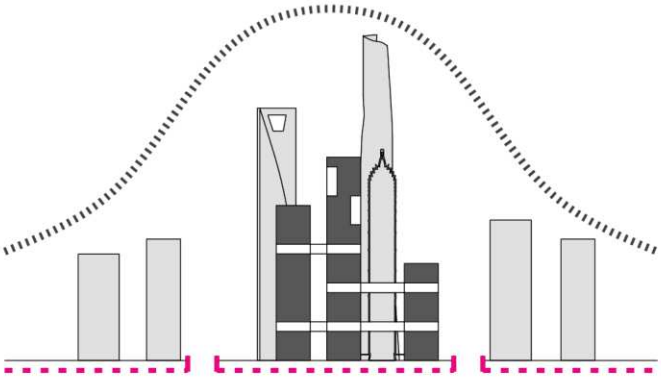


Fig 75: option 2

OPTION 2

This option for an investigation in Lujiazui would represent a multi-dimensional tower-cluster within a tower-cluster. If not in the green heart for Lujiazui but as part of a CBD on top of a metro station this option would be the preferred strategy. Due to the boundary conditions by the on-site building structures and the missing ground floor qualities this option needs to be ruled out. Instead of solving and bridging certain problems a project like this would ignore its surrounding and would clear out one of the last green spaces in Shanghai.

Central Green Space as podium for the surrounding „standing alone towers“

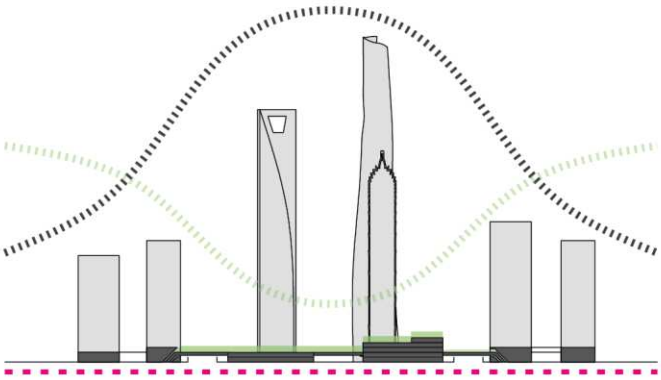


Fig 76: option 3

OPTION 3 (CHOSEN ONE)

This option for an investigation in Lujiazui puts the needs and missing links of Lujiazui on the top. The elements ground floor, podium, podium deck and a huge semi-public sport park as semi-public space change the way the pedestrian is experiencing Shanghai ‘s main bank quarter. This strategy is the only one that complies Central Green Space as Green Oasis in a new and structured form and interconnects the surrounding standing alone towers to a giant, almost urban, multi-dimensional tower-cluster.

5.5 The Project

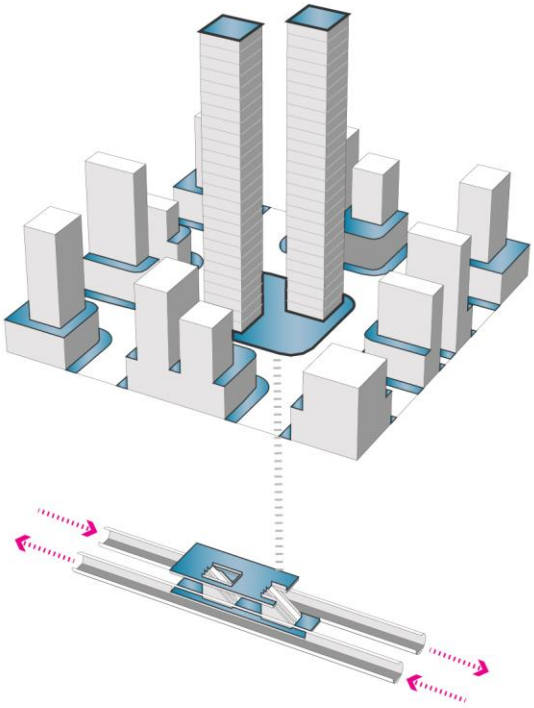


Fig 77: schematic 20th century super block concept

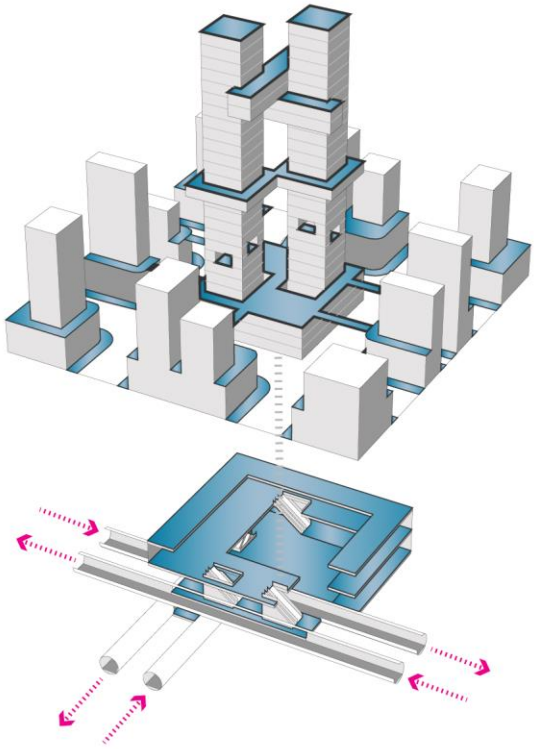


Fig 78: schematic 21th century block with LPS concept

The 20th century high-rise super block is the outcome of economic growth and the Modernism era. Stacking uncountable of identical monofunctionally used floors on top of each other is tilting the balance of accessible and sellable space. The lack of diversity in functionality causes an almost dead scenery of business districts after around 6 o ‘clock and weekends.
Cities like New York and Chicago are famous examples of this concept.

Before the end of the last century China took over the leading role in the high-rise industry and made the podium with communal functions as a state-of-the-art element of their architecture.
Since then, bringing the public, or at least semi-public flows every higher, the LPS is responding to this trend and enables individual high-rise buildings to turn into a multi-dimensional tower cluster.

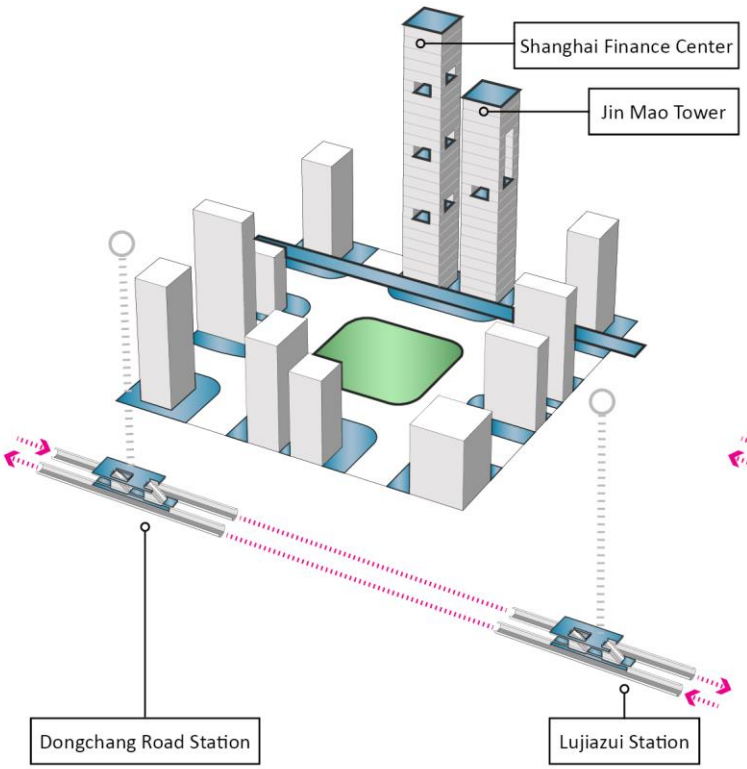


Fig 79: schematic illustration of Central Green Space

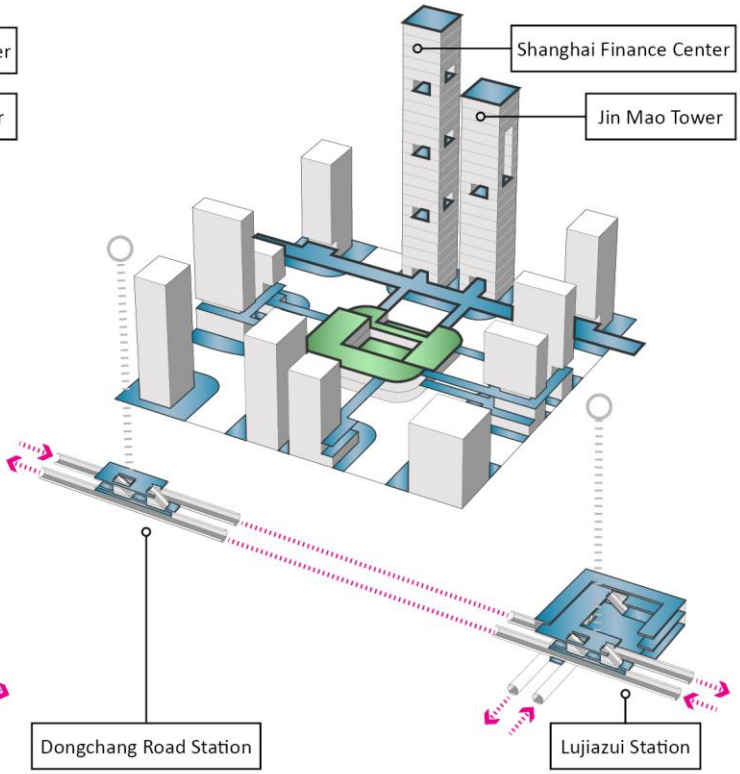


Fig 80: schematic intended LPS urban network at Central Green Space

To implement LPS into the existing building structure on Central Green Space, we need to include the existing high-rise buildings into our design intensions. Central Green Space is also not on top of a metro station but in-between two stations. All surrounding towers do not have a noteworthy lower podium part with multifunctional functionality. Pedestrian flows are also always interrupted by wide high traffic roads. The added elevated walkway improved the pedestrian flow for the tourists visiting the Shanghai Finance Center, Jin Mao Tower and Shanghai Tower but had little effect on locals from other towers.
Mr. Pfau mentioned that New York ‘s qualities are based on the certainty that the whole city is operating as if it is sitting on top of a giant urban podium. To give Lujiazui its needed public and semi-public qualities, it is necessary to introduce an urban network based on the LPS concept.

The intended project is trying to connect the individual towers in Lujiazui by using the existing elevated pedestrian walkway and to include a critical mass of educational and cultural facilities. A high-rise project at Central Green Space would have always competed with the adjacent Shanghai Finance Center and the Jin Mao Tower, would have destroyed the green island effect in the center of Lujiazui and would have demolished every vis-a-vis qualities of the existing high-rise building structure.

Central Green Space should be treated with a certain respect due to its greening and leisure qualities. Economic growth and liquidity are already represented by the surrounding towers.

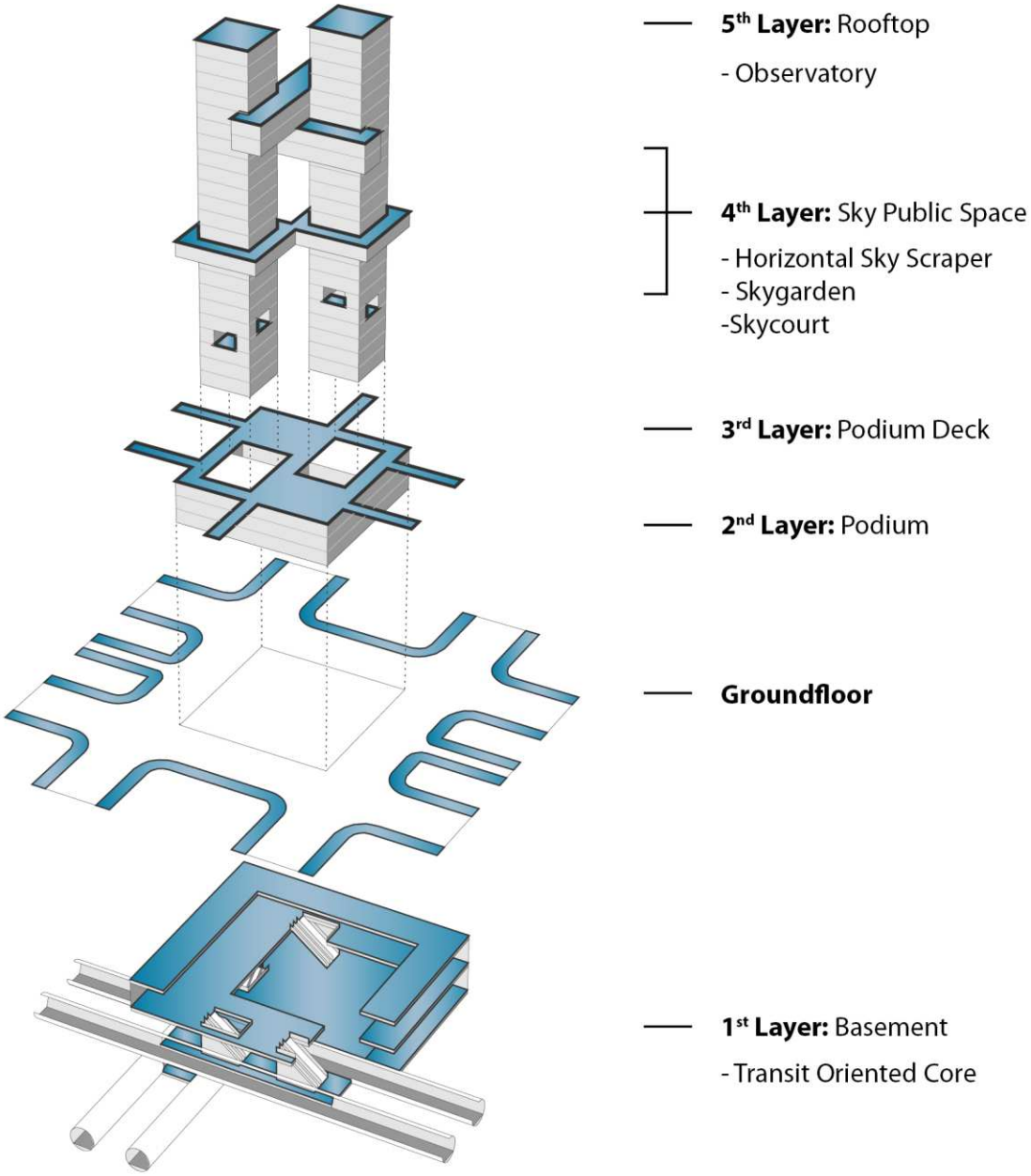


Fig 81: 21st century LPS-Model, Exploded Diagram

In this diagram the defined layers of the LPS-Model get explained on the concept of the 21st century concept. It represents the theoretical perfection. Not every building/plot/block has the privilege of a Transit Oriented Core and has to follow certain height restriction to fulfill urban planning goals. Depending on its surrounding, the model of the multi-dimensional tower cluster needs to be reevaluated and adapted to merge into the urban network.

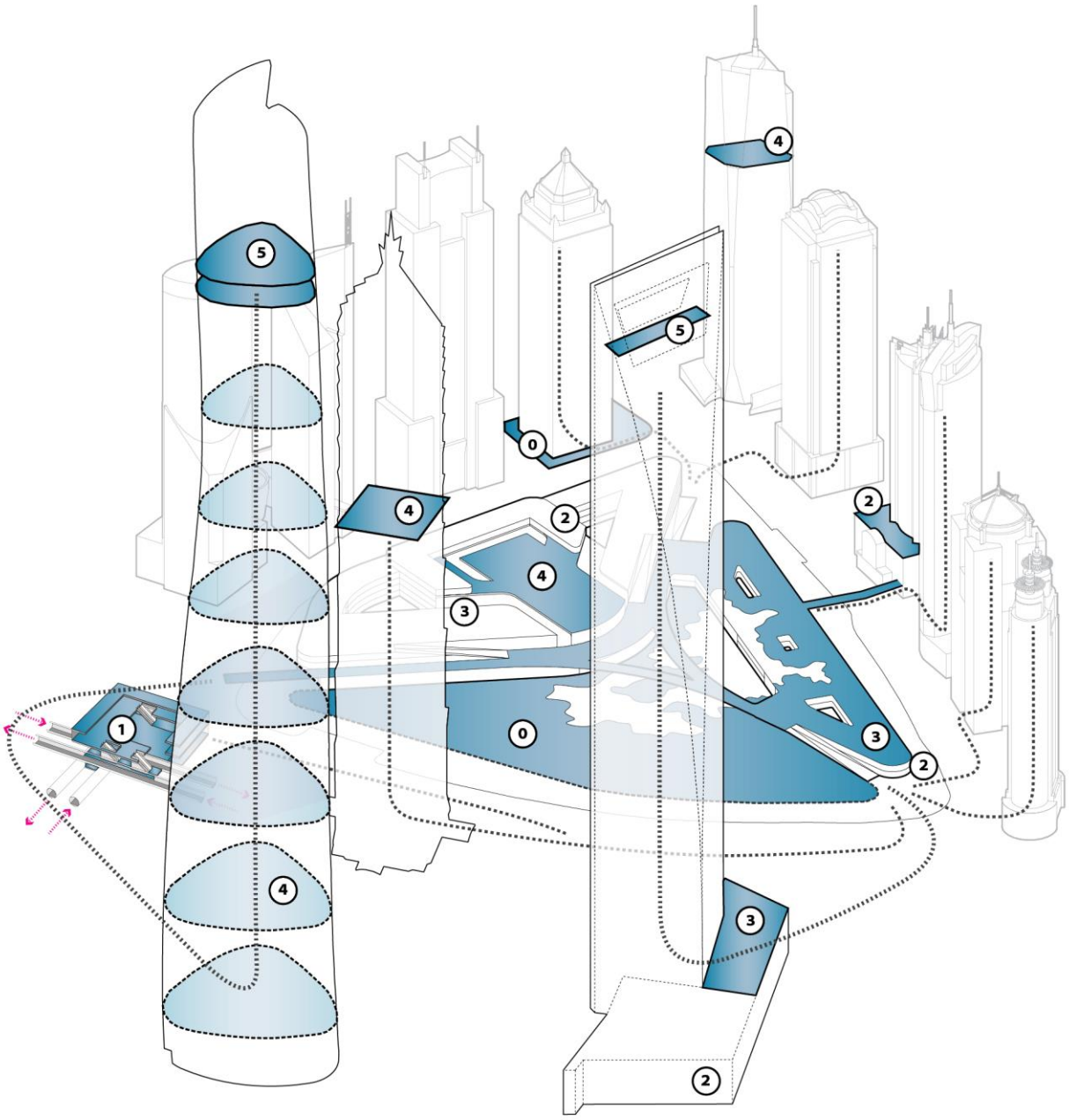


Fig 82: Urban LPS-Model of Lujiazui Central Green Space

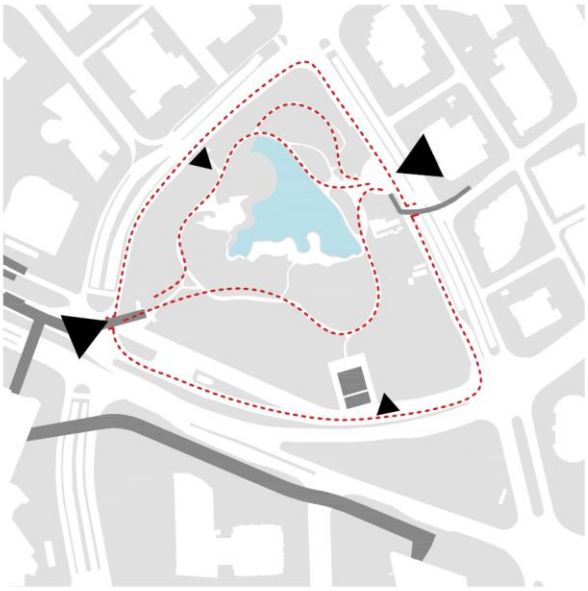
This diagram illustrates the intended LPS-Model of Central Public Space and its surrounding. This strategy complies Central Green Space as Green Oasis in a new and structured form and interconnects the surrounding standing alone towers to a giant, almost urban, multi-dimensional tower-cluster. The focus lies on integrating a critical number of square meters of layer 1-4.

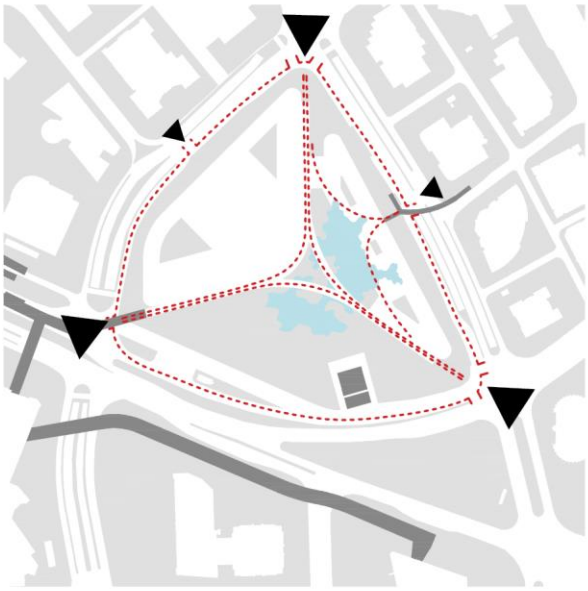
5 ... 5th Layer: Rooftop
4 ... 4th Layer: Sky Public Space
3 ... 3rd Layer: Podium Deck
2 ... 2nd Layer: Podium
0 ... Ground Floor
1 ... 1st Layer: Basement

let’s continue what has been started

Fig 83: existing elevated walkway extension

The existing infrastructure stops directly before entering the park. The current pedestrian flow is interrupted, because of its dead-end street quality.





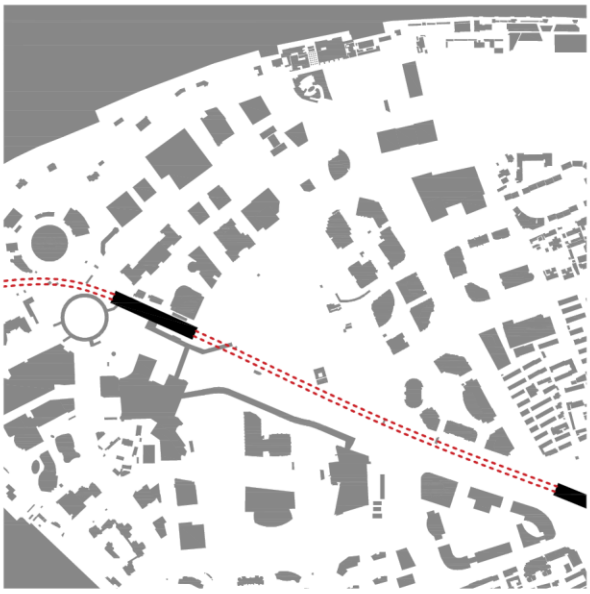
CURRENT

Central Green Space is articulated as almost enclosed place. The major entry is north-south and therefor the park has physically almost no relevance to the local people. Visually it definitely has Central Park qualities, which under all circumstances have to be restored.

FUTURE

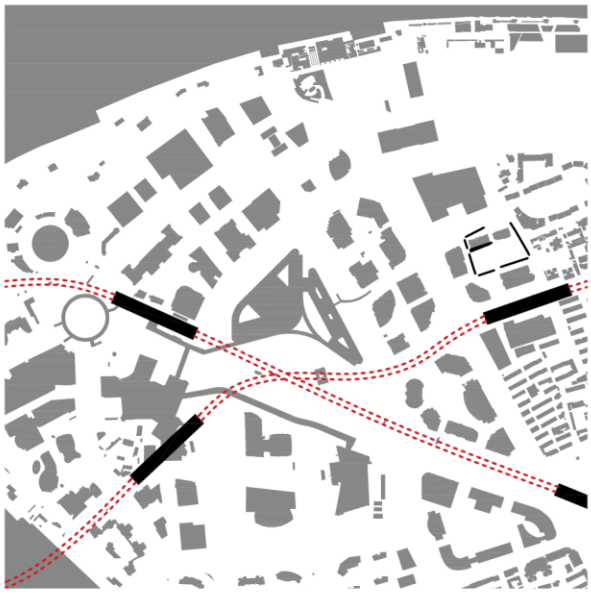
The project introduces three major routes on site, that are connecting the corners of Central Green Space with each other. This allows pedestrians to penetrate into the parks center, which gets the main meeting place. It allows locals to get from their working place to the metro station by traversing a green oasis which is far away from the noisy and polluting road traffic.

Fig 84: existing elevated walkway extension



CURRENT

Currently, only Line 2 is supporting the area with one centered and a peripheral station. The majority of pedestrian flows get pumped throw Lujiazui Station.



FUTURE

Line 14 is currently under construction and will turn Lujiazui Station into the leading hub in Pudong. The additional South Pudong Road Station of line 14 to the east of Central Green Space enables pedestrians to enter Central Green Space easily from each side.

Fig 85: existing and intended public transport-system

CURRENT

The black plan reveals a massive disposability of uncovered square meters. The individual front gardens of each standing alone tower and the wide roads hold over half of this potential.

Once EVA and self-driving cars get state-of-the-art technology this area will have the potential to get redefined but for this project the street edge is treated as a boundary condition.

FUTURE

Because the intended structure is with a maximum of 5 floors above ground rather flat, the black plan might be slightly irritating, especially because major roof areas will be covered with LUSH greenery.

Fig 86: existing and intended black plan

CURRENT

Most of the existing tree stock is located in the third in the south and at the boundaries of Central Green Space. Short grass is not working in the tropical climate of Shanghai.

Due to ecologic demands, Central Green Space always needs to be articulated as green oasis in the urban context of Lujiazui that is dominated by car traffic and high-rise buildings.

FUTURE

Shrubs and trees need to replace the grass areas to turn Central Green Space into a shaded and pleasant environment. The lake gets moved more to its center and play an essential role cooling down the entire development.

Fig 87: existing and intended greening

make Central Green Space to the main destination

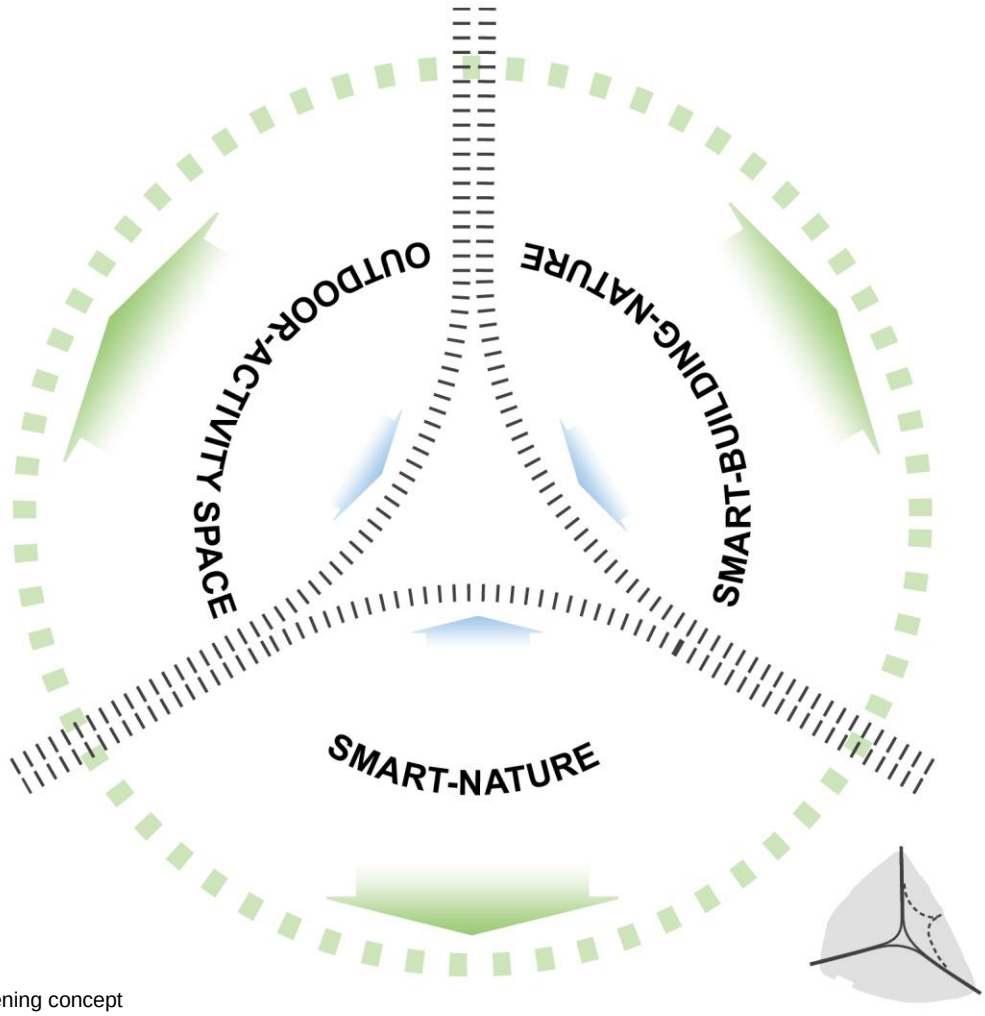


Fig 88: greening concept

The Greening Concept insures public and recreational standards:

SMART NATURE
This third is facing the noisy and hectic road, which connects Pudong with the other side of the river. The whole third should be planted with trees to turn into a comprehensively diverse and interconnected habitat for little animals and insects. This green belt should operate as nature barrier for the whole site.

SMART BUILDING NATURE
A natural landscape which is designed for public gathering, little chats and small niches. Little pavilions for snacks ensure a turmoil after working hours.

OUTDOOR ACTIVITY SPACE

This area should be related to sports and group activities. It is mainly for the employees and students of the project and the surrounding buildings.

Fig 89: greening layout

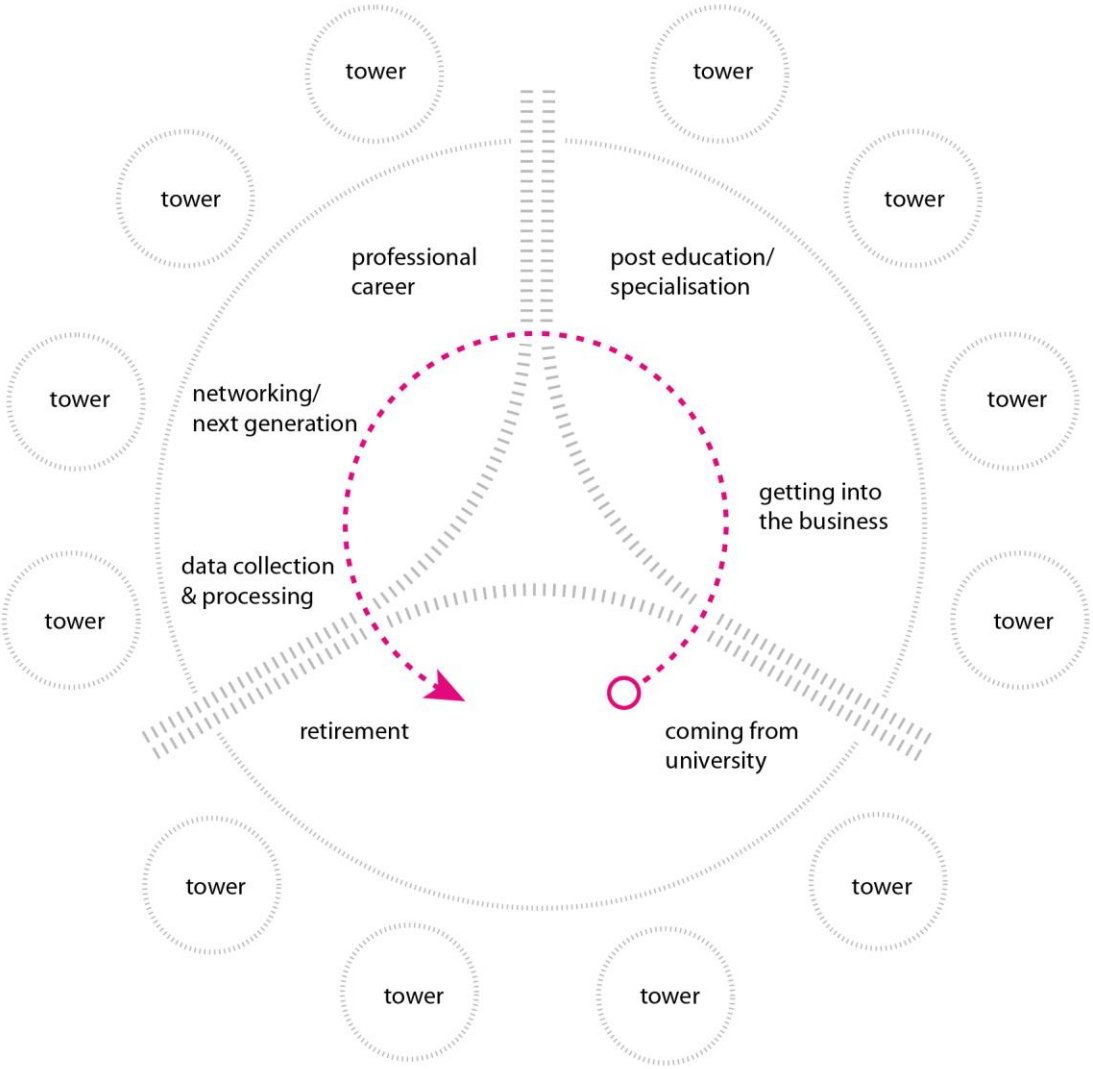


Fig 90: metaphorical life cycle diagram

The idea is that bellow the green carpet different generations of people work and live together and can learn from each other. This way Central Green Space really turns into a vibrant destination with a professional lower habitat and a relaxing habitat for the public on top.

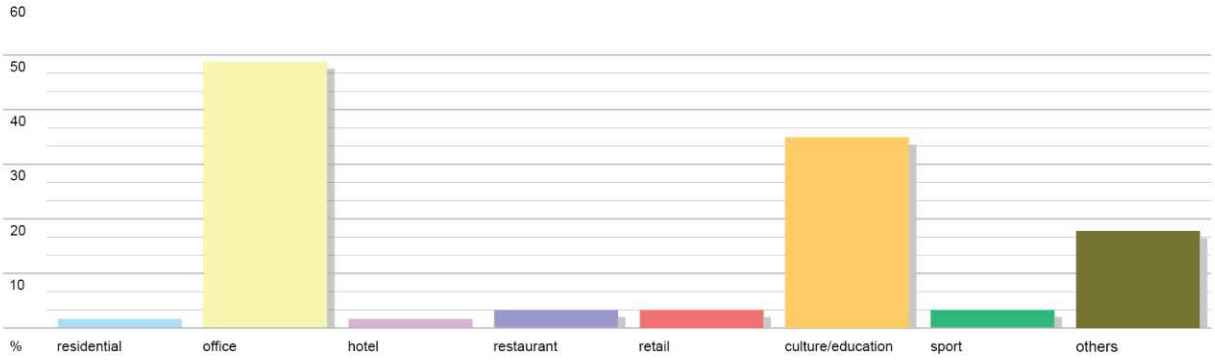


Fig 91: functional distribution

office	46%	38 950 sqm	**culture**	33%	27 478 sqm
restaurant	1 %	627 sqm	**sport**	2 %	1 676 sqm
retail	1 %	838 sqm	**others**	17%	14 249 sqm
GFA					**83 818 sqm**
GPR		92 %	**CPR**		149 %
CGI		100 %	**ECI**		100 %

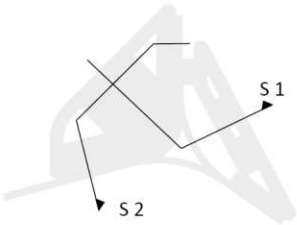


Table 20: functional distribution

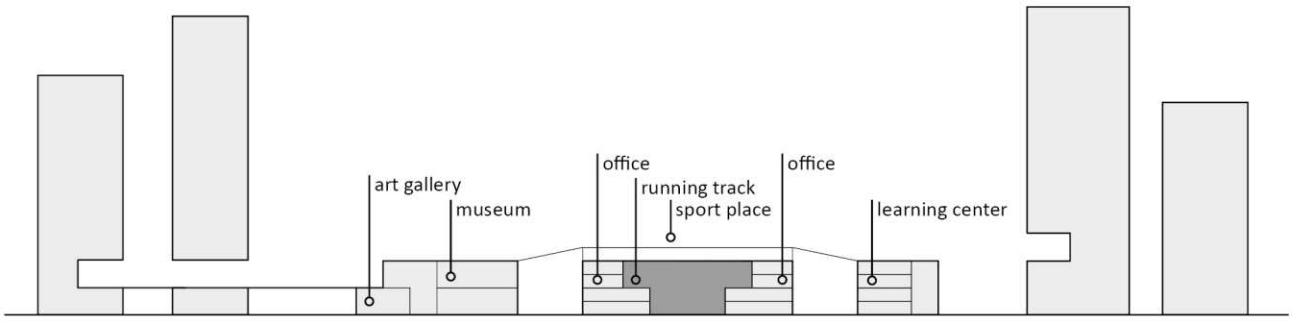


Fig 92: diagram section 1

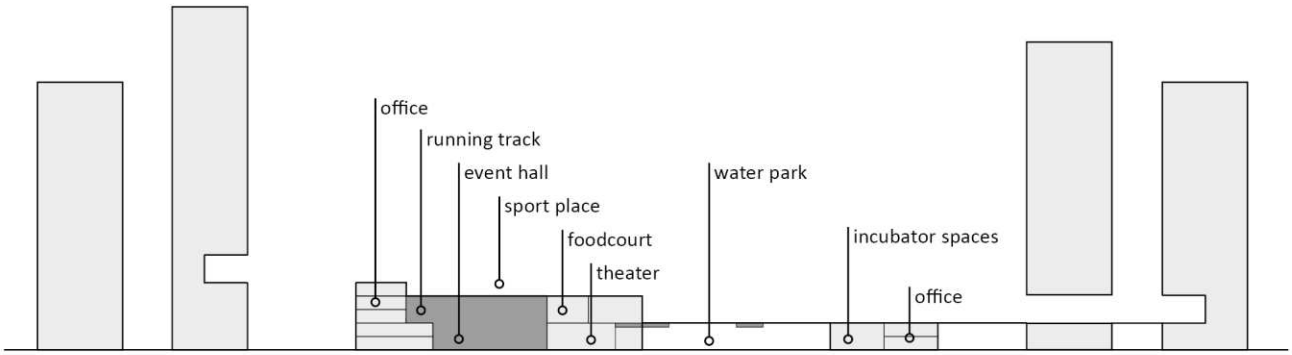


Fig 93: diagram section 2

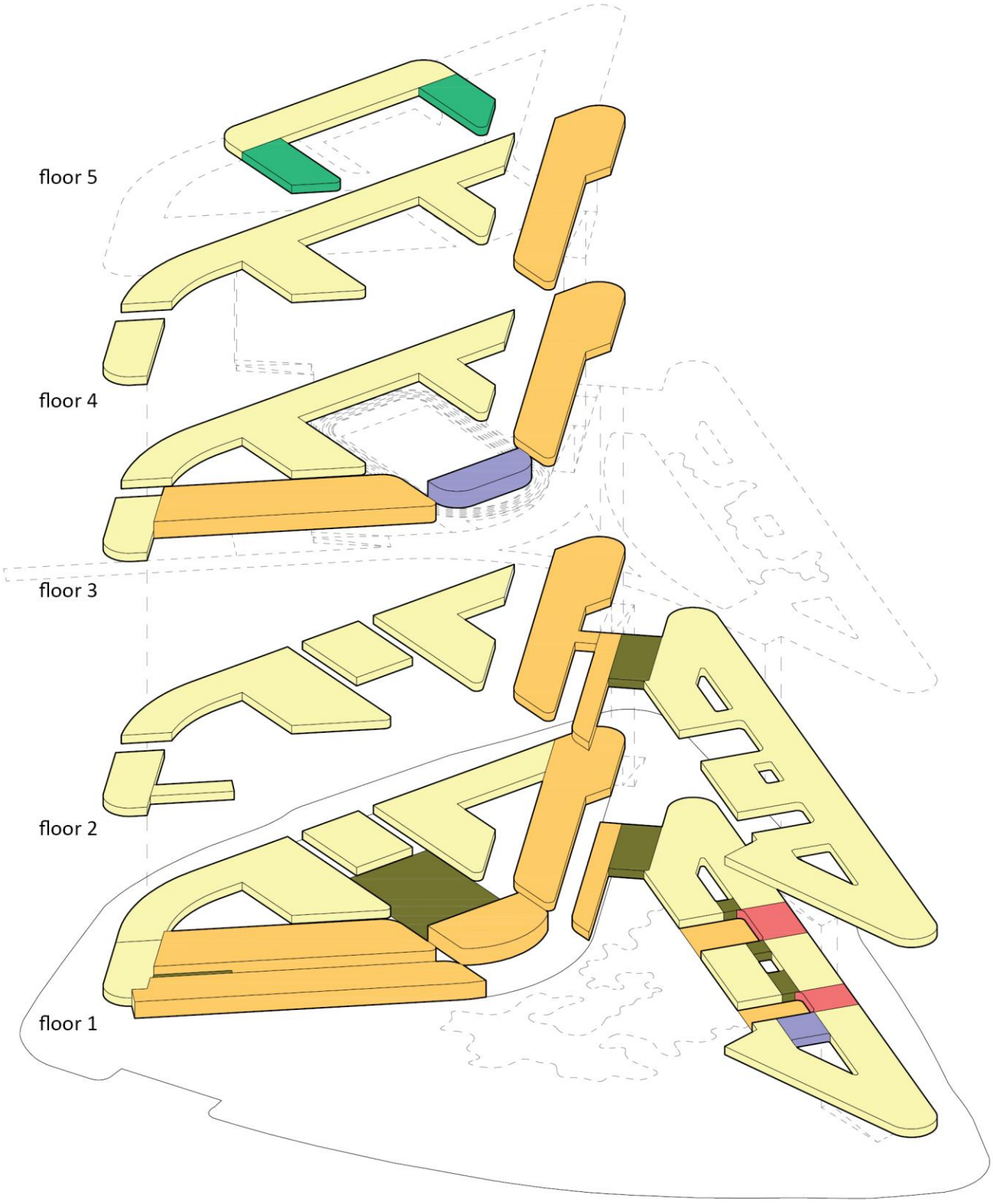


Fig 94: functional explosion diagram

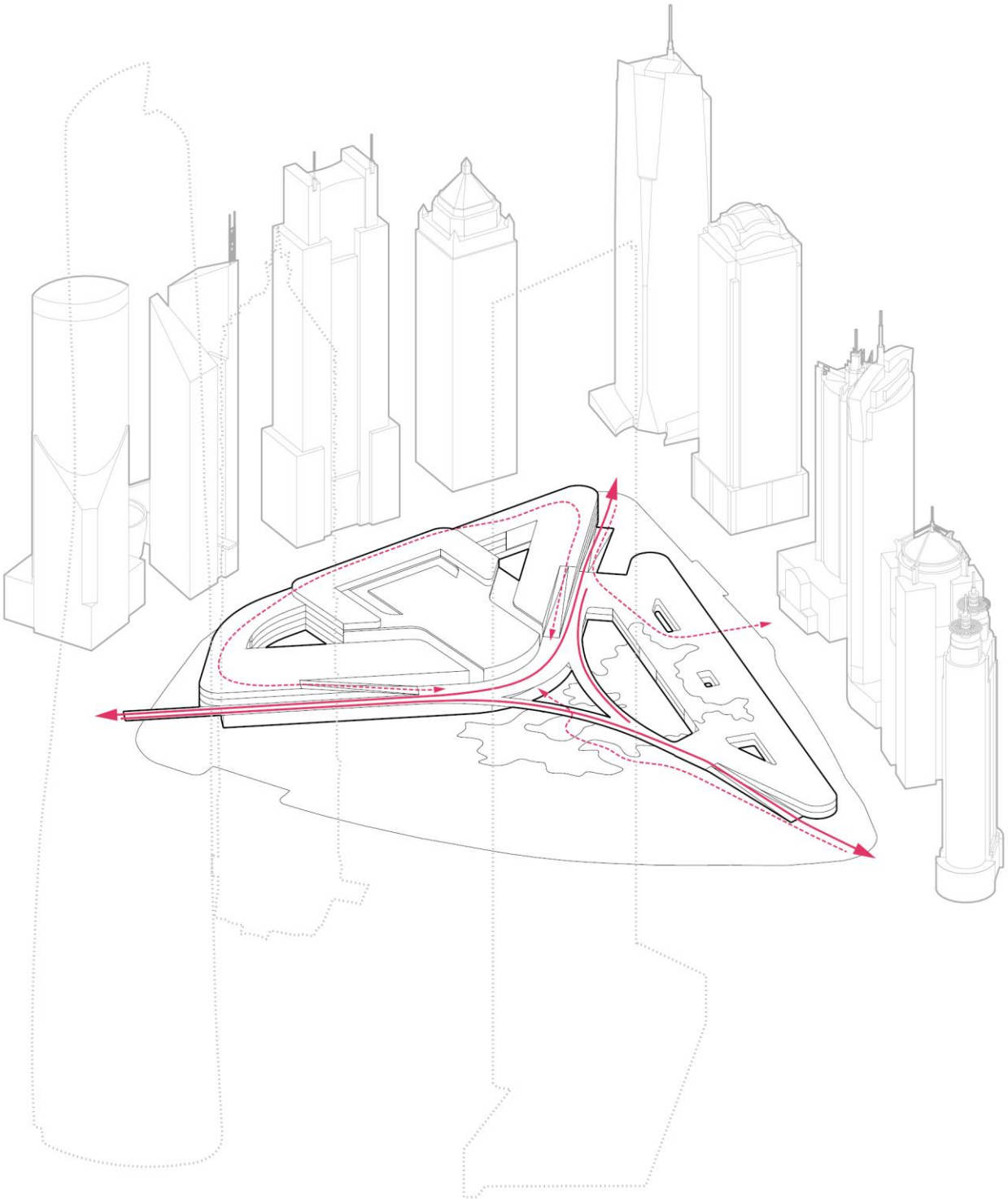


Fig 95: main walkways

Fig 96: functional bubble diagram

While the third in the south is given back to nature, the north-east part is laid out as collaborative and creative space for upcoming hope career. The north-west part is loaded with educational and public institutions and facilities.

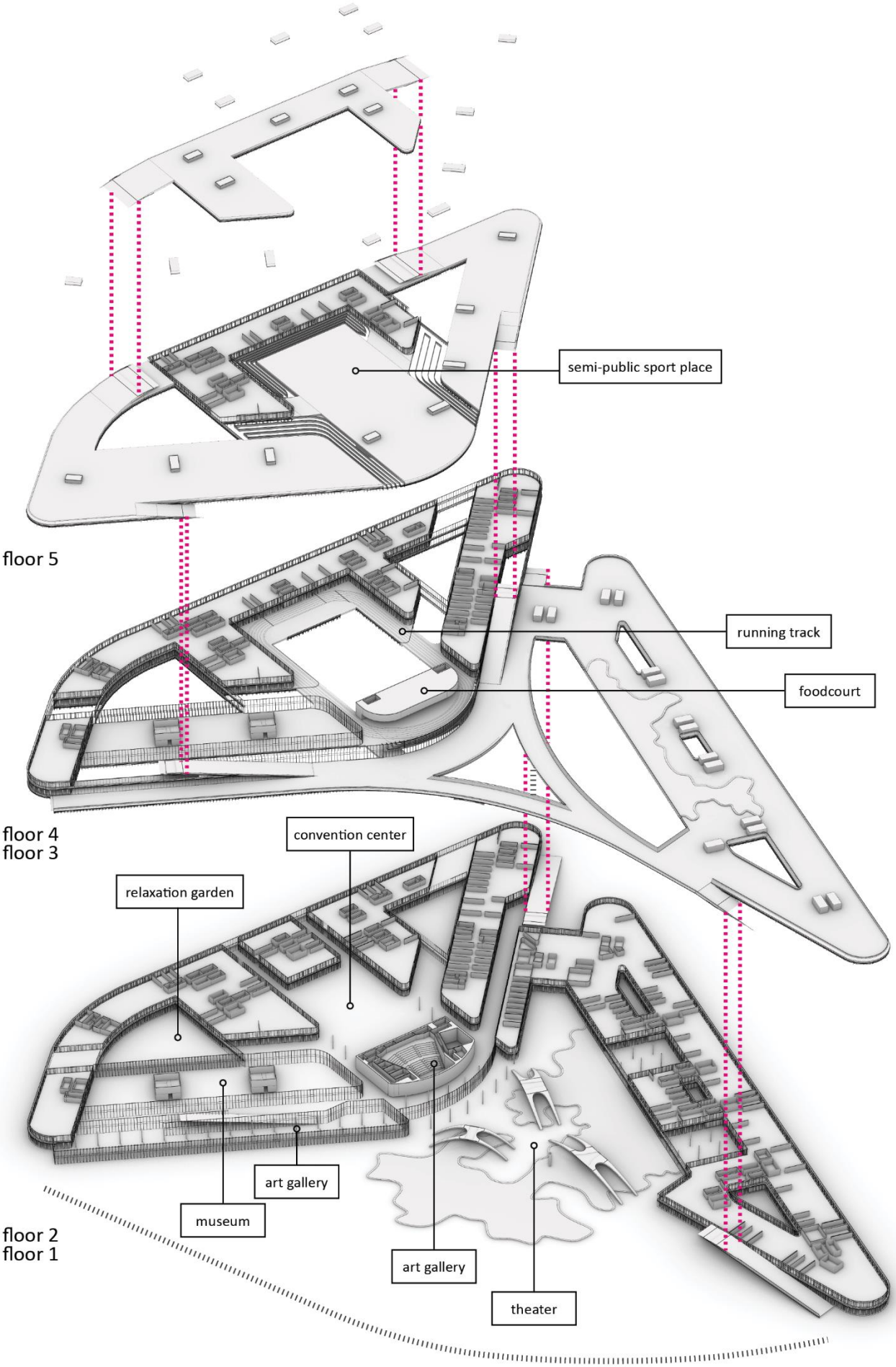


Fig 97: explosion diagram

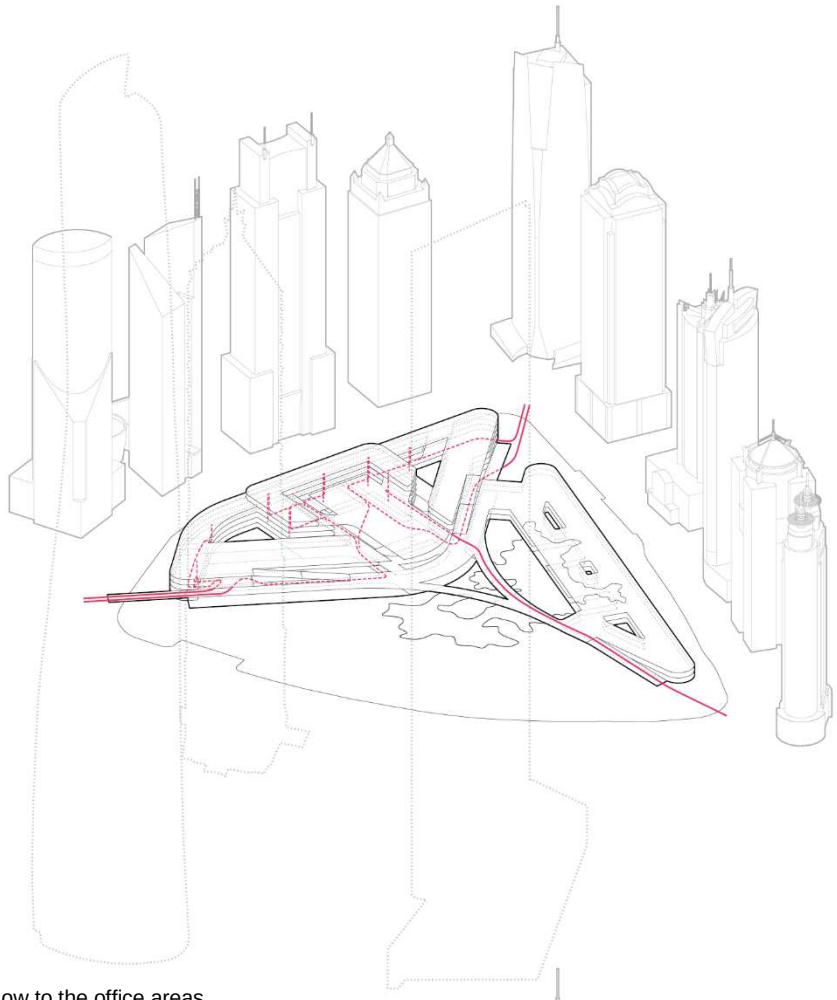


Fig 98: pedestrian flow to the office areas

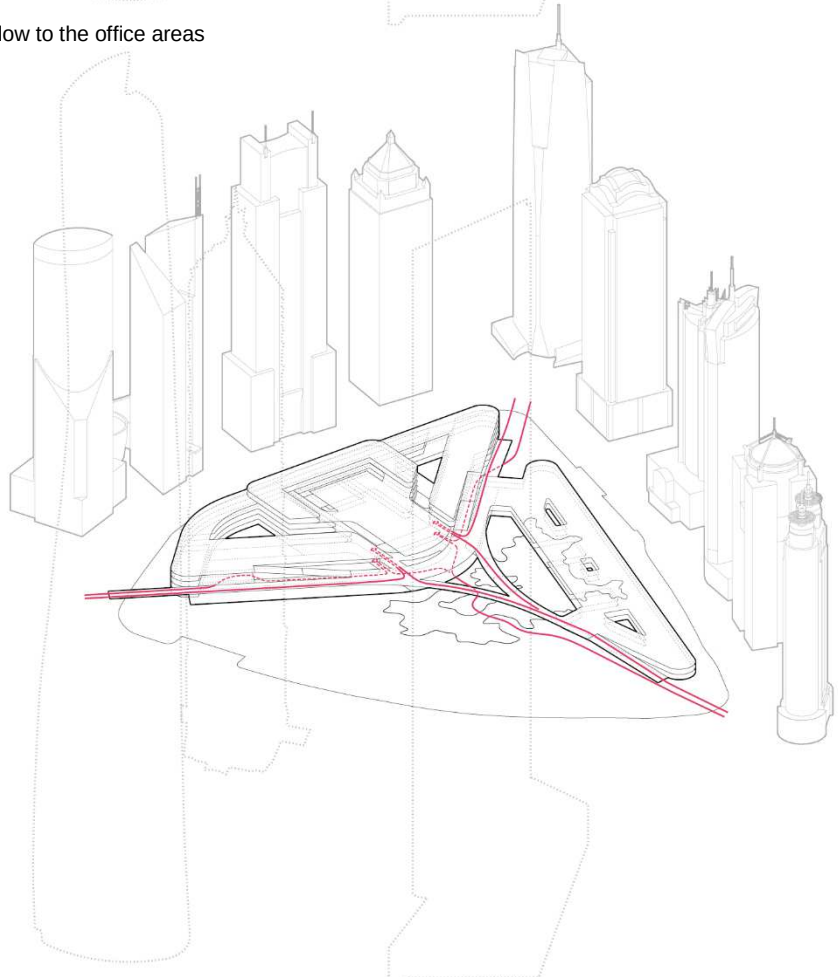


Fig 99: pedestrian flow to the theater, congress center and food court

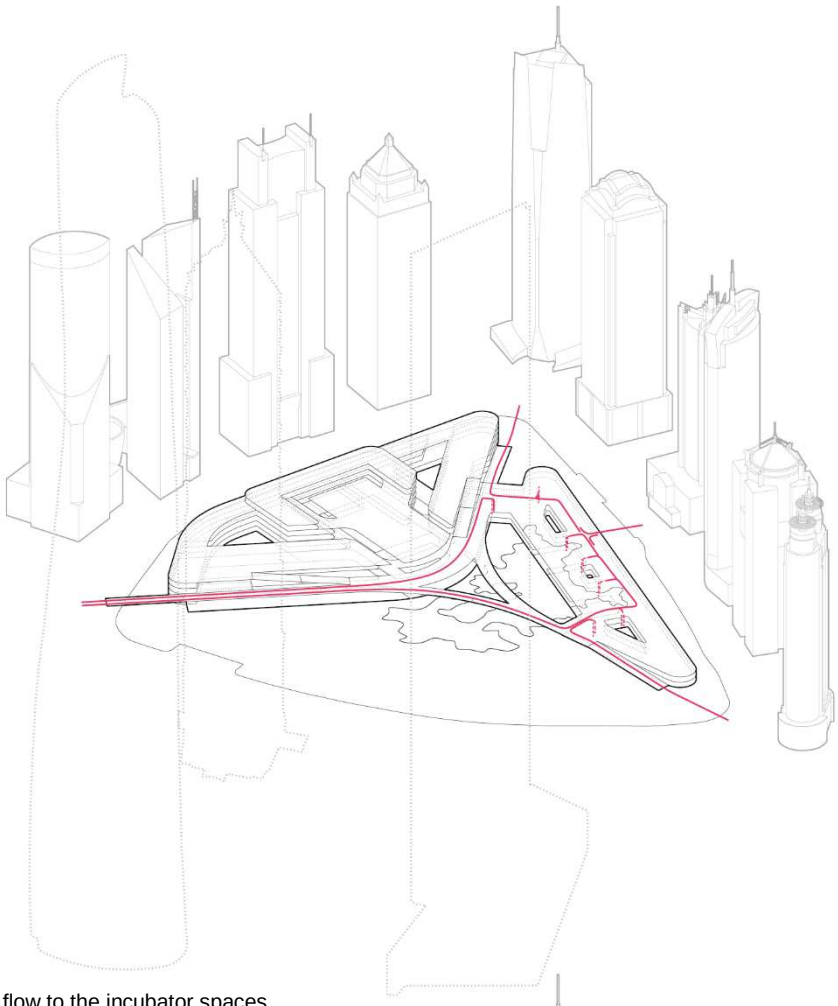


Fig 100: pedestrian flow to the incubator spaces

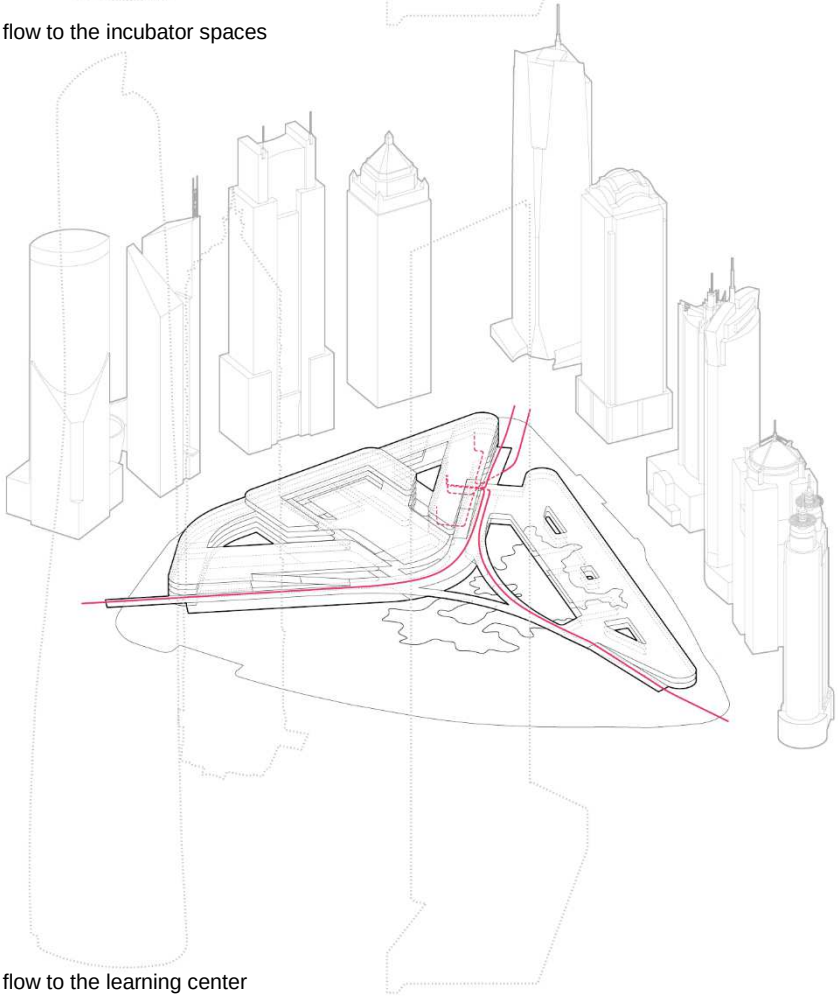


Fig 101: pedestrian flow to the learning center

Fig 102: Triple Towers with Project

Central Green Space gets preserved as green oasis, however gets defined into several layers and operates as the all-embracing podium of Lujiazui in Central Pudong.

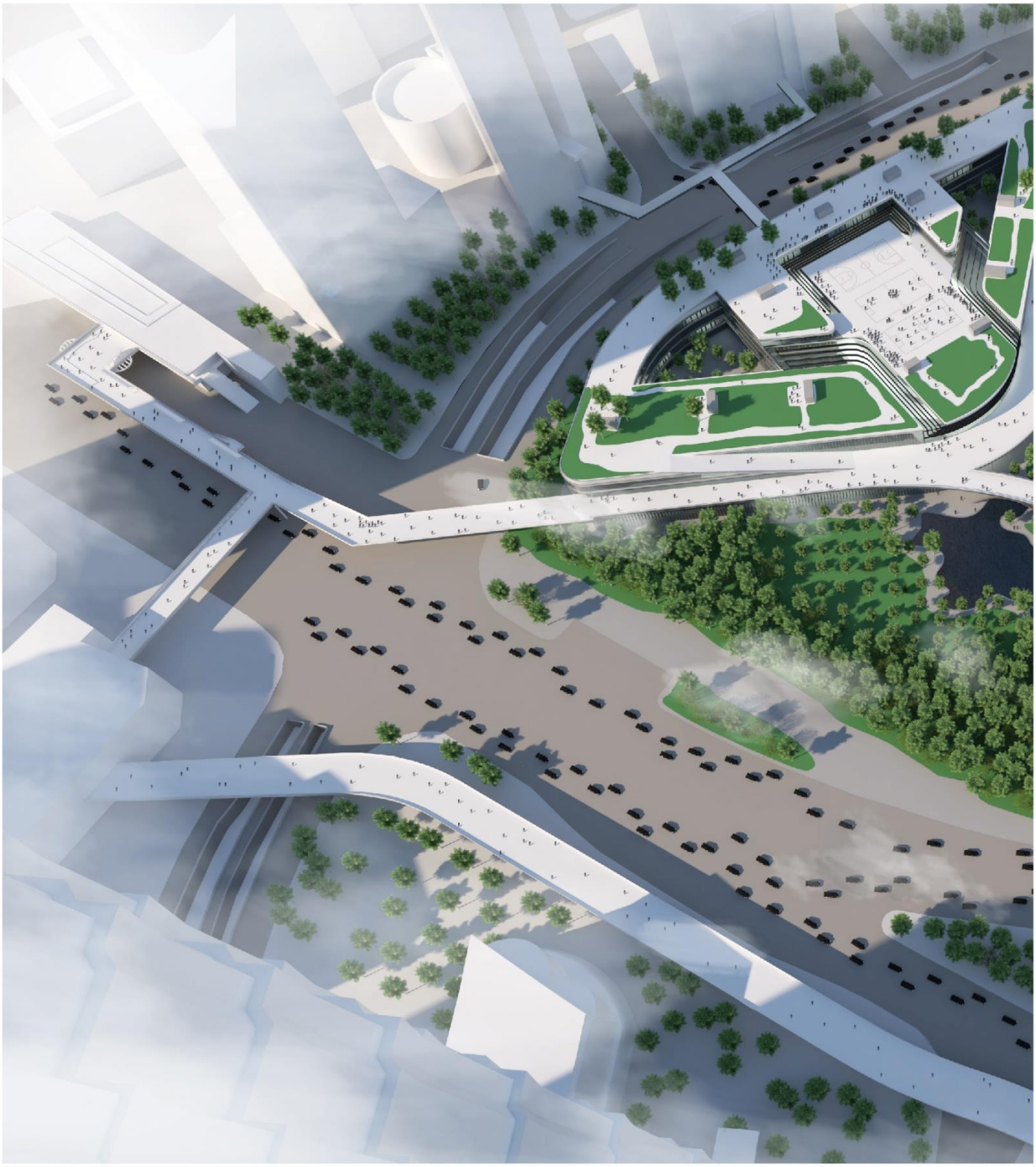
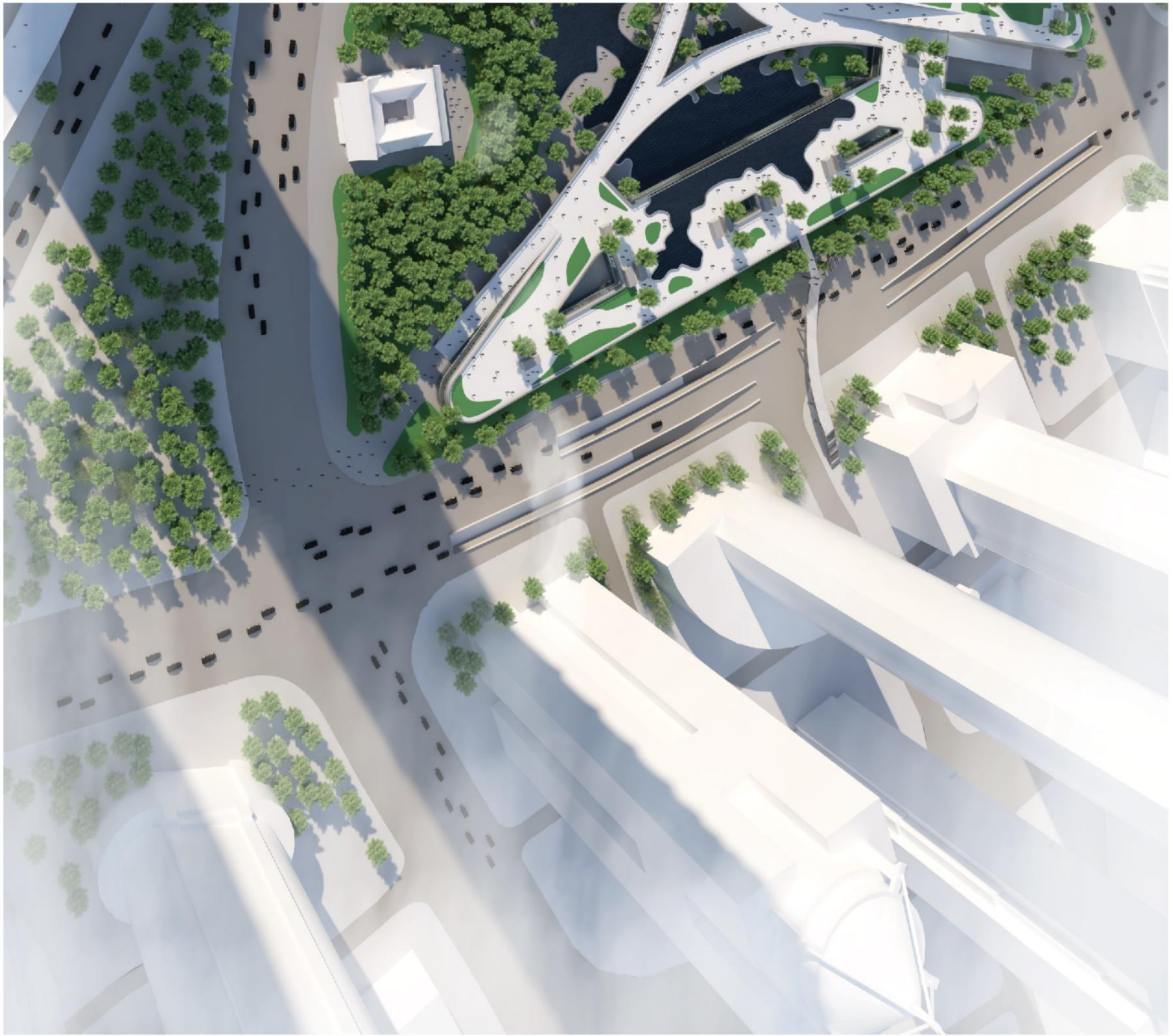


Fig 103: bird-view rendering



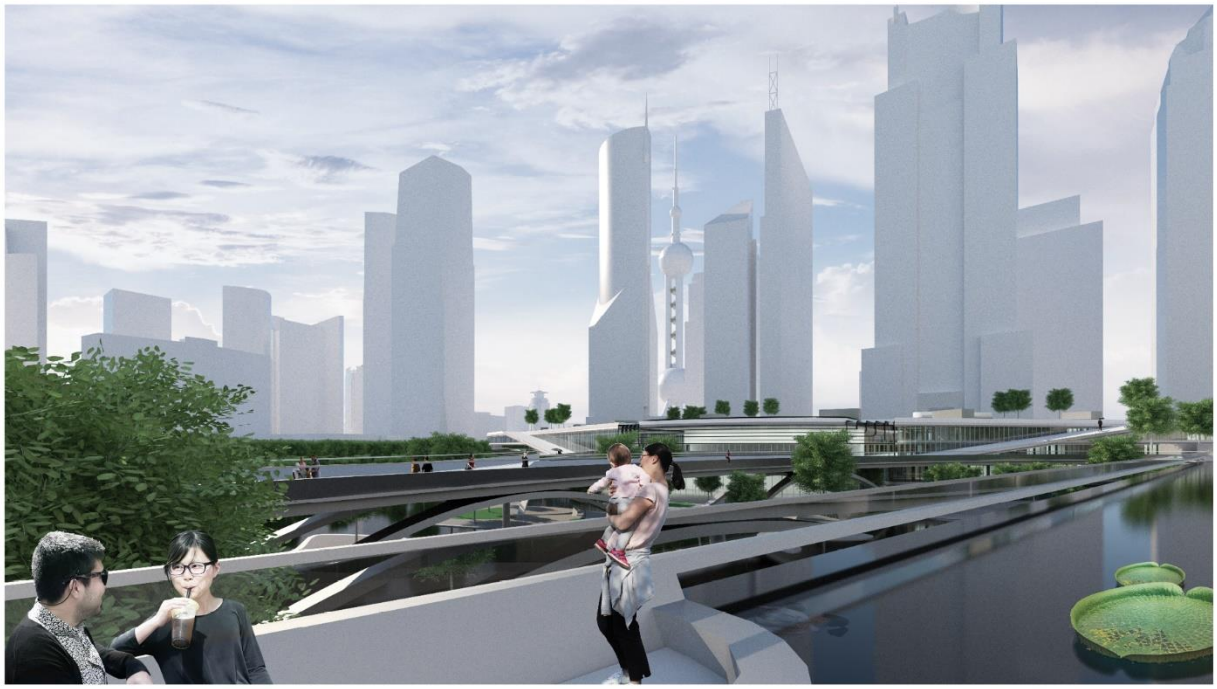


Fig 104: outdoor rendering 1

Fig 105: outdoor rendering 2

Fig 106: interior rendering 1

Fig 107: interior rendering 2

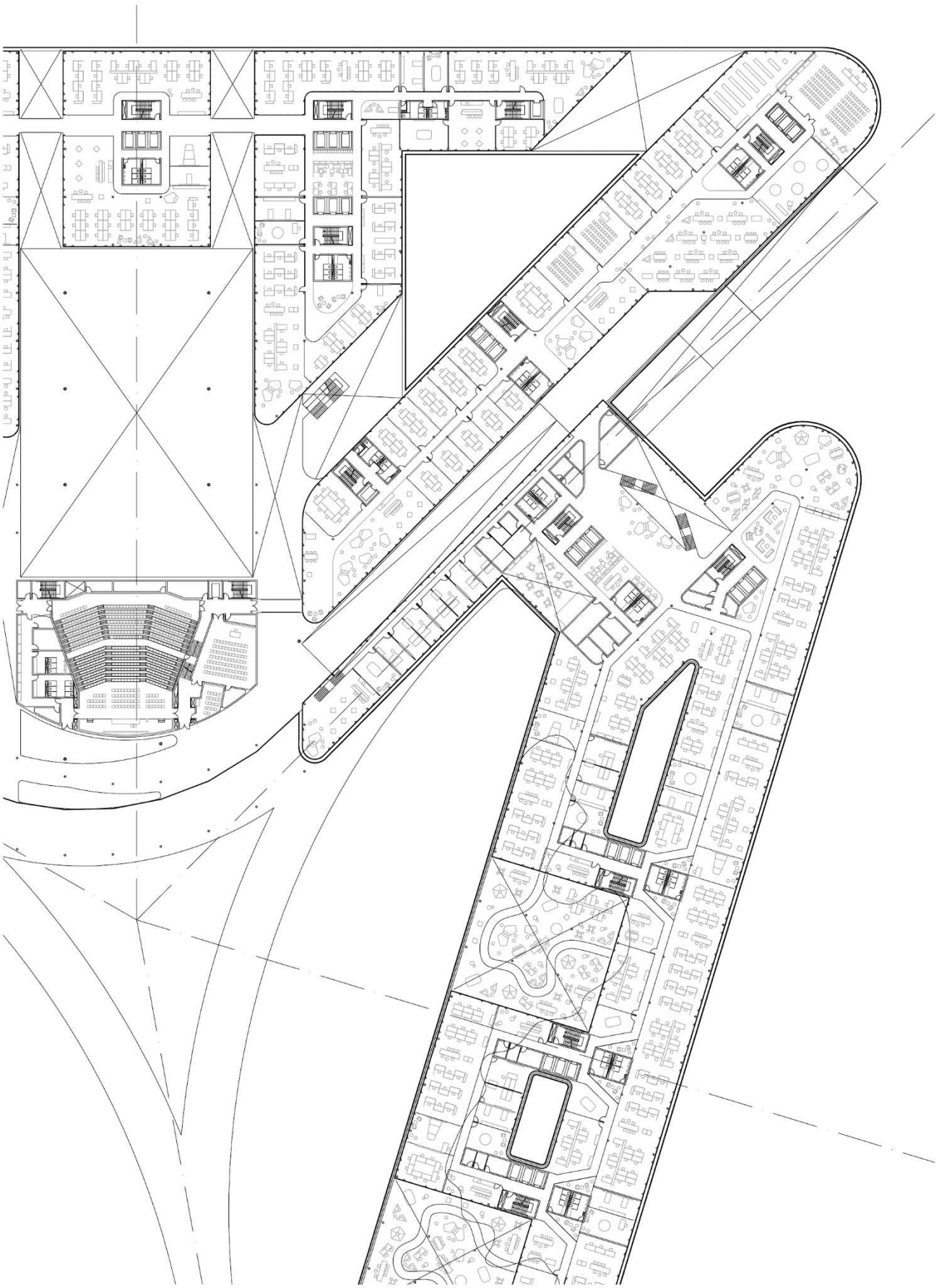


Fig 108: floor plan (2) with furniture

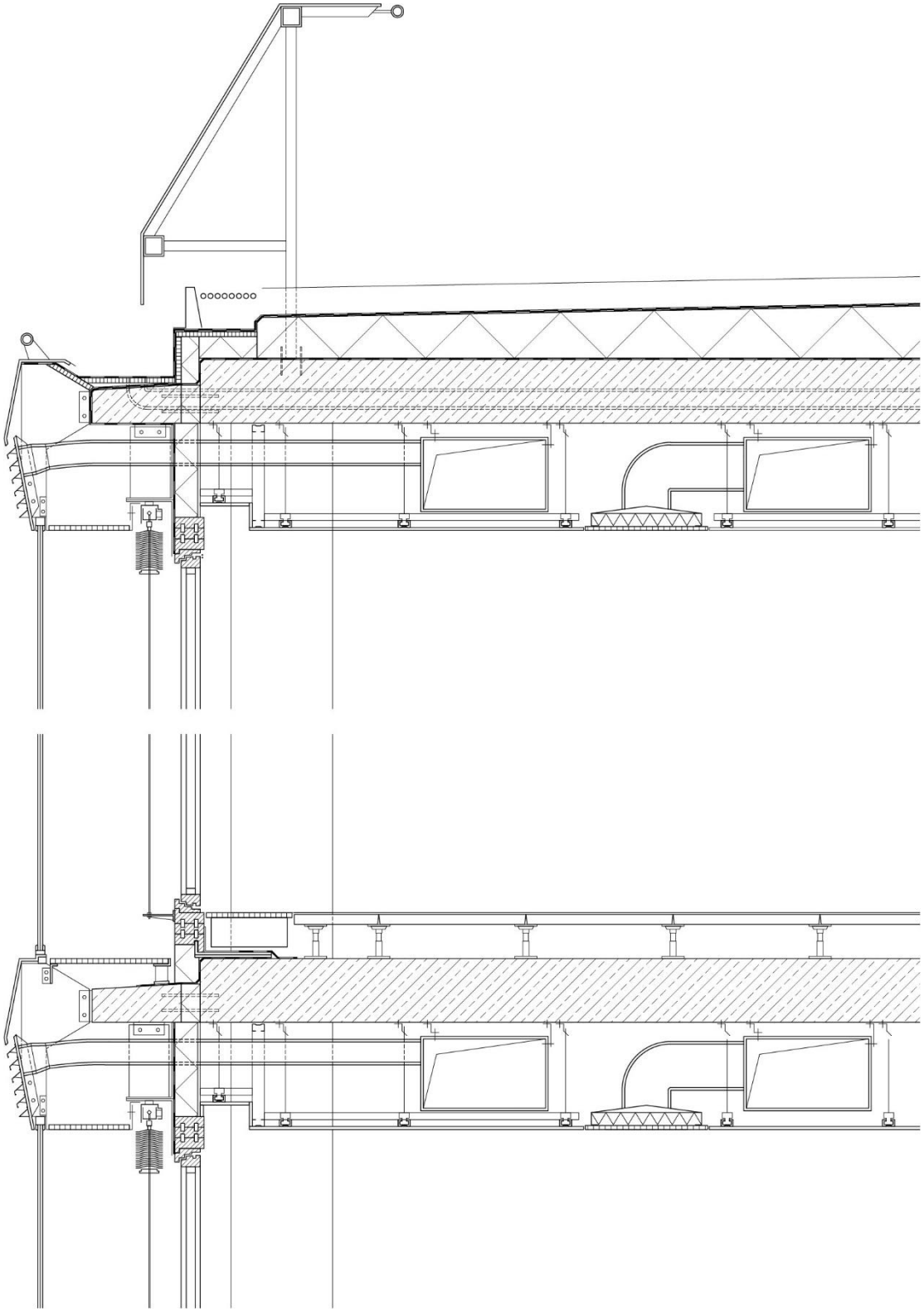


Fig 109: 1:25 double-skin facade

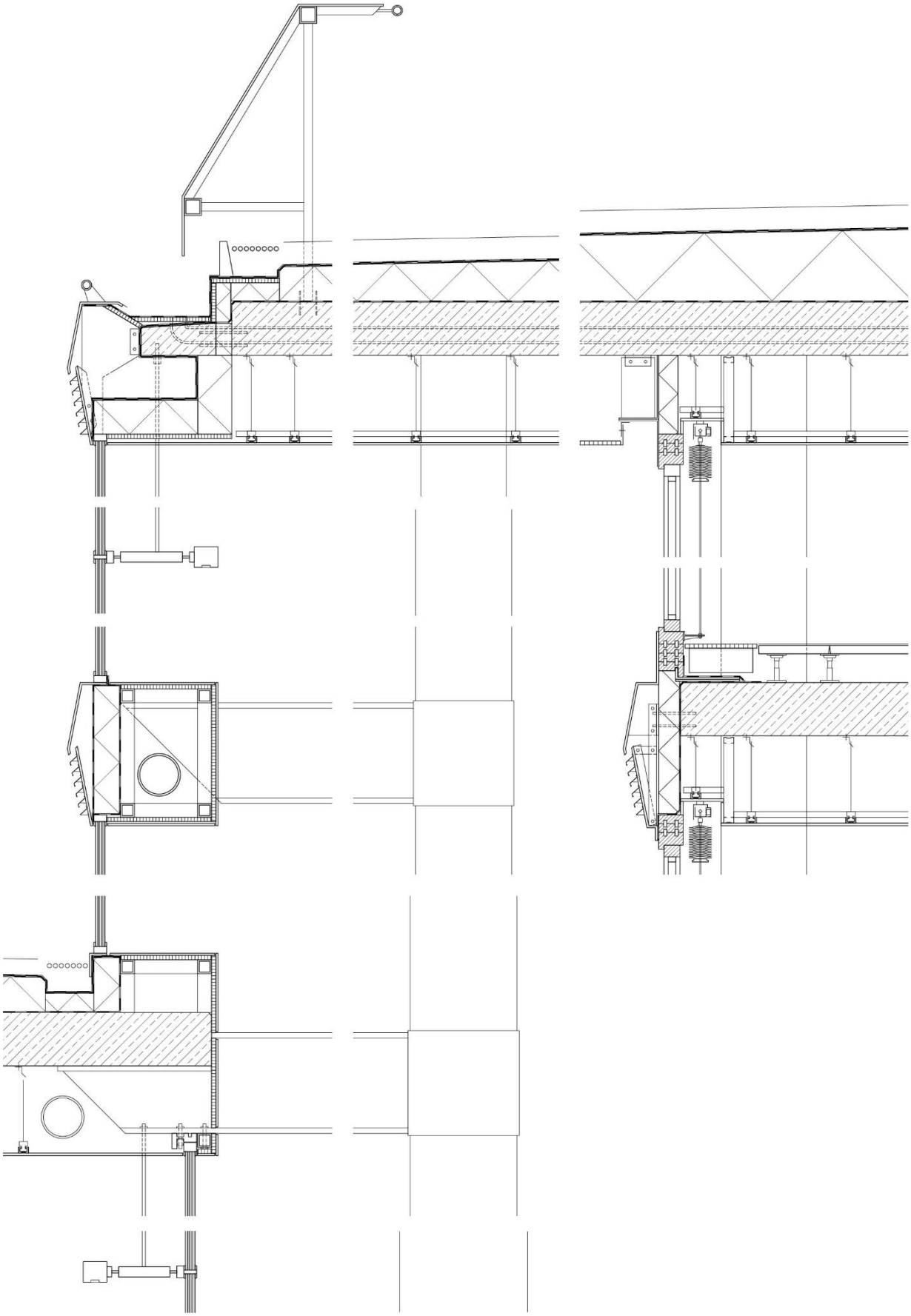


Fig 110: 1:25 single-skin facade

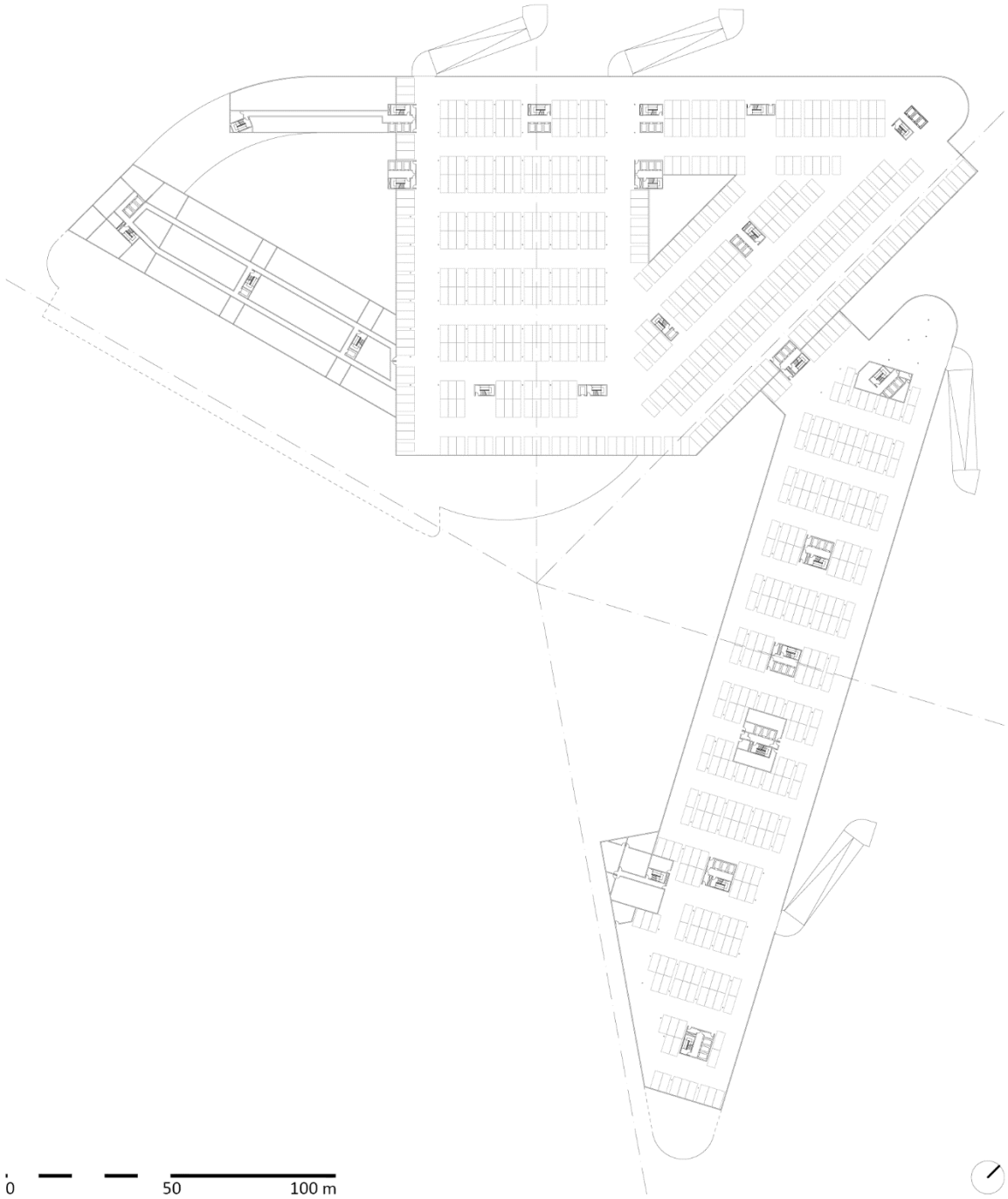


Fig 111: -1 floorplan

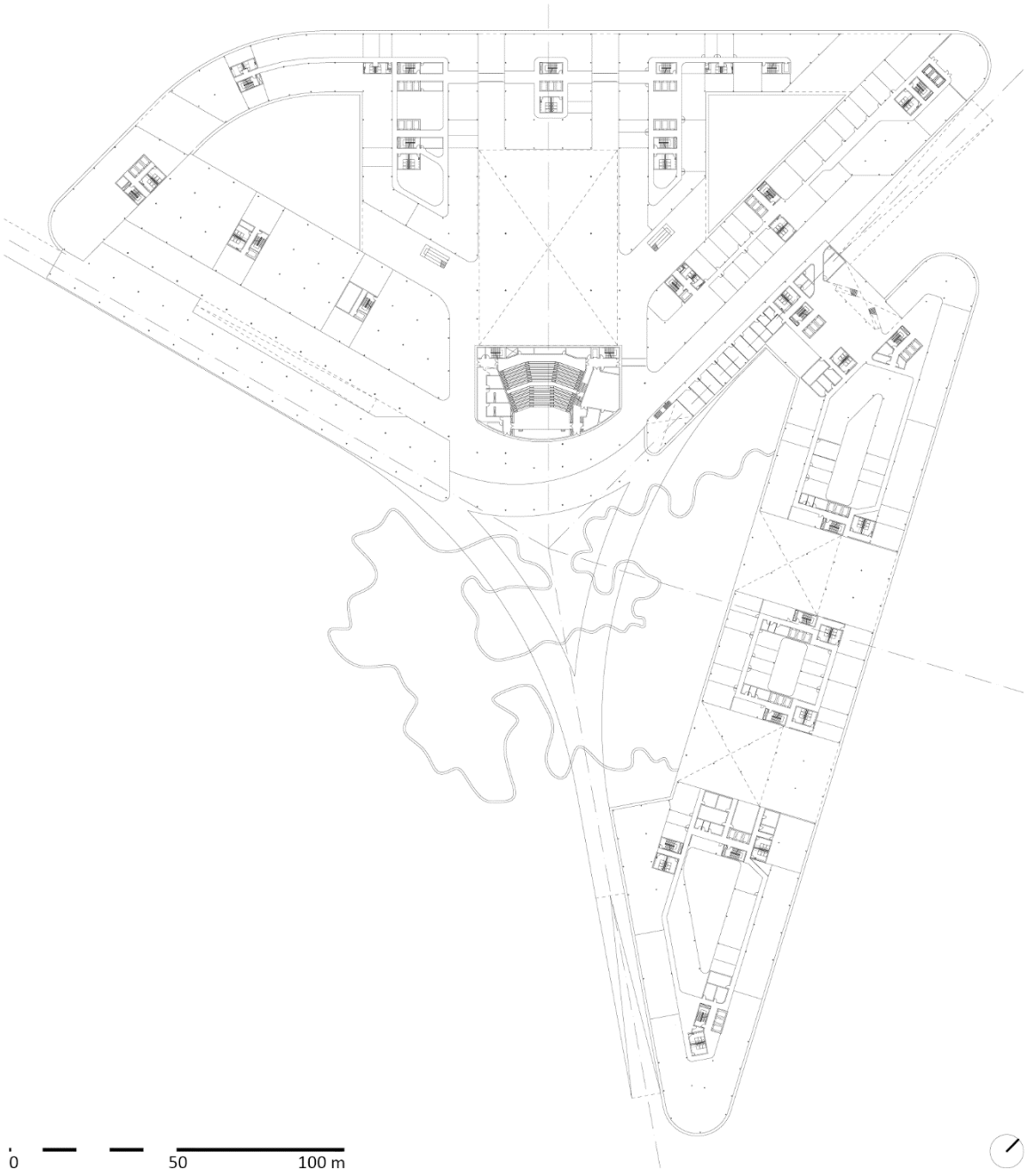


Fig 112: 1 floorplan

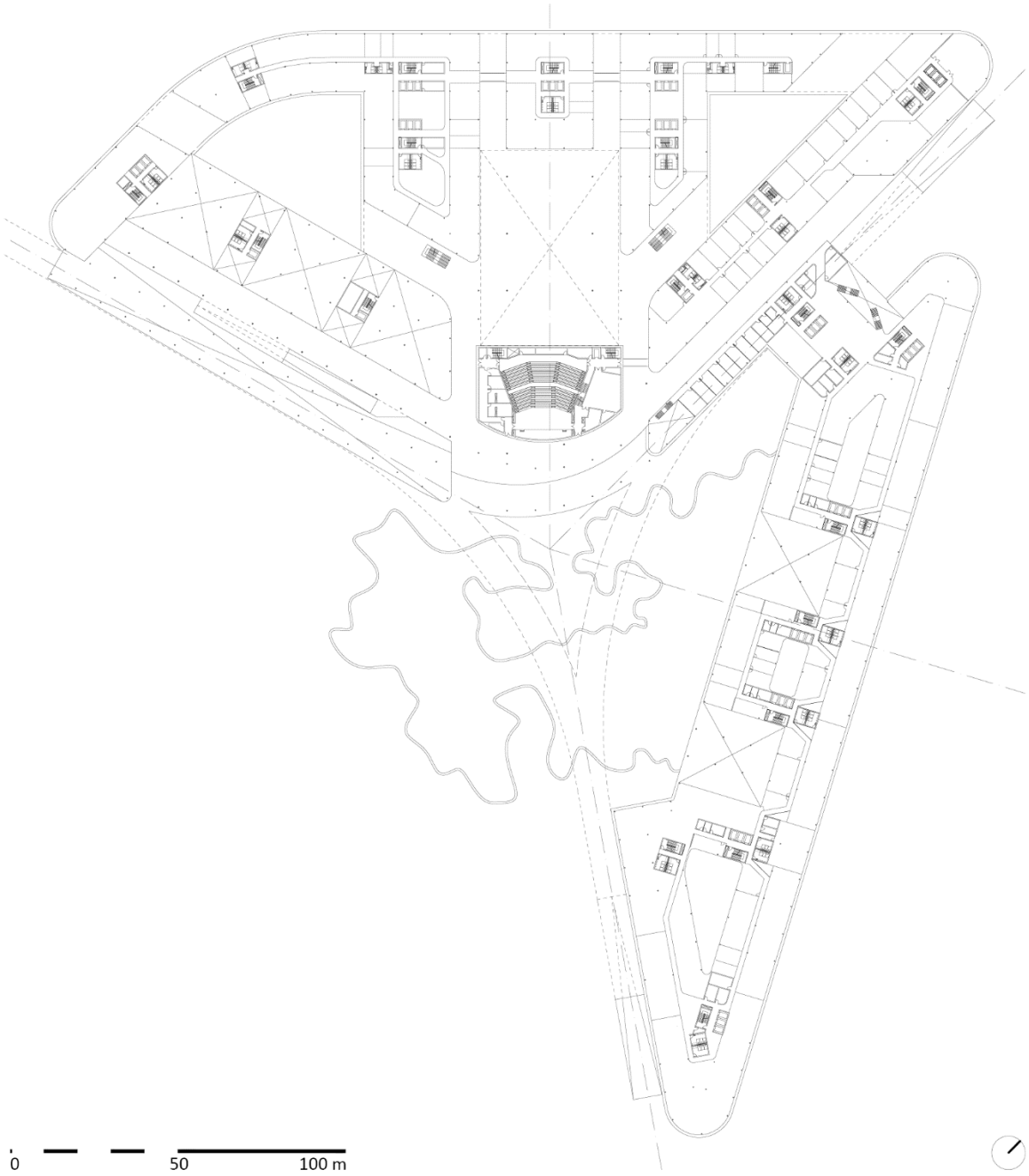


Fig 113: 2 floorplan

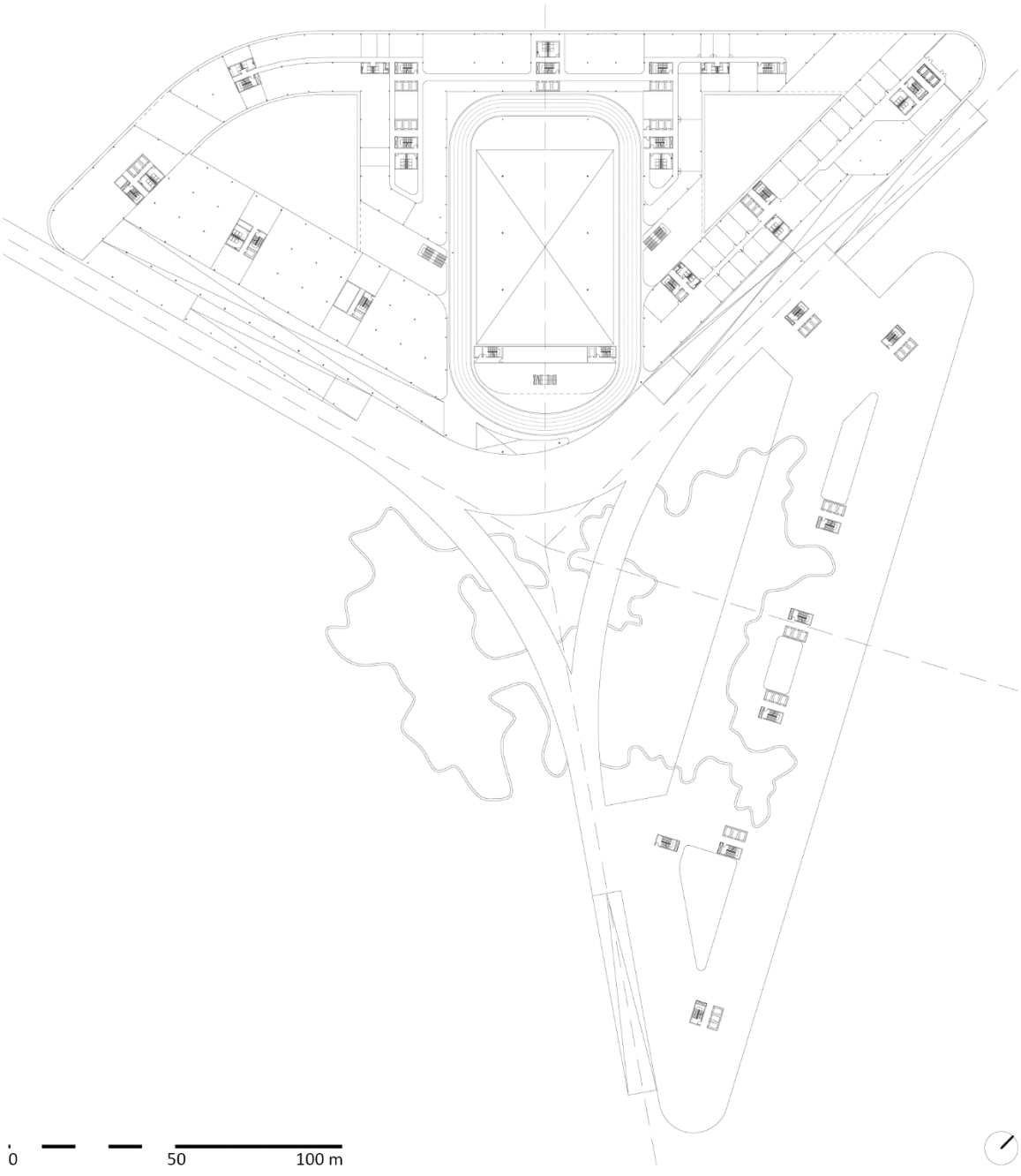


Fig 114: 3-4 floorplan

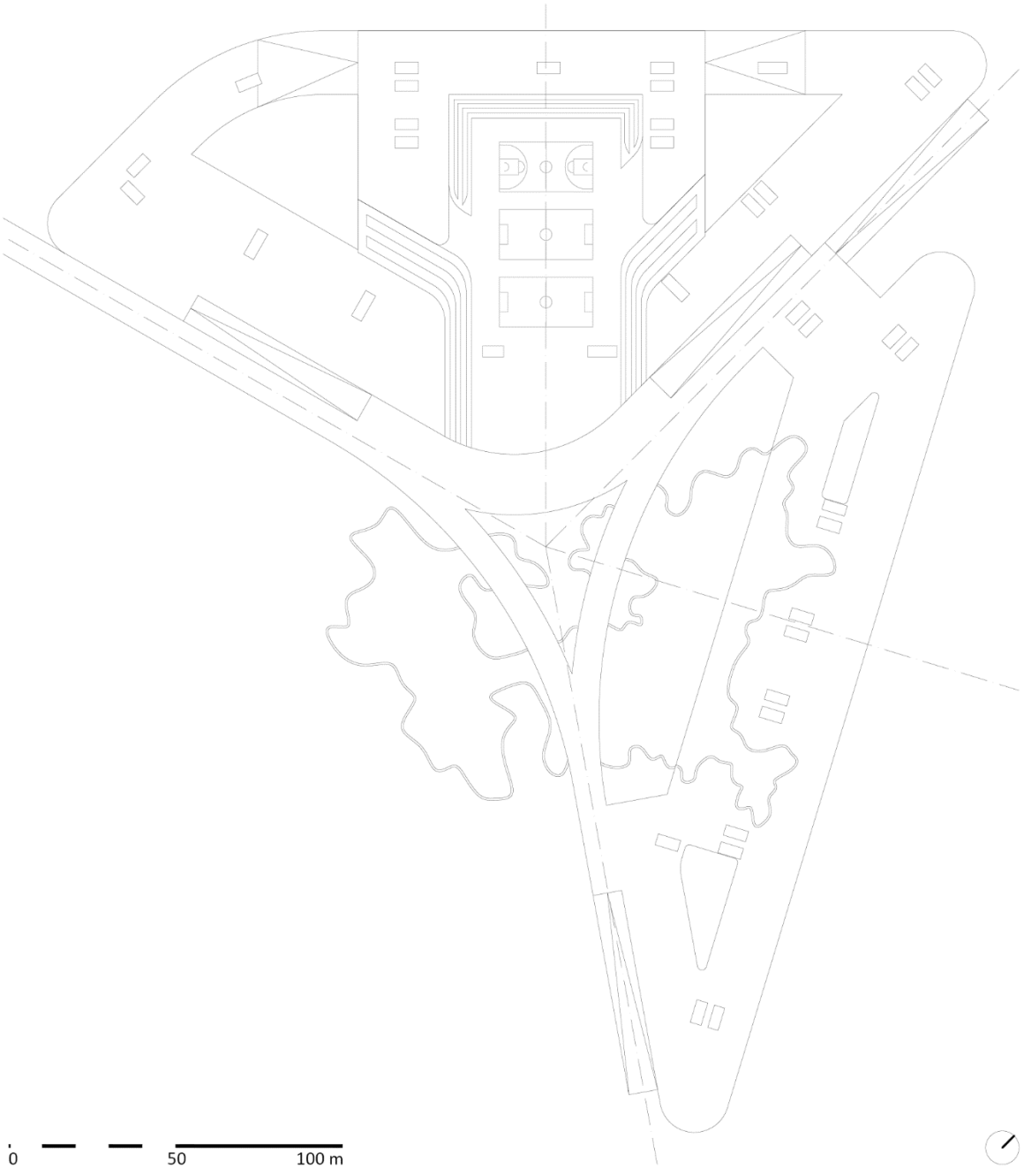


Fig 115: roofplan

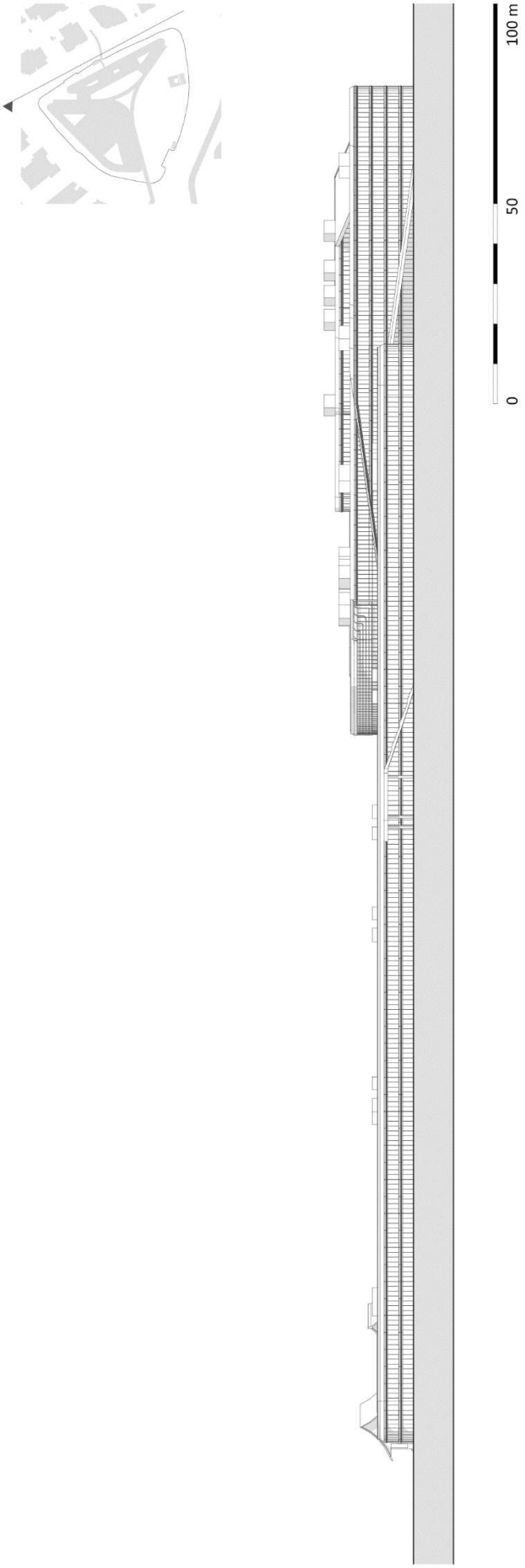


Fig 116: north-east elevation

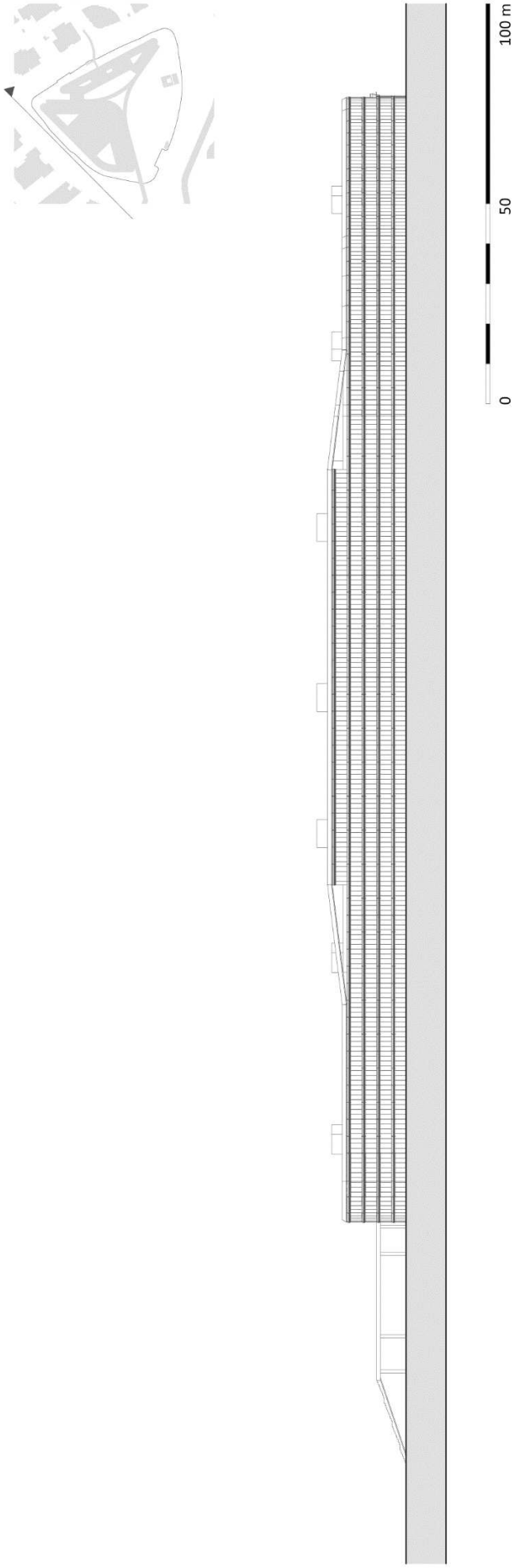


Fig 117: north-west elevation

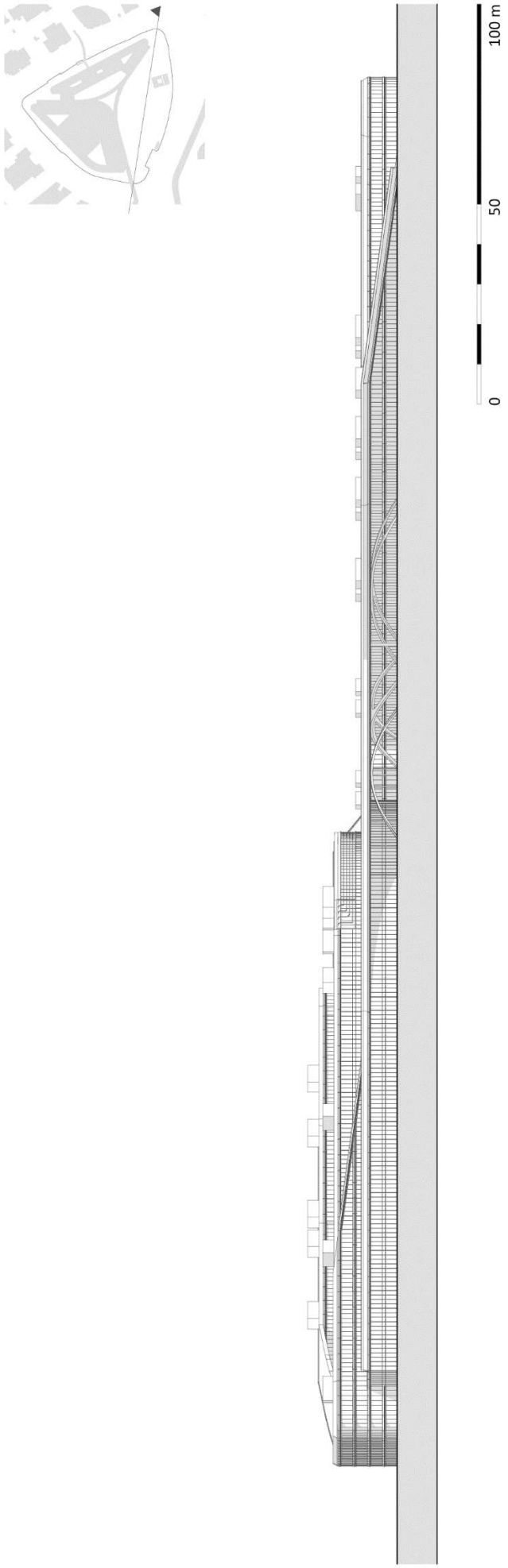


Fig 118: south elevation

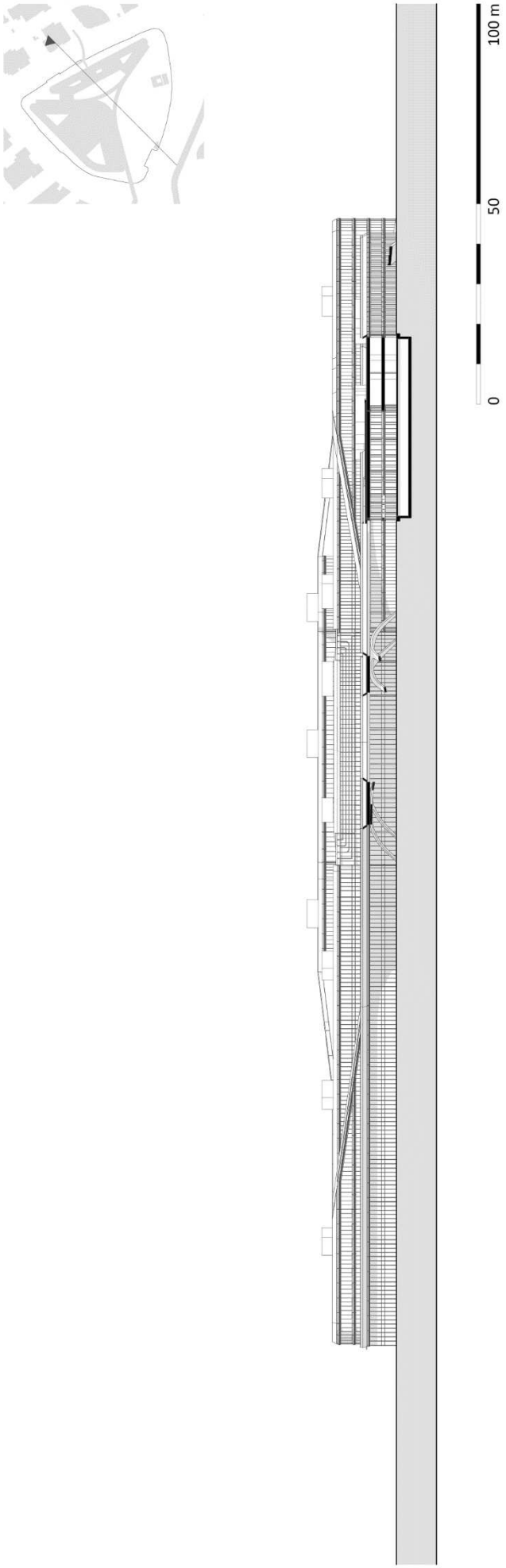


Fig 119: section 1

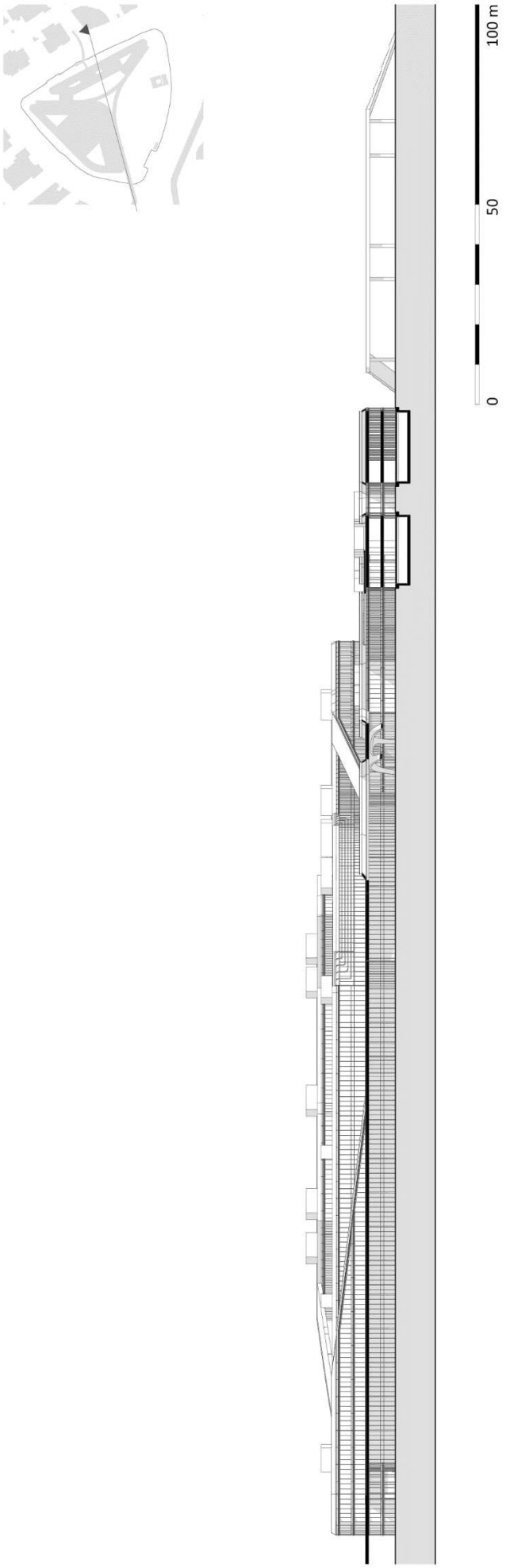


Fig 120: section 2

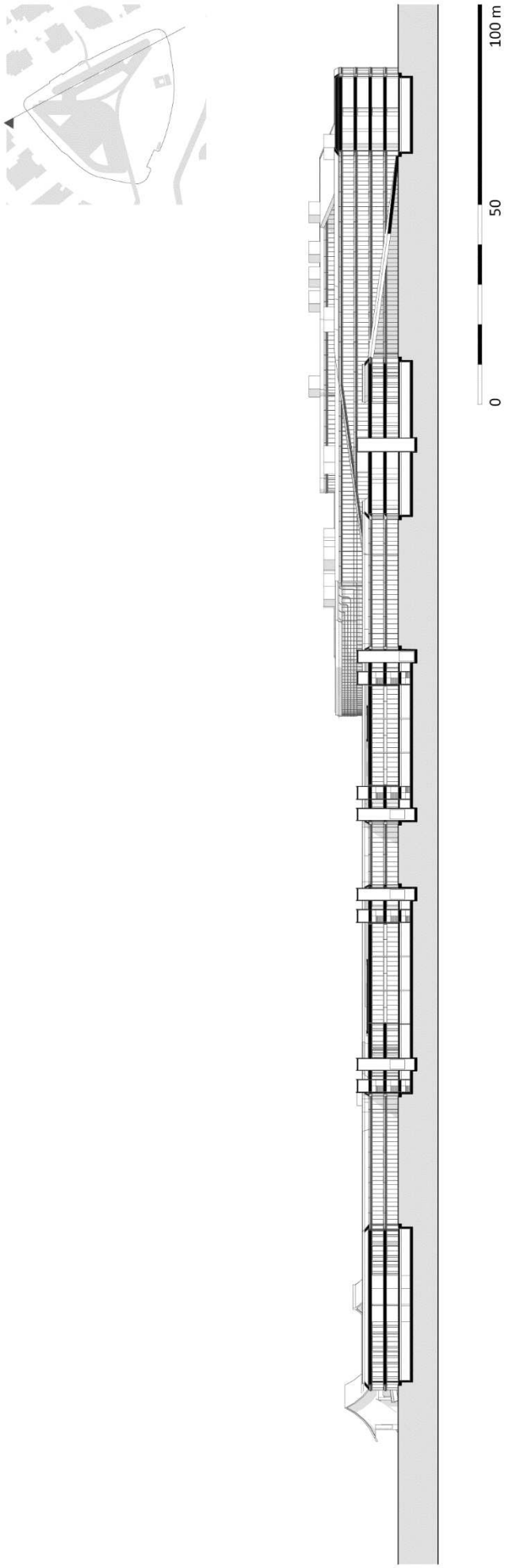


Fig 121: section 3

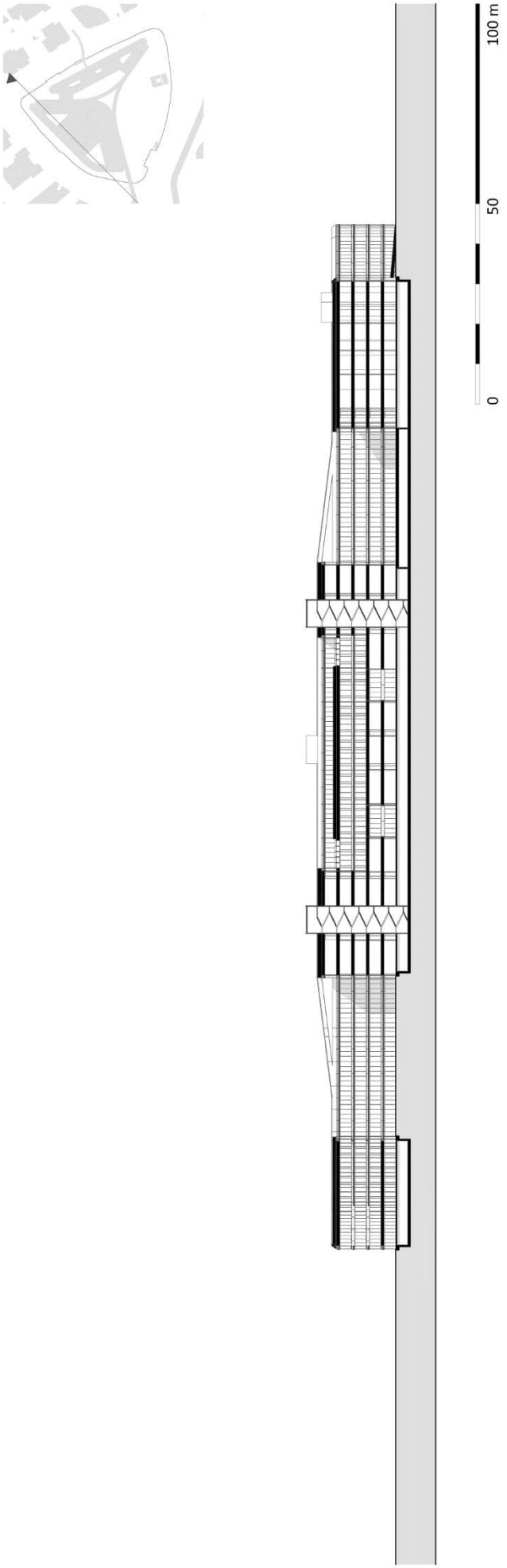


Fig 122: section 4

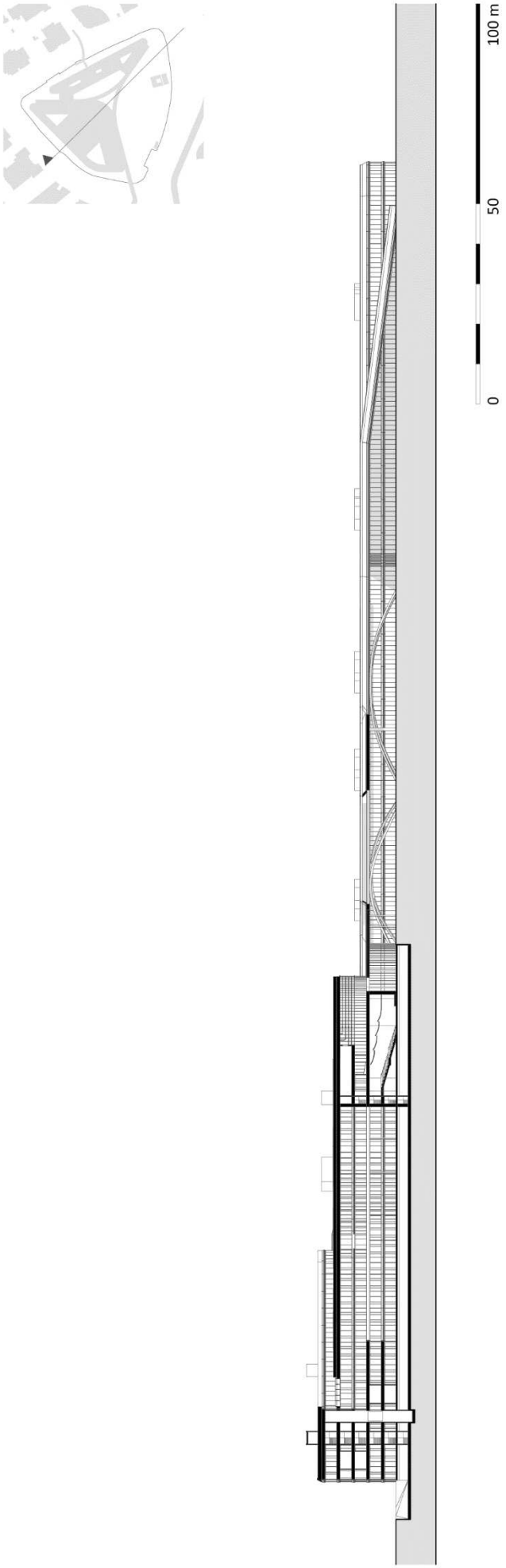


Fig 123: section 5

6. Conclusion

6.1 Summary of Research

In this chapter, the proposed project on Central Green Space will be evaluated under the consideration of the LPS-Model explained in the literature review, the case studies and the interviews' output. The idea and value of defining public space in layers to elaborate manifold usages is stated additionally in the conclusion of the chapter "Cross-Comparative Interview Study". The findings of this approach respond to the question of the fundamental requirements of tower structures to turn them into multidimensional networks.
Accessibility, existing house construction, traffic, socio-economic factors and others are boundary conditions that always make a reevaluation of exercised strategies necessary.
When the LPS-model is understood as superior system, it could have been arguable that Central Green Space gets covered with a massive podium and several interconnected mixed-use high-rise buildings towering above. Instead, under reconsideration of the performance wheel factors regarding economic, social and economic factors this option was reevaluated. Shanghai does have very few green parks with local public and leisure value and especially therefore a rather sustainable and ecological strategy was chosen. The surrounding high-rise buildings of Central Green Space are limited in their accessibility. Due to their articulation as standing alone towers with front gardens as transitional spaces without amenities for public gathering, the wide streets remain a barrier.
The intended project on Central Green Space integrates the LPS-model into the existing building structure and turns Central Lujiazui into a multi-dimensional tower cluster that does not limit itself to just one block but becomes vertically and horizontally a boundary comprehensive network.

Accessibility:
By making three main entrances on each corner instead of one entrance on the north-east side, that is not connected with the surrounding pedestrian walkways, Central Green Space turns into an accessible green oasis for lunch meetings and public gathering for all different kinds of user groups.

Public Space:
The primary route system, which connects the three main entrances with each other, intersects Central Green Space in three parts. The south part facing Lujiazui E Road will be covered completely with trees to operate as natural barrier against noise and air pollution. The elevated walkway moves the pedestrian up into the treetop giving the human the possibility to experience the forest from the perspective of a bird. It also generates a concave forest edge, which is ideal to find the ideal selfie-spot with your favorite tower. By this strategy, Chen Guichun's Residence's surrounding will correspond with its formerly context

in 1917, when it was built. The north-east third offers a very differentiated public space with little corners, small food pavilions, water games and trees for shading. Ramps enable the pedestrian to also penetrate into the north-west third, however major parts are articulated as a sport park which needs to be considered as semi-public space, because it is restricted to locals and students of the learning center. The public can watch the hustle and bustle from the viewing deck which is accessible by the ramps.

These added elements, the ground floor as forest (0), the lower roof of the podium (2) as roof deck (3) and the upper roof as sky space (4), together with the observatory of the Shanghai Tower, the Shanghai Finance Center and the hotel lobby of the Jin Mao Tower as sky planes (5), turn Central Green Space and its surrounding towers truly into a layered public space within a multi-dimensional tower cluster.

Functionality

The bank tower typology with their office functionality are dominating Lujiazui. To achieve a vibrant user group activity, cultural and educational facilities are added. This enables young and motivated students to get in contact with the professional sector and gives companies the possibility to get attentive on upcoming talents that help to navigate their business into the future. A learning center offers the infrastructure to gain post graduate knowledge and events in the convention center inform about state-of-the-art technology. Lectures and speeches can be held in the on-site theater in a representative setting.
Modern working happens as collaborative. Therefore, incubator spaces are facilities where geeks can show their abilities by solving problems next to the working spaces of global specialists to allow a knowledge cross-over. A museum and a gallery are representing the window to the broad public where everyone who is interested can get inspired by achievements that have already been done in the heart of Shanghai. The intended project on Central Green Space is a working environment of tomorrow that closes the gab of physical and visual barriers and offers a certain infrastructure that goes beyond current standards.

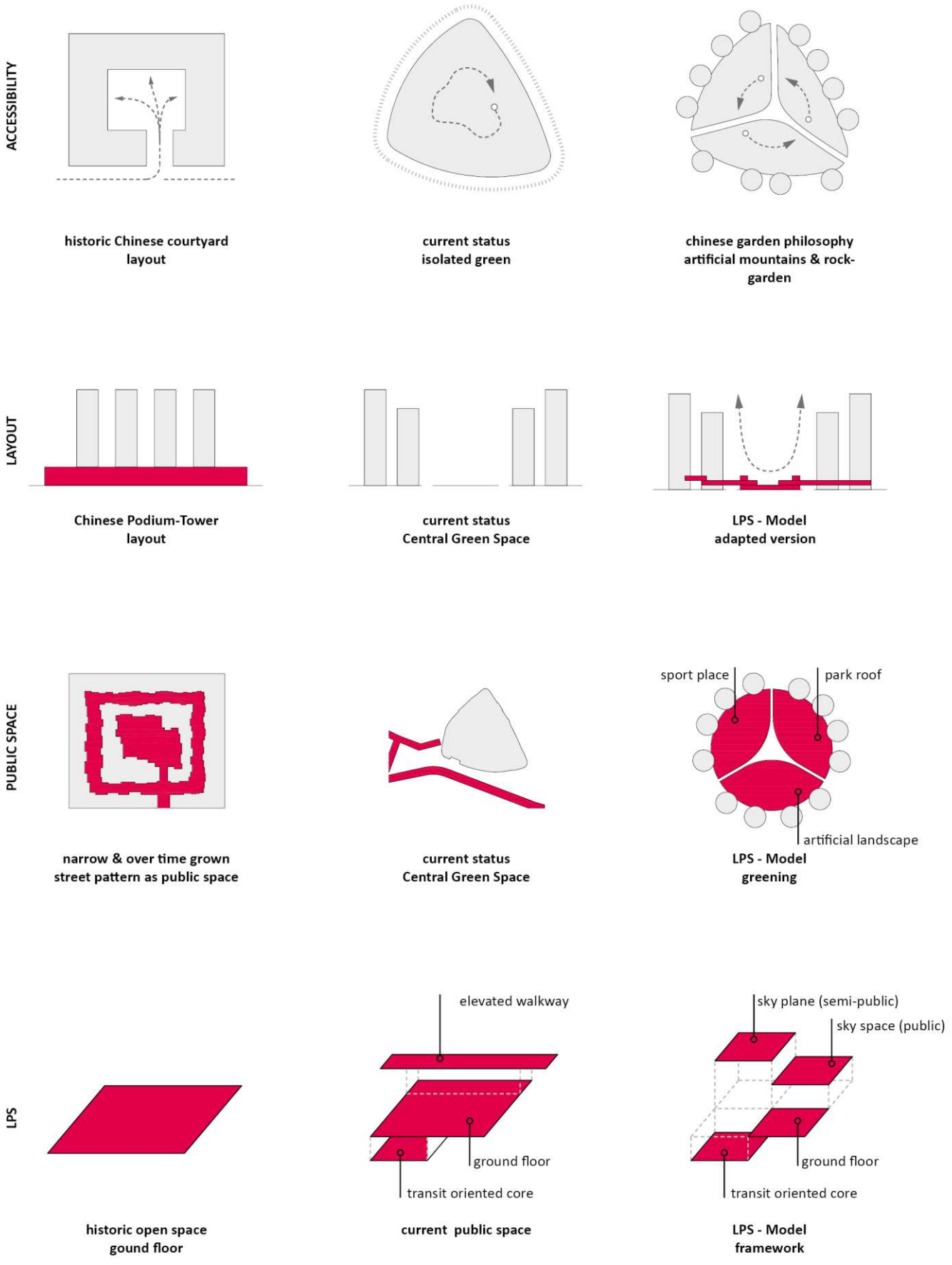


Fig 124: adaption strategies for Central Green Space

6.2 Directions for further Studies

The formulation of the 5 layers of the LPS-model and the allocation of different public spaces in terms of publicness, open access and vertical alignment needs to be seen as a benchmark and represents the starting point of how we define our future building structure that turns into an all-embracing urban network.

The intervention on Central Green Space can be seen as a role model of how we reintegrate nature into our built environment and that we can't afford the loss of these green inner urban oases. We already know that greenery and water have an enormous effect on people's health. This duality needs to become more investigated and will make the reintegration of nature into our everyday routes necessary.

How can new policies synergies the architect's design intention, developer's vision and the approach by the government to balance public and private interests? This would regulate also the status of LPS. For instance, Urban strategies of Singapore or Hong Kong are already heading towards the right direction. How can the method of social return on investment (SROI), which incorporates environmental and social value into the financing strategy, change the layout of future real estate projects? This kind of questions won't be solved by the architects nor urban planners, politicians or accountants on their own. People from the creative, technological, state and economic industries need to work as a collaborative together on these big questions of our future and the intended design project on Central Green Space could become a laboratory for trendsetting showdowns.

Fig 125: future site plan

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9. List of Abbreviation

LPS	Layered Public Space
M-DTC	Multi-Dimensional Tower Cluster
POPS	Privately Owned Public Space
BIM	Building Information Modeling
CBD	Central Business District
HVAC	Heating Ventilation and Air Conditioning
HPT	High Performance Tower
WTC	World Trade Center
PATH	Port Authority Trans-Hudson
SEZ	Special Economic Zone
SHM	Structural Health Monitoring
DCS	Destination Control System
NASA	National Aeronautics and Space Administration
ESA	European Space Agency
URA	Urban Redevelopment Authority
LUSH	Landscaping for Urban Spaces and High-Rises
GPR	Green Plot Ratio
CIAM	Congrès Internationaux d'Architecture Moderne
TPS	Treaty Port System
ULI	Urban Land Institute
ICTs	Information and Communication Technologies
TOD	Transit-Orientated Development
ROI	Return on Investment
SROI	Social Return on Investment
GEA	Global Energy Assessment
AR	Augmented Reality

10. References

Abdelrazaq, Ahmad. “Validating the Dynamics of the Burj Khalifa.” *CTBUH Journal, 2011*, no. 2 (2011): 18–23.

Al-Kodmany, Kheir. *Eco-Towers: Sustainable Cities in the Sky*. Southampton, Boston: WIT Press, 2015.

———. “Placemaking in the High-Rise City: Architectural and Urban Design Analyses.” *International Journal of High-Rise Buildings* 2, no. 2 (2013): 153–69.

———. *Understanding Tall Buildings: A Theory of Placemaking*. London; New York: Routledge, 2017.

Altshuler, Alan, William Morrill, Harold Wolman, and Mitchell Faith. *Governance and Opportunity in Metropolitan America*. Washington, D.C., 1999.

AT THE TOP. “Fact Sheet: Burj Khalifa.” AT THE TOP, Burj Khalifa, 2010.

Axon Consulting. “The Orchard Residences.” Accessed June 8, 2019. https://www.theorchardresidences.com/home.php?page=about_us.

Bagley, Forth. “The Mixed-Use Supertall and the Hybridization of Program.” *International Journal of High-Rise Buildings* 7, no. 1 (2018): 65–73.

Barney, Gina, and Lutfi Al-Sharif. *Elevator Traffic Handbook: Theory and Practice*. 2nd ed. London; New York: Routledge, 2016.

Beijing Tourism. “The Yintai Shopping Center.” Accessed June 9, 2019. http://english.visitbeijing.com.cn/a1/a-X9YI0G00E47C173F849DC2.

Beijing Yintai Property CO., Ltd. “BEIJING YINTAI CENTRE.” Accessed June 10, 2019. http://www.yintai-centre.com.

Berkel, Ben van, Caroline Bos, and Nick Roberts. *Knowledge Matters*. Frame Publishers, 2016.

Binder, Georges. *Tall Buildings of China*. Australia: images Publishing, 2015.

Bingham-Hall, Patrick. *Garden City, Mega City, Rethinking Cities for the Age of Global Warming*. Pesaro Publishing, 2016.

Bunnell, Tim. *Malaysia, Modernity and the Multimedia Super Corridor: A Critical Geography of Intelligent Landscapes*. London; New York: RoutledgeCurzon, 2004.

Cache, Bernard. *Earth Moves: The Furnishing of Territories (Writing Architecture)*. MIT Press, 1995.

Calthorpe, Peter. *The Next American Metropolis: Ecology, Community and the American Dream*. WIT Press, 2015.

Camp, John McK. *The Athenian Agora: A Short Guide to the Excavations*. Athen: The American School of Classical Studies, 2003.

Carla, Joana, and Soares Goncalves. *The Environmental Performance of Tall Buildings*. London, Washington, DC: Earthscan, 2010.

Carter, Thomas B. “Sustainability in the Cement Industries and Chemical Admixtures.” In *Green Building with Concrete Sustainable Design*. CRC Press, 2012.

Chen, Collin. “Liuxiandong-Plot A4+B2 of Vanke Design Community / FCHA.” Architectural Autocad Drawings,Blocks,Details Download Center, January 1, 2019. https://www.ai-architect.com/liuxiandong-plot-a4b2-of-vanke-design-community-fcha/.

Chen, James. “Return on Investment (ROI).” Investopedia. Accessed April 24, 2019. https://www.investopedia.com/terms/r/returnoninvestment.asp.

Cho, Im Sik, Chye Kiang Heng, and Zdravko Trivic. *Re-Framing Urban Space: Urban Design for Emerging Hybrid and High-Density Conditions*. London; New York: Routledge, 2016.

Chongqing Guide Culture Media co.,Ltd. “Chaotianmen Square.” Accessed June 16, 2019. http://www.chongqing-guide.com/sightseeing/Chaotianmen-square.html.

Christiaanse, Kees. “Green Urbanism: Models of a Dense and Green Urban Context.” In *Dense+Green: Innovative Building Types for Sustainable Urban Architecture*, 70–83. Basel: Birkhäuser, 2016.

Cook, Rick, Bill Browning, and Chris Garvin. “Sustainability and Energy Considerations.” In *The Tall Building Reference Book*, 145–55. London; New York: Routledge, 2013.

Cooperman, David. “Time’s Arrow: Tall Moving Targets And Social Research.” In *Second*

Century of the Skyscraper, 53–58. New York: Van Nostrand Reinhold Company, 1988.
CTBUH. “The Skyscraper Center, Shibuya Hikarie.” *The Global Tall Building Database of the CTBUH*, 2019.
Dangerfield, Andy. “‘It’s Not What We Were Promised,’” January 8, 2015, sec. London. https://www.bbc.com/news/uk-england-london-30709757.
Edgett, Steve. “Vertical Circulation: Past, Present and Future.” In *The Tall Building Reference Book*, 229–337. London; New York: Routledge, 2013.
Fairhurst, Charles. “Going Under to Stay on Top.” *Underground Space* 1 (1976): 71–86.
Fenske, Gail. “A Brief History of the Twentieth-Century Skyscraper.” In *The Tall Building Reference Book*, 13–31. London; New York: Routledge, 2013.
Ferris, Hugh. *Power in Buildings; An Artist’s View of Contemporary Architecture*. New York: Columbia University Press, 1953.
Frampton, Kenneth. *Modern Architecture: A Critical History*. London: Thames and Hudson Ltd, 1980.
Frechette, Roger, and Russell Gilchrist. “Case Study: Pear River Tower, Guangzhou, China,” 1–11. Dubai: CTBUH, 2008.
Gehl, Jan. *Cities for People*. Washington: Island Press, 2010.
Gianotten, David, Rem Koolhaas, and Sylvia Chan. “The Public Meaning of Skyscrapers: Shenzhen Stock Exchange and CCTV.” In *CTBUH 2014 Shanghai Conference*, 57–62. Shanghai: CTBUH, 2014.
Giedion, Sigfried. *Space, Time and Architecture: The Growth of a New Tradition*. 3rd ed. Cambridge: Harvard University Press, 1959.
Goldberger, Paul. “Architecture and Society.” In *Second Century of the Skyscraper*, 101–16. New York: Van Nostrand Reinhold Company, 1988.
———. “Architecture: Antonio Sant’Elia.” *The New York Times*, February 21, 1986, sec. Arts.
González, María Francisca. “Shanghai Greenland Center / Nikken Sekkei.” ArchDaily, 2018. https://www.archdaily.com/905876/shanghai-greenland-center-nikken-sekkei.
Graham, Bruce J. “Tall Buildings as Symbols.” In *Second Century of the Skyscraper*, 117–48. New York: Van Nostrand Reinhold Company, 1988.
Griffiths, Keith. “City Hubs.” In *Cities to Megacities: Shaping Dense Vertical Urbanism*, 75–82. CTBUH, 2016.
Gu, JianPing. “Shanghai Tower: Building a Green, Vertical City in the Heart of Shanghai.” *Asia&Australasia: A Selection of Written Works on the World’s Tall Building Forefront*, 2015, 56–63.
———. “Shanghai Tower: Re-Thinking the Vertical City,” 28–32. Shanghai: CTBUH, 2012.
Günel, Mehmet Halis, and Hüseyin Emre Ilgin. *Tall Buildings: Structural Systems and Aerodynamic Form*. London; New York: Routledge, 2014.
Haji Awang, Azman bin, ed. “The Cyber Cities of Malaysia: Realising the Vision.” In *Cities in the Third Millenium*, 249–67. London; New York: Spon Press, 2005.
Hakonen, Henri, Marja-Liisa Siikonen, and Janne Sorsa. “Elevator Selection with Destination Control System,” 1–13. CTBUH, 2005.
Hammond, Peter. *Towards a Church Architecture*. London: The Architectural Press, 1962.
Hanson, Steve, and Roger Courtenay. “Islands in the Sky, Cities on the Ground: The Public Realm and Its Impact on Tall Buildings.” In *The Tall Building Reference Book*, 111–21. London; New York: Routledge, 2013.
Harvey, David. *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change*. Blackwell, 1991.
Hénard, Eugène. “The Cities of the Future,” 357–67. London: The Royal Institute of British Architects, 1910.
Hensel, Michael, and Jeffrey Turko. *Grounds and Envelopes: Reshaping Architecture and the Built Environment*. London; New York: Routledge, 2015.
Hikarie. “渋谷ヒカリエ/Shibuya Hikarie.” 渋谷ヒカリエ/Shibuya Hikarie. Accessed June 7, 2019. http://www.hikarie.jp.
Ho, Goman. *Arup’s Tall Buildings in Asia: Stories Behind the Storeys*. London; New York: Routledge, 2017.

Holl, Steven. *This Is Hybrid: An Analysis of Mixed-Use Buildings*. a+t architecture publishers, 2014.
———. *Urbanism: Working with Doubt*. New York: Princeton Architectural Press, 2009.
Hornyak, Tim. “Shibuya Station Area Redevelopment Plan – Shibuya Station.” Accessed June 6, 2019. https://www.shibuyastation.com/shibuya-station-area-redevelopment-plan/.
———. “Shopping in Shibuya – Shibuya Station.” Accessed June 6, 2019. https://www.shibuyastation.com/shopping-in-shibuya/#shibuya-hikarie.
Huberman, Jack. *The ABC of Zoning*. New York: Civitas Citizens, 1991.
Huggins, Jeffrey. “Raffles City Chongqing Conservatory: Studies For a New Bridging Building Type.” In *Cities to Megacities: Shaping Dense Vertical Urbanism*, 584–92. CTBUH, 2016.
Hughes, Jonathan. “Hospital-City.” *Architectural History* 40 (1997): 266–85. https://doi.org/10.2307/1568678.
Imam, Mohamed, and Branko Kolarevic. “Towards Resource-Generative Skyscrapers.” *International Journal of High-Rise Buildings* 7, no. 2 (2018): 161–70.
ION Orchard. “Perfect 10: A Wonder-Full Decade at ION Orchard.” Accessed June 9, 2019. https://www.ionorchard.com/article/Perfect-10-A-wonder-full-decade-at-ION-Orchard.
Johansson, Thomas B., Anand Patwardhan, Nebojsa Nakicenovic, and Luis Gomez-Echeverri. *Global Energy Assessment: Toward a Sustainable Future: Key Findings Summary for Policymakers Technical Summary*. International Institute for Applied Systems Analysis (IIASA), Cambridge University Press, 2012.
Karanouh, Abdulmajid, and Ethan Kerber. “Innovations in Dynamic Architecture.” *Journal of Facade Design and Engineering*, no. 3 (2015): 185–221.
Keating, Richard. “Tall Buildings in the Public Domain.” In *The Tall Building Reference Book*, 87–93. London; New York: Routledge, 2013.
King, Kenneth S. H., and Kellogg H. Wong. *Vertical City: Solutions to Sustainable Living*. Portland: Vertical City, 2013.
Kohn, Margaret. *Brave New Neighborhoods: The Privatization of Public Space*. London; New York: Routledge, 2004.
Koolhaas, Rem. *Delirious New York: A Retroactive Manifesto for Manhattan*. New York: The Monacelli Press, 1994.
Kothmann, Hella, and Wolf-Eckart Bühler. *Toscana: Handbuch Für Individuelles Entdecken*. 6th ed. Bielefeld: Reise Know-How, 2009.
Kurokawa, Kisho. *Kisho Kurokawa: Selected and Current Works*. Publishing Co., 1999.
Kwok, Michael, and Alexis Lee. “Engineering of Guangzhou International Finance Centre.” *International Journal of High-Rise Buildings* 5, no. 4 (December 2016): 49–72.
Le Corbusier. *Towards a New Architecture*. New York: Dover Publications, 1986.
Le Corbusier, Georges Candilis, Richard Herre, and Nora von Mühlendahl. *Der Modulor*. 10th ed. München: Deutsche Verlags-Anstalt, 2013.
Lefebvre, Henri. *The Urban Revolution*. Minnesota: University of Minnesota Press, 2003.
Lin, Shaopei, and Zhen Huang. *Comparative Design of Structures: Concepts and Methodologies*. Springer, Shanghai Jiao Tong University Press, 2016.
Ling, Lay, and Adeline Tan. “ION Orchard - ‘Centre of Gravity’ for Singapore Retail,” 2007.
Lollini, Tom. “Tall Buildings, Tight Streets.” In *Second Century of the Skyscraper*, 275–85. New York: Van Nostrand Reinhold Company, 1988.
Lomholt, Isabelle. “Hangzhou International Expo Center in the Zhejiang Province.” e-architect, 2018. https://www.e-architect.co.uk/china/hangzhou-international-expo-center-in-the-zhejiang-province.
Lubin, Jaron. “Humanizing the Megascale.” *CTBUH Journal, 2016*, no. 1 (2016): 12–18.
———. “The Evolution of the SkyPark Since the Marina Bay Sands.” *International Journal of High-Rise Buildings* 8, no. 1 (2019): 19–27.
Luong, Andrew, and Michael Kwok. “Finding Structural Solutions by Connecting Towers.” *CTBUH Journal, 2012*, China’s Unique Linked Towers, no. 3 (2012): 26–31.
Luong, Andrew, Michael Kwok, Patrick McCafferty, and Penny Cheung. “Raffles City Chongqing: A Skyscraper within a Development.” In *Global Interchanges:*

Resurgence of the Skyscraper City, 182–89. CTBUH, 2015.
Lynch, Kevin. *The Image of the City*. MIT Press, 1960.
Lyster, Clare. *Learning from Logistics: How Networks Change Our Cities*. Basel: Birkhäuser, 2016.
Miles, M. Margaret. *A Companion to Greek Architecture*. John Wiley & Sons, 2016.
MnDOT. "Local Historic Bridge Report - Abridged." Minnesota Department of Transportation (MnDOT), 2014.
Mostafavi, Mohsen. "A Conversation with Zaha Hadid." *El Croquis 103 Zaha Hadid 1996 - 2001: Landscape as a Plan.*, 2001.
Nakamura, Hiroshi. "Tokyo Plaza Omotesando Harajuku." 2013.
Newman, Peter, ed. "Sustainability and Cities: The Role of Tall Buildings in This New Global Agenda." In *Cities in the Third Millenium*, 75–109. London; New York: Spon Press, 2005.
Norberg-Schulz, Christian. *Genius Loci: Towards a Phenomenology of Architecture*. Rizzoli, 1979.
Odlinger, Katie. "Agenda Document for Planning and Transportation Committee." Guildhall: City of London Corporation, 2015.
Oechsling, Werner, and Peter Eisenman. *Die Formale Grundlegung Der Modernen Architektur*. Zürich: gta Verlag, 2005.
Old Testament, n.d.
Oliveira, Luciana, and Maria Augusta Justi Pisani. "Privately Owned Public Space: POPS in New York City." In *Paisagem Ambiente 39*, 113–32. N.39. Sao Paulo: Faculdade de Arquitetura e Urbanismo da Universidade de São Paulo, 2017.
Palladio, Andrea, and Hans-Karl Lücke. *Die Vier Bücher Zur Architektur*. 3rd ed. marixverlag, 2012.
Peters, Tom F. "The Relative Value of Invention and the History of Tall Buildings." In *Second Century of the Skyscraper*, 25–32. New York: Van Nostrand Reinhold Company, 1988.
Pomeroy, Jason. *The Skycourt and Skygarden: Greening the Urban Habitat*. London; New York: Routledge, 2014.
Portman III, John. "30 Years in China." Congress presented at the CTBUH 2012 Shanghai Congress, Shanghai, 2012.
Portman, John. "30 Years in China: An Architect/Developer's Perspective," 226–33. Shanghai: CTBUH, 2012.
———. "Beijing Yintai Centre | Portman Architects." *Archilovers* (blog), 2010. https://www.archilovers.com/projects/30931/beijing-yintai-centre.html.
Quantrill, Malcolm. *The Norman Foster Studio: Consistency through Diversity*. London; New York: E&FN SPON, 1999.
Rassia, Stamatina, and Panos Pardalos, eds. *Sustainable Environmental Design in Architecture: Impacts on Health*. Springer Optimization and Its Applications, v. 56. New York: Springer, 2012.
Regan, Leane. "Systems Approaches for Global Transformations: IIASA Research Plan 2016-2020." IIASA Council Meeting June 2015. International Institute for Applied Systems Analysis (IIASA), 2015.
Rice, Charles. *Interior Urbanism: Architecture, John Portman and Downtown America*. Bloomsbury Publishing Plc, 2016.
Robinson, James, and Antony Wood. "Beyond Icons: Developing Horizontally in the Vertical Realm," 81–88. CTBUH, 2014.
Rockwool Group. "2018-19, Buildings That Reshape the Future," 2019.
Rowe, Peter. *Emergent Architectural Territories in East Asian Cities*. Basel: Birkhäuser, 2011.
Ruan, Xing. "The Dong Tower." In *Skyplane: What Effect Do Towers Have on Urbanism, Sustainability, the Workplace and Historic City Centres?*, 74–83. Sydney: University of New South Wales Press Ltd, 2009.
Safarik, Daniel. "The Other Side of Tall Buildings: The Urban Habitat." *CTBUH Journal 2016*, no. 1 (2016): 20–25.

Safdie, Moshe. “Case Study: Marina Bay Sands, Singapore.” *CTBUH Journal, 2011*, no. 1 (2011): 12–17.
———. *The City After the Automobile: An Architect’s Vision*. United States: BasicBooks, 1997.
Safdie, Moshe, and Jaron Lubin. “Dense Urbanism: The High-Rise Tower as a Building Block for the Public Realm.” In *Asia & Australasia: A Selection of Written Works on the World’s Tall Building Forefront*, 88–99. CTBUH, 2015.
Saiidi, Uptin. *Inside Chinese Tech Giant Tencent’s Vertical Campus*. CNBC Reports, Report. CNBC International, 2018.
Samant, Swinal, and Srilakshmi Menon. “Exploring New Paradigms in High-Density Vertical Hybrids.” *International Journal of High-Rise Buildings* 7, no. 2 (2018): 111–25.
Sarkisian, Mark. *Designing Tall Buildings: Structure as Architecture*. 2nd ed. London; New York: Routledge, 2016.
Sbriglio, Jacques. *Le Corbusier: The Villa Savoye*. Birkhäuser, 2008.
Schnizer, Roland, Irene Gallou, Adam Davis, Wah Kam Chia, and Weng Hin Ho. “South Beach Towers, Singapore.” *CTBUH Journal, 2017*, no. 2 (2017): 12–19.
Schröpfer, Thomas. *Dense+Green: Innovative Building Types for Sustainable Urban Architecture*. Basel: Birkhäuser, 2016.
———. “The Dense and Green Paradigm.” In *Dense+Green: Innovative Building Types for Sustainable Urban Architecture*, 12–37. Basel: Birkhäuser, 2016.
Sellar, Irvine. “Developing an Icon - The Story of the Shard.” In *Global Interchanges: Resurgence of the Skyscraper City*. New York: CTBUH, 2015.
Sennett, Richard. *The Fall of Public Man*. England: Penguin Books, 1978.
Shai, Aron. *The Fate of British and French Firms in China, 1949-54: Imperialism Imprisoned*. Macmillan press, 1996.
Singh, Gurjit, Hossam Eldin Elsouefi, and Peter Brannan. “Case Study: Gate Towers, Abu Dhabi.” *CTBUH Journal, 2013*, no. 4 (2013): 12–17.
Skillings, Pamela. “World Trade Center Photos.” TripSavvy. Accessed February 19, 2019. https://www.tripsavvy.com/world-trade-center-photos-2287248.
“Sky Habitat Resolves Design Challenges.” *The Singapore Engineer October 2016* 2, no. 3 (2016): 14–18.
Sorkin, Michael. *Some Assembly Required*. Minneapolis: University of Minnesota Press, 2001.
Stalker, Caroline. “Beyond the Podium: Urban Spaces for Tall Buildings in a Subtropical City,” 172–83. CTBUH, 2015.
Sun, Ping. “Tencent Seafront Tower: Practice on Binding Buildings.” In *Cities to Megacities: Shaping Dense Vertical Urbanism*, 1307–13. CTBUH, 2016.
Terranova, Charissa N. “Ultramodern Underground Dallas: Vincent Ponte’s Pedestrian-Ways Systematic Solution to the Declining Downtown.” *Urban History Review*, Downtowns, Past and Present, 37, no. 2 (2009): 18–29.
Tierra Design Studio Pte Ltd. “Ion Orchard.” Tierra Design. Accessed June 9, 2019. https://tierradesign.squarespace.com/ion-orchard.
Tragbar, Klaus. *Vom Geschlechterturm Zum Stadthaus*. Münster: RHEMA, 2003.
United Nations. “Policies on Spatial Distribution and Urbanization: Data Booklet.” New York: Department of Economic and Social Affairs, 2018.
———. “The World’s Cities in 2018: Data Booklet.” New York: Department of Economic and Social Affairs, 2018.
Venturi, Robert, Denise Scott Brown, and Steven Izenour. *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form*. MIT Press, 1977.
Vitruvius, and Frank Granger. *Vitruvius: On Architecture: Book 1-5*. Vol. 1. Loeb Classical Library. Harvard University Press, 1955.
Vuuren, Detlef van, Katerine V. Calvin, and Lex Bouwman. “Pathways Toward Sustainable Development.” In *Global Environment Outlook - GEO-6: Healty Planet, Healthy People*, 511–43. Cambridge University Press, 2019.
Wang, Fang. *Geo-Architecture and Landscape in China’s Geographic and Historic Context: Volume 1 Geo-Architecture Wandering in the Landscape*. 1 vols. Springer, 2016.

Wang, Xian, and Peiming Song. *Creativity in China*. Fashion China. Intercontinental Press, 2007.
Ward, Jonathan, and Jiemin Ding. “Taking the Corporate Campus Vertical.” *CTBUH Journal, 2018*, no. 2 (2008): 12–19.
Ward, Jonathan, and Chao (Ivan) Wan. “The Impact of Tech Companies in Rethinking the High-Rise Workplace.” In *Cities to Megacities: Shaping Dense Vertical Urbanism*. CTBUH, 2016.
Warerkar, Tanay. “Touring the Massive Skybridge Connecting SHoP’s American Copper Buildings.” American real-estate blog. *Curbed NY* (blog), 2016. https://ny.curbed.com/2016/4/25/11498552/photos-shop-architects-skybridge-american-copper-buildings.
Watts, Steve. “Tall Building Economics.” In *The Tall Building Reference Book*, 49–70. London; New York: Routledge, 2013.
Wen, Tay. “A LUSH and Resilient City: LUSH 3.0.” 2017.
Wilkinson, Chris. “Aesthetics, Symbolism and Status in the Twenty-First Century.” In *The Tall Building Reference Book*, 33–40. London; New York: Routledge, 2013.
WOHA. “Oasia Downtown.” In *Dense+Green: Innovative Building Types for Sustainable Urban Architecture*, 234–43. Basel: Birkhäuser, 2016.
Wong, Mun Summ, Richard Hassell, and Hong Wei Phua. “Oasia Hotel Downtown, Singapore: A Tall Prototype for the Tropics.” *CTBUH Journal 2018*, no. 3 (2018): 12–19.
Wong, Raymond W. M., ed. “Recent Infrastructure Developments in Hong Kong - the Background, Current and Future Developments.” In *Cities in the Third Millenium*, 1–28. London; New York: Spon Press, 2005.
Wood, Antony. “Tall Trends and Drivers: An Overview.” In *The Tall Building Reference Book*, 1–9. London; New York: Routledge, 2013.
Wood, Antony, Wan-ki Chow, and Dean McGrail. “The Skybridge as an Evacuation Option for Tall Buildings in High-Rise Cities in the Far East.” *Journal of Applied Fire Science* 13, no. 2 (2005): 113–24.
Wood, Antony, and Daniel Safarik. “Skybridges: A History and a View to the Near Future.” *International Journal of High-Rise Buildings* 8, no. 1 (2019): 1–18.
Xia, Jun, Dennis Poon, and Douglas Mass. “Case Study: Shanghai Tower.” *CTBUH Journal, 2010*, no. 2 (2010): 12–19.
Xue, Charlie. *Hong Kong Architecture 1945-2015: From Colonial to Global*. Singapore: Springer, 2016.
Yoos, Jennifer, and Vincent James. *Parallel Cities: The Multilevel Metropolis*. Minneapolis: Walker Art Center, 2016.
達也浅岡. “Amazon Fashion Week Tokyo, 2019 Autumn/Winter.” 2018.

11. Appendix

11.1 Case Study Calculation

Program	Shibuya	ION Orchard	BYC	Tencent	Raffles City
residential		38 240	56 622		365 635
office	50 000		151 669	130 990	159 992
hotel			37 018		58 781
restaurant	10 000	7 000		16 040	56 691
retail	22 000	59 300	51 449	5 350	170 073
cultural	24 000	1 000	39 212	34 750	
sport		1 500	750	24060	3 600
others	38 000	18 930		58 810	319 488
GFA	144 000	125 970	336 720	270 000	1 134 260

Program	Shibuya	ION Orchard	BYC	Tencent	Raffles City
residential		30%	17%		32%
office	35%		45%	49%	14%
hotel			11%		5%
restaurant	7%	6%		6%	5%
retail	15%	47%	15%	2%	15%
cultural	17%	1%	12%	13%	
sport		1%	0%	9%	0%
others	26%	15%		22%	28%

General	Site Area	Leaf Area	GPR	Com. Space	CPR
Shibuya Hikarie	9 640	2100	22%	41500	430,50%
ION Orachrd	18650	11800	63%	40720	218,34%
Beijing Yintai Center	39000	14830	38%	71222	182,62%
Tencent Seafront	25470	15590	61%	112358	441,14%
Raffles City Chongqing	91 700	82200	90%	147379	160,72%

Leaf Area	Shibuya	ION Orchard	BYC	Tencent	Raffles City
areas	2 100	7 000	8 950	1 160	4 600
		4 800	2 740	950	4 600
			670	640	4 600
			670	1 540	4 600
			400	1 550	32 750

			1 400	2 090	31 050
				650	
				770	
				3 240	
				60	
				370	
				280	
				2 290	
	2 100	11 800	14 830	15 590	82 200

Com. Area	Shibuya	ION Orchard	BYC	Tencent	Raffles City
areas	8 000	16 000	13 050	96 228	33 628
	24 000	16 000	9 260	16 130	41 465
	9 500	3 070	39 212		14 695
		350	4 400		57 591
		5 300	5 300		
	41 500	40 720	71 222	112 358	147 379

11.2 1st Interview with Hongxi Yang

date: 2018 – 08 – 09
location: Park Hyatt Hotel, 1366 Qianjiang Road, Hangzhou, China

CN: First let's talk about your background and your undergraduate and graduate school?
HY: Sure! I grew up in Hangzhou. My undergraduate school was Zhejiang University (CHECK.1) in Hangzhou and graduate school was Columbia University in New York.
CN: How did you get started in your career as a practical architect?
HY: Well in my career, I was most of the time in America, but I also stayed for 20 months in Shanghai, because of the Visa, so I had to come back for a certain amount of time to get this problem solved. After that I moved back to the States and started working for Pelli Clarke Pelli Architects in 2012. I have been working for, altogether, 6 years by this October.
CN: During my preliminary investigation, I noticed that the Petronas Twin Towers were designed by your office (Pelli Clarke Pelli Architects) and the first project's location I was working on, at my off-campus internship office, was next to them. We were greatly interested in analyzing the location and importance of these towers for the region. Alright, let's get started!
HY: Oh really! Yea, I actually wrote down a lot of notes, but a while ago. So, give me a second to read my notes if needed.
CN: Your office is well known for large, mixed-use developments including high-rise buildings. What do you see as the major drivers of these projects and how can the general public benefit from them?
How can the high-rise buildings become a real address and not just serve as an office tower?
HY: Yea, I wrote down several things. Our general society is constantly evolving, as well as current developments and skyscrapers. Everything is driven by changes in technology and

economy. Each plot is surrounded by office space, hotel, service apartment, retail, etcetera, and the whole society is benefiting from these mixed-use developments. It is obvious, and currently a general idea, to think of the general public and how it can be further integrated by using these sky lobby, sky garden ideas. When you put it into practice, you can rethink the way amenities, which are now included in the tower, are enriching the developments. So, you are basically using the towers more intensively. Furthermore, I think the high-rise building can also be a great icon and a symbol. It is like a lighted house to the society, a landmark. It is guiding towards a more spiritual sense of an idea and gives it its confidence and acceptance or differently said, it is like a 'cultural element'. I think, because you mentioned the Petronas Twin Towers in Malaysia before, they are a good example. They are really a symbol of the whole state of Malaysia. Even if you don't really use the tower by going to the sky garden, sky deck, sky lobby and you are not actually working there, you still get affected by their silhouette which is visible throughout the entire city. The nation by itself is using that as an icon to attract more investment and reinforces its confidence. So, it has something in a spiritual sense as well.

So basically, I answered the second half of your question. Furthermore, you are talking about the major drivers of these projects. I think most important is the financial status of the developers or even of the whole nation, because when being able to develop such a big building, you need funding or investment groups. So, their financial status needs to be stable and they have to gather together all their consultants. It is a huge deal and so that is why only large investment groups can afford all these buildings, if you want to make it great. Additionally, another major thing is the policy like the urban planning criteria or the regulations. For example, look at New York City. Since the end of the last decade, we have noticed an immense increase of these pencil towers. They are super slender and the form of the appearance of these towers is guided by the urban planning policy and the reinterpretation of the air rights, caused by "zoning lot merger" on quite small plots in the heart of Manhattan. According to my knowledge, the NYC Building Code changed recently, which has first increased and now controls the further development of pencil towers. It is understandably that developers want to generate as much sell-able space as possible. That is why, they end up almost always with rectangular towers trying to make them super-efficient. Well, it is not that efficient because of the footprint, but they definitely try their best.

CN: Ok, then let us go to the next question:

CN: The "three-dimensional city" concepts of the last century are highly controversial ideas, while modern "neighborhood in the sky" concepts are put into practice. What is your opinion of the contemporary situation?

HY: Can you briefly introduce me to the movement of the last century you are talking about?

CN: What I mean by that are the ideas of British landscape designers. They came up with the idea of the parallel city concept. The Russians put it into practice to establish kind of gated communities. Within a development everyone could see each other, but couldn't enter

other levels except the one they were actually living on. Of course, that's a problem and that is why it failed in Russia due to a closed society problem. What shall we pay attention to in order to guarantee certain future sustainability of layering access routes? I mean, Hong Kong for example was also designed by British landscape designers and planners, and they were successful.

HY: So, we are talking about management and security issues that caused the failure in Russia?

CN: Yes, simply interconnecting buildings on a second level with each other without equipping them with amenities or program is condemned to failure. Furthermore, probably it was too secure. What I mean by that is that the possibility of social interactivity was not given!

HY: Yeah, well let's try to make a comparison with China. Within the last two years, there is a new guideline from the government which is saying that closed gated communities for residence developments are no longer desirable. Now architects are trying to interpret it in different ways, because when looking at the present situation you see all the existing compounds. They have closed gates, to insure people's subjective demand of safety. The current trend is actually to think more about the urban context of the residential blocks to insure a better connection to its embedded surrounding. However, I think also the security problem is not disregarded by the government which is looking for a compromise and it looks quite good that this is a successful way for the future. Especially now, more and more skyscrapers have kind of gated communal areas like the sky lobby, sky garden. With present technology you can ensure exactly the safety. Facial ID and, in general, the artificial intelligence is helping to secure the building and the worries about crime and security issues are no longer given. I think, in general, the three-dimensional city is a positive development with all its problematic side effects. Still today, when people think about high-rise towers, they think of a very repetitive and restricted way of living and working environment. Let me tell you a story of the Shanghai CTBUH 2014 International Conference which I was visiting. It is a great opportunity to get together with consultants, structural engineers, architects, MEP consultants and all these specialists who are working on high-rise towers. In the closing speech, the lecturer asked everybody sitting there the question, "How many of you want to raise your child in a high-rise tower?" It was quite controversial that only a minority of these experts in this field raised their hands. I can just answer the result of this survey by supposing that most of them where thinking of more traditional towers which are really closed. You probably know the people living on your floor, but that's it. All the other floors are not accessible and especially within these skinny towers, the isolation problem doesn't get solved.

To sum it up, at the first glance onto your question when you were saying "controversial" I thought that is what you were talking about, but in my opinion, that is becoming less and less a problem because of the new elements like sky deck, sky garden. I think later on you

mention the landscape, because it's like you have to have an artificial landscape. Those two questions and the answers are highly connected with each other.
CN: Yes, I mention it in a following question. I kind of tried to split the development into the main parts; basement, ground, podium, podium deck, tower and tower roof.
HY: Yeah, yeah right. So, I think even the landscape is less of a problem. You have the plants on the different levels.
CN: The next question was actually specifically done for you, because you talked about Transbay Transit Center in San Francisco in your lecture at the Eco Community Urban Design Workshop 2017 in Hangzhou.
CN: Basement: Metro stations turn into complete transit centers. Can you make a suggestion of how the demands of (public) transport will change in the near future?
HY: Program wise and how the different public programs are linked together, the transit center is in contrast to the metro station not a mono-functional development. If you look at other programs like museum or library, they are becoming more and more blurry. The definition of the program is not strict anymore and the public demand inquires more variety and multi-functional public spaces. The transit center could become a shopping center or a museum, a gallery or even a library, a digital library maybe. Probably in the future you can work in the museum and it is not just an exhibition space anymore. The boundary of different programs and what is accepted in a museum is more and more open. If you go to the British Museum in London, it is more like a shopping mall with gift shops, cafes and there is a kid's program with a playing ground.
So, the public functionality will increase and will become more connected to the rest of the contents. That is actually the idea of that roof garden of Transbay Transit Center in San Francisco. It is working like a linkage of the surrounding towers and buildings to the transit center. You can imagine, during the lunch hour, the office people are going down to that roof garden and they can have their lunch in the garden. This wouldn't be possible without the transit center, because city gardening is quite rare in this area. The Highlight of this roof top was an amphitheater. It offers place for 1000 to 5000 people, so it is kind of a large number. Before this project the area was a ghost town in the evening, because all the people went home and the office towers went dark. There are very demonstrative movies of different performance and nighttime situations. But now, with more public functionality, it is always filled with people. You don't have that "dead town effect".
CN: Ground floor: By shifting the major pedestrian routes above and below the ground, what is the future of the ground floor and how can it be protected from being completely engrossed by infrastructure?
HY: Actually, I wrote a question mark, because I don't know why we should say it is protected, because it is not damaged by the infrastructure. If you are talking about super connected or interactive multi-layered public space, the ground floor will be blurry. Sometimes you will get into a building and then you will lose the feeling of where the ground

actually is, because sometimes you go into the elevator, there are like L and LG or G and it's rather defined by the program than the ground itself. For example, when you go to Chongqing you will notice the unique typology of the city. It is sitting on a mountain, which probably goes into the building or is part of it. The ground lobby is on the 10th floor and you go down to the so-called ground floor, but it is no longer the ground floor, because it could be B10 instead of 0. So, it is more about how to define where the ground floor is. That is why I didn't really answer this question, because I got a little confused.

CN: No worries. That is a critical answer and also very useful.

HY: Maybe I am too positive. I feel like infrastructure is a good thing as long you maintain and manage it well. The 00 floor is not something that we have to have or even need to protect. Once you are within that zone, you don't know where the ground floor is.

For example, when we think of the Transbay Transit Center we just talked about, you could also argue that.

If infrastructure and traffic are becoming more and more, they are going to expand the multi-layered public space. Let's say in 50 years, they feel like this is a great idea. So, the whole zone of that district will be filled with this roof gardens and linkages, like Highline. They even expanded it two times and in 2014 the city inaugurated the third section.

Then you know for the office tower, the office people, they probably think that the roof garden is the ground level, because it has vegetation and it is super connected to everywhere else. Then maybe the real ground floor will become a basement. I think, the one major quality we really need to focus on its ground floor illumination and the question "How do you get into the zone?" when the little transit zone is lifted above ground floor. Imagine you are building something giant on this one block then the ground floor is usually very dark and a subjective comfortable feeling can't be achieved, because it is isolated from the rest of the city. But if the entire city is adopting the same idea, like in 50, 100 years, then I don't think it's a problem. For the current status, I think the lighting and ventilation are the crucial points. That's why in Transbay Transit Center, they have these "lighting columns" to have the natural light going to the ground floor.

CN: Podium: Mixed-use tower clusters almost always rest on a shared podium. What are the future potentials of this part?

HY: The current projects we are doing deal with a lot of different kinds of program, because the tower is usually a mixed-use development. For example, the Ningbo Tower (published on Pinterest) was a project I was working on. The lower section, is an office part and above we have the service apartment and then the hotel. So, it is really a mixed-used tower. The podium usually is the retail part with a shopping mall. Actually, nowadays they turn into food course and are filled with restaurants. During lunch hour, the people working in the connected towers are floating down into the podium, have their lunch and go up again. A lot of the restaurant functionality can survive there and get supported by other functionality like the hotel. The hotel industry usually puts the banquet there, like for wedding and you know

like today's presentation (Conceptual Architecture and Landscape Design on the International Zone of 2022 Asian Game Athlete Village, Hangzhou). As we are talking about the supporting functionality, we should also think of the MEP, the cooling tower, all the mechanical stuff, which are usually put on the top of the podium. That's the current status. Like, if we are talking about what is happening in China at the moment. More and more often, they also have something like a big theater on the rooftop, for instance an imax or cinema, indoor or outdoor and sometimes for the amenities for the hotel, they put the gym. I think in the last project, they were saying they want to have a Jacuzzi on the top.

CN: Kind of a clubhouse scenario.

HY: Yea! I think you were as well asking what are the future potentials of this part? It doesn't really fit your question but might be helpful as well to think about. What you have to pay attention to is that China has a quite different fire code compared to the United States. Recently the regulation affecting the schema of towers sitting on top of a podium was changed. Now a certain amount of the facade has to come all the way down to the ground floor to enable the fire ambulance to have the facade to lay on their ladder. Maybe it is a very China thing, but on the other hand, as an architect, we also hope that the building can meet the ground by itself as much as possible, because it is a landmark quality. Especially, when looking from the distance. If this building is resting on top of something, you can really feel this striking image. It is just for aesthetic of the design, but when you have this facade as one undisturbed vertical motion, it has a high potential of becoming a really handsome tower. Actually, I just finished a competition project in Chengdu. It was 677 m. But then they cut it down to 610m, but still, it's above 600m. It's amazing and the developer is really experienced. They actually demand that the tower is isolated from everything. Therefore, the podium is not attached to it, but they connect it underground, like B1. They achieved a landmark quality recognizable from 360 degrees. You never see a landmark sitting on top of something. Like Petronas Twin Towers or Shanghai Tower. They are always having a certain percentage of the front facade exposure to the outside. This is more technical stuff related to tower design.

CN: Podium Deck: The majority of Asian cities have an open space and greening problem. What potentials do these places have to become an area-wide artificial landscape within the city?

HY: Are you talking about Transbay Transit Center again?

CN: My thesis project later on will be located in Central Green Space next to the Triple Towers. For the government and involved urban planners it is very important to integrate the public as much as possible. While today this green island is today lacking accessibility and almost total isolation because of heavy traffic surrounding it. I am looking for ideas how to improve the current situation.

HY: Sure! Triple Tower, you mean there are three towers?

CN: With Triple Towers I mean the Shanghai Tower, the Shanghai Finance Center and the

Jin Mao Tower standing very present next to the site.
HY: Ahh I see! Well I think, I wrote here just two words: walkable, accessible. One thing about the Shanghai Triple Towers, the whole zone Lujiazui, is that because high towers need to have a certain distance to each other, you cannot have them really close to each other. In many cases, they just leave in between space empty and built all these very wide roads to meet the demands of the infrastructure. By doing that, the blocks get cut off from the rest of the city. As a pedestrian, it seems really far to get from any point inside the lot to the other side. So, most people get to all these towers via underground, like the subway.
It has to be accessible and also the distance on a walkable scale. Think of going on summer days uncovered 1000 meters just to walk around, which is highly unlikely because of the climate. I see a big scale issue. If the distances between the different activities get smaller by adding certain attractions, I see some hope. Just offering a green park is not enough.
CN: Is there a limit? Because for instance, Beijing Yintai Center, they almost rebuilt a historical Chinese village on top.
HY: On the top of the podium?
CN: Yes. Or would you say, do you see a problem with a kind of “Disneyfication”
HY: Well, I think, without judgment, you can basically build everything on it that is accepted by the community, because it is a public space. You can put it into all kinds of usage. And there is another issue whether you judge it. Traditional architecture should have its own contexts, which is not isolated from the rest of the world. If you lift it up you are doing exactly that.
When you think function wise and very objectively about what it can be, it can be everything, but it has to be accessible, otherwise nobody is going to go there. It was the same issue, when we were working on a competition of the West Station in Hangzhou. Our idea was to bury the tracks into the ground. This way, we avoid the usually caused problem. When you look at the map, the railway tracks and the station cause a separation of the city into two parts. It works kind of like the sides of a river bank. That is exactly the reason why not so many people use the great park in front of the East Station in Hangzhou. There is a huge plaza in front of the station, but it is been isolated by the railway tracks from the rest of the world. In fact, they have a really nice park, but nobody is going there. Think of parking the car next to the station and then being completely exposed to everything without any kind of shelter or program, just green.
CN: Public Space in the Sky: Linkage strategies of different public space levels, which are really far away from the ground, remain a major weakness. How can these public spaces be further integrated in our everyday routes?
HY: Can you please further specify this question.
CN: For instance, the Petronas Towers. Why do they have this connection in the middle? Of course, it is a skydeck and a tourist attraction but it also serves as a backup in the evacuation plan for vital terrorist attacks destroying major parts of the structure, as long as

just one tower is in an unsafe condition. So, each tower has its staircases going all the way down to the bottom and additionally are sharing them in the part below the skybridge.
HY: This possibility of using the skybridge as emergency exit of the endangered got rejected after the 9/11 incident. They tested the unlikely case of each tower being attacked by an airplane and they decided that it is better to evacuate them separately and not making it more complicated and riskier.
But in Malaysia they probably have a different fire code than China. The Chinese regulations refer in the stair case calculation to the square meters of each floor. Once you exceed the allowed square meters you have to fit another set of staircases, fire elevator and MEP into the core. When making the floor plan bigger is necessary due to any reason, it is important to maximize the floor area to use the full possible capacity to make the tower efficient.
To come back to your main question, I think it is more an elevator issue you are talking about?
CN: Yea! I was probably talking about, what could be an existing solution or is there something we can use to solve the linkage problem?
HY: Maybe I'm not answering the question, but usually the diagram is that bellow 24 meter of a tower or the first 5 to 6 floors, depending on how high each of the floors are is, are used for public functionality. For example, the first two floors have a clear height, because you have to have a grand entrance situation. Sometimes, the linked podium is a conference room or a banquet and other amenities. To meet the demands of the fire regulations, usually the 4th or the 5th floor is MEP. In China every 15 meters you have to have a refugee floor and they need have a certain square meter area and other requirement. In practice, the refugee room gets combined with the necessary MEP floor area to maximize the efficiency of the tower.
So, the bottom part is all public and in a super tall tower sky lobbies are inserted. In my experience, double decker elevators are state of the art. Therefore, two floors at the bottom are necessary as entrance lobby. While the upper floor is supporting the even numbers of floors, the lower floor is supporting the uneven numbers. Additionally, high-speed shuttle elevators are bringing the people just to the sky lobbies where they have to change to an elevator supporting local floors. If you really think about it, at least all these connecting levels of a tower are public. Currently the system is tried to be further improved, so let's see what comes next.

CN: Public Space in the Sky: The two signature developments, Marina Bay Sands (Singapore) and Shanghai Tower (China), both provide a number of public space layers. What are, in your opinion, the strengths and weaknesses of these two different understandings of public space?

HY: I think you are talking about two different kinds of atmospheres when talking about "two different understandings". So, I drew that little diagram: (diagram). In Marina Bay Sands, the public is mainly restricted to go through a set of connected atriums. When leaving the individual hotel room, you can look down onto the people passing through this canyon. Either

way you have a view to the inside.
When you are in that atrium, all what you see are these layers of the upper floors. It can be compared to the Jin Mao Tower atrium. In contrast, in the Shanghai Tower the three corners that are winding up the tower are used as the atriums. In that sense, you have a view to the outside.
One of the beauties of building such skyscrapers is that you can go higher and you look further. That is the handsome part of doing a high-rise tower, because you are feeling like you are above the world. But if you cannot look outside, you can't really take advantage of the tower typology. So, I think to compare it, the positive thing of Marina Bay Sands is maybe the aesthetic quality of the ground lobby. But it is not really usable, because you can just sit there and appreciate how grand the building's atrium is. The negative part is the lack of views to the outside and the efficiency of each floor is also quite less. When you calculate the efficiency of the tower, the usable area gets divided by the overall area of the tower. In that sense the volume is big, but then the usable area is drastically reduced. The efficiency is compromised. Personally, every time I go to such a tower, like the Jin Mao Tower, I worry about sitting in the hotel atrium, having a coffee and someone drops something from the upper floors. In terms of the safety issue, also the problem of fire remains. However, recently this year the Chinese fire code changed and has more strict regulations in terms of material use, height of the atrium and the floors above are no longer allowed to be visually connected to the central void. This new regulation is instantly killing everything that plays with the idea of having a big atrium inside a tower because it doesn't make any sense anymore.
CN: What about the Shanghai Tower?
HY: The Shanghai Tower and its concept has of course some positive things. There are by far more views to the outside and they are placed prominent in the three corners (diagram). The entire tower is also segmented into several sections. Marina Bay Sands has one big atrium, but the Shanghai Tower has a number of atriums along the entire tower. The actually negative point is that in reality, when standing inside this sky gardens and especially when looking out of a regular floor, the view is quite compromised by the huge amount of structure supporting the outer curtain facade. If you have seen the pictures of it, there are millions of trusses.
CN: I already had the possibility to get inside and go to one of the sky gardens. Beside what you already mentioned, I noticed, that it was super-hot inside!
HY: Well, they are foregrounding the sustainability and saying that the hot air is going up, while cold air is coming down. I heard that this concept turned out to have some weaknesses. However, beside the problem of looking out of the regular floors, also the Shanghai Tower, due to its atriums, is facing fire code, efficiency and in total sustainability issues. It seems like once you decide to work with atriums you have to compromise.
CN: Rooftop: Previously, the top of a major high-rise development was mainly occupied by facilities for tourism. What are the duties of this part of the skyscraper in

the future?

CN: This is a question related more about design. John Nouvel puts a hemisphere on top of the skyscraper, others, like the Shanghai Tower, keep the top flat with its efficiency platform. What is your opinion and what is important to consider for a sustainable and intelligent tower design?

HY: Well, one thing I have to point out when thinking of a high-rise tower, which is intended to become a landmark is the aesthetic question of how to touch the ground and how to meet the sky.

You are talking about how you meet the sky. The traditional tower design encompasses MEP area, antenna, chilling and cooling towers on top. These facilities require 8 meters of clear height. Nowadays with the modern technology and the project can also rely on a good structural engineer, you don't even need a dumper which would be a quite negative point. When you need dumpers due to structural issues, you have to integrate a separate deck just for the dumpers.

It's a waste of space and also aesthetically you can't really use it, because it's enclosed. Nowadays, due to fire regulations, a tower also requires a helipad on the top.

It's a completely different method than the conventional one, which would not work anymore, because of the immense height of the building. So, they separate the tower in smaller sections and in case of an emergency they want the people to go to the refugee floors. A person in the upper part should be rescued by going to the roof and helicopters are evacuating the people. In my opinion, to be honest, this is too beautiful to work out in reality, because you would need a lot of helicopters to make this idea work.

Additionally, it is more like a trend nowadays, to give the top of the building a public function, like galleries and other typologies that are more than just an observation deck. In my opinion that's actually reinforcing the duty of an iconic tower. It is not just an image for the area, but you also serve the community by getting an address within the surrounding area.

CN: Publicness: Already today public space is not always public to everyone, but restricted to closed societies. How can certain strategies ensure a balance of social stratification within multidimensional tower clusters?

CN: So, also in the Shanghai Tower, these sky gardens are not really public in fact.

HY: Well, it's how we define the term public space. Are you talking about an observation deck or a roof bar, because when you pay you could go there.

CN: I am not talking about these areas that are meant to refund the tower floors, but the idea of the sky garden. These places are just available to the people actually living or working in this complex, but as a tourist or visitor.

One example would be the Jin Mao Tower because it is kind of tolerated going to the sky lobby of the hotel and appreciate the inner atrium. It's even possible to take the elevator and enjoy the atrium looking down from above, without paying anything.

HY: I think every developer hearing of this idea would worry about a security issue. If you are

intending to integrate public functionality into the building, it is very important to explain the developer how he can actually benefit from additional values by bringing people to the upper floors. This can be done by integrating galleries, cocktail parties, wedding, banquet and in best case these areas are easy to adapt for other usage. When dealing with different user groups, you have entrance lobbies with elevators designated to stop at specific local floors. The user can get to this lobby by swiping a card or use face-id. In fact, it's a management that can be solved with the upcoming trend of implementing virtual intelligence into our buildings. You can design your core in the way that only the local floors are accessible and the general public cannot enter the office floors. For example, from the perspective of a developer, during the weekend I cannot make money with most of the towers area, because the offices are shut down. If I include public functionality, there will be meet and greets, events and other social activities that can generate money by utilizing this temporary unused space.

To sum it up, future projects of this kind demand to have an easy access, an efficient management strategy and the security issue needs to be resolved.

The previous tower project of 610 meters of height I mentioned before is meant to be a vertical city. A building that is really serving the community and is a true landmark tower. The developer themselves should have their vision and also humbleness to pay so much tribute to the society.

CN: The human scale defines the evolution of our cities and buildings. The high-rise building gives the city its volume, but how can tower clusters meet the needs of humanity?

HY: What is your definition of the term "needs for humanity"?

CN: Do we need high-rise towers? Kind of, how can we look into the future, how the people want to live and work together?

HY: Oh, let me quote my boss Mr. Cesar Pelli. He has a very famous one saying, "The desire to reach for the sky runs very deep in the human psyche". Every nation will try to build higher and outperform other skyscrapers. That's also a big achievement of humanity.

But having said that I don't think that it is a necessary need of humanity to build high. I thought you were talking about human needs, meaning more communication and intermittent space?

CN: Yea, there is a change in our urban fabric when considering the tower as part of it and not just placed object.

HY: I would try to answer your question in that way, landscape and places for recreation are tried to be thought as part of the tower with this sky gardens.

But as I already said before answering your very first question, the high-rise tower is mostly driven by the economy of the society and for my interpretation less by the human scale.

CN: The sky is the limit: Can you outline your vision of the concept of layered public space at the end of this century?

HY: I wrote a lot of stuff to that question. I think it is a very good question, because it really opens up your mind to different kinds of stuff. I am in practice and therefore very realistic with the vertical city concept.
Basically, the general idea is very positive and if you go into the details, as an architect, I think we should push the utilization of a hybrid program even further. The boundary between different public programs is less of an issue. Related to that we should think of real multi-functional space. It is like your smart phone. It is just a phone, but with the app stores, you can add in any kind of function you want. It can be a camera, a mp3 player, a recorder, it can text messages, and basically, it is “one plus one bigger than two” idea. In the future, also buildings should have more visual or sensational connection achieved with the help of new technologies, like AR and VR. For instance, the hololenses developed by Microsoft. By wearing this kind of glasses, you are no longer restricted to your location, height or even the area of the space, because you can be everywhere you want. Let’s have better usage for the space. I tried it in New York and it is amazing. The experience blew my mind. It will change your life, you should go there and try it yourself. The hololenses is not really a virtual reality device, because it integrates the reality as well. if you see a black wall, it’s still there, but with these glasses, but with a gesture, you can open a screen and you can click on it. The demonstration video shows someone walking into a room and there is a big globe, that can be manipulated within a real room.
To use it in our buildings, for example, looking out of the window, we see the city. When I want to look inside that building, I just execute a certain hand movement and the building will become bigger and I can even turn on the x-ray mode to look what is happening inside. Something like this, it is truly crazy!
So, by taking the advantages of your being able to look inside and outside, it opens up completely new possibilities that are actually unique to the high-rise tower. Virtual reality can be experienced on your couch at home, it doesn’t matter. But I think using augmented reality in our buildings opens up millions of possibilities. It is also by far more flexible and you can change things with a software update.
Another problem is fast and easy access. The spine is a crucial part of the circulation of a tower. It is pretty much about elevators and MEP related shafts. In the future, I think it is already a reality, horizontal escalator is becoming a common solution. This can totally change the form of a building. If there is a smooth transition between vertical and horizontal movement, we totally change the way how we circulate and enter the building. New structural engineering solutions are also pushing the bar to new levels. Maybe there will be other forms than these needle towers that are kind of a trend at the moment.
A big upcoming topic is destination control with the way how we secure our buildings. Access cards are almost out of that and constantly replaced by face-id systems. All these systems are a big investment at the beginning phase but pay of in the long run and make it a truly sustainable building.

Almost all projects are talking about wellness. That is standard in LEED, which is an overused term, but it helps to focus on how to make the building greener and offers arguments why to integrate landscape into our buildings. LEED tries to measure how people feel inside the space.
CN: Thank you very much for your time.

11.3 2nd Interview with Garett Wang

date: 2018 – 08 – 27
location: UNStudio Office 43-55 Wyndham Street, Central, Hong Kong

CN: Probably we should start with a brief introduction about your undergraduate and graduate school education and some background about your work experience in this field.

GH: Sure! I actually went to Brown University, my undergraduate University and I studied more Computer Science and Visual Arts and after that I worked for a few years actually doing more business development and marketing for an architectural office. After that experience, I decided I want to study Architecture. I shifted my major to architecture and went to graduate school at MIT and I got my Masters of Architecture from there. After I graduated, I joined my friend's start-up and we did, kind of a multi-disciplinary design office, which was more working on the kind of the customizing computational programs for offices and doing digital fabrication. We had 3d printers, laser cutters and we were doing also prototyping. We were developing a pattern for a medical device. So, I did that for a few years and then I actually moved to Shanghai and joined UNStudio and I have been working here

for 7+years. That's my history!

CN: That's a really diversified background, combining many advantages from different subjects!

GH: Well, a lot of architects start right after high school and they go into architecture, but I came from a very technical background, the programming background and put art into it. It helped later on what I would have never expected because Computer Science is part of any architectural field.

CN: Let's start with the first question:

CN: Your office is well known for large mixed-use developments including high-rise buildings. What do you see as the major drivers of these projects and how can the general public benefit from them?

GH: We do a lot of large-scale developments. But I think the UNStudio approach is very much based on a programmatic diagram. Our concepts are very intertwined with an aesthetic concept, with circulation and programmatic ideas. I think that when we do these large developments, our intent is the same with a residential project or any other kind of project, which is to kind of serve the functions of the project. You can see a diagram of any user group. First, you set up your user groups. If it is a family, you have four residence let's say. If it's a mixed-use development, you think as well about the different users, if you have residential, commercial, retail and people who work there. It is about making sure that the development really serves each of those groups and helps to activate the site and it helps to activate then its urban condition. I think for us as architects, it is about scale. In the same way it is allowing the same functionality and being able to resolve the same issues not just of a giant tower. I think, it also allows us to be involved in defining a skyline, really activating or helping as a catalyst for a new business district. This is what Raffles City in Hangzhou was all about. When we started that project, there weren't many buildings in the Hangzhou CBD and we finished, when there were tons around. But the project stands actually quite unique by itself. I think it's so different in shape and approach.

CN: The "three-dimensional city" concepts of the last century are highly controversial ideas, while modern "neighborhood in the sky" concepts are put into practice. What is your opinion of the contemporary situation?

GH: From my personal experience and from my projects I worked on, I may think one is always density and space. The reason why Hong Kong has to keep pushing up is, because

there is literally no more room to spread horizontally. So, it is really a response to the urban condition and I think places that have big space, there is not such a need. The early pioneers of England and Russia were thinking of the future and I think in Asia it is always a good reference. You have Tokyo with the early Metabolists, they also brought these ideas of kind of vertical cities. I think for us, what we are all responding to that condition, that's what I think we have done it a few times, but in more or less small-scale, with for instance, projects like our Citic Shanghai project. We did a very small-scale version of flipping the commercial street vertically until markets are coming up the void. Which provides kind of a retail situation. Right now, it seems like there are not many academics who are thinking of this. You have of course Steven Hall, his project is flipped, but I think most architects are using this as a solution from a non-academic standing point. There is a problem they are trying to resolve. I think in Asia, Shanghai and the other cities, when we are talking about over 20 million people living in a city, you have no space, you have to go vertically. I think that's an interesting idea. I don't think it will always work the same way. Hong Kong is kind of unique, in Shanghai you still cannot mix commercial program vertically. They are still not used to it, not like Hong Kong, where you have these pencil towers and you have one shop per floor and everyone is used to go to these RD&E restaurants with a single lift going up. It doesn't necessarily work as well as here, but there is this idea that you can stack. You can have hotels in the sky, the highest hotel right now in Shanghai is the Shanghai Tower and starts from the 86th floor up. I think in western cities people are quite excited when you have parking on top of retail, but here in Asia stacking it that way is common.

CN: From my experience so far, especially here in Hong Kong, the envelope helps the whole city to really articulate this urban strategy. Shanghai is flat.

GH: Think of the German expressionists, where you had all the walkways and the trains flying through the sky and other ideas like this. Hong Kong likes that, because they like having walkways connecting every building and up there is creating this other layer. You have escalators going up hills. Everything is kind of developing this way and it has become the next big element of this solution.

CN: Basement: Metro stations turn into complete transit centers. Can you make a suggestion of how the demands of (public) transport will change in the near future?

GH: Everything gets more and more complicated, but you still have these nodes, the transit centers, where all kind of transportation is going through. You have too many means of transportation. I think, Hong Kong is great, because here it is all about logistics and efficiency. Everything is intentionally grouped together underground and their intention is to make everything connected. A ferry is connected next to a mall and connected to your metro

station. Then it also connects to your high-speed rail that brings you to the airport. I don't know about the future, I am wondering if this gets more and more complicated. I think, maybe it is possible I mean you hear about lifestyle, everything is defined by lifestyle. If you see the evolution of retail and lifestyle, it is no longer about shopping, it is about living while you are experiencing retail.

I think the same thing is happening with transit centers. They are no longer just about traveling anymore. It is about taking care of all your needs. For instance, Amsterdam has a supermarket in its airport. I mean when you come back from the train station or coming back from work or the airport, on your way home you can't just stop at the supermarket closest to your place where you live, because at the time you got home it is probably closed. So, you go to the supermarket at the airport and then you bring it home. In my opinion, in terms of transport I don't think that transport can always bring the different user groups more together, but I think it is a fact that you have actually more lifestyle elements tied together with your transport centers.

CN: Ground floor: By shifting the major pedestrian routes above and below the ground, what is the future of the ground floor and how can it be protected from being completely engrossed by infrastructure?

GH: It's quite controversial that the majority of planners try to push the entire infrastructure up or down. They try to retain the ground floor. At the moment the priority on the ground floor is given to the vehicles. The train stations and the subway system are already in general located off ground. As I was mentioning, here in Hong Kong we have bridges everywhere, because it rains so much. We have created another elevated plane of the ground.

Everything is actually shifting up and down. I think that is kind of reason, why it became almost like a trend to shift up and down the pedestrian roots as well. I think the ground floor in a way has also a lot of potential to become more pedestrian again. Think of Times Square, where they removed all cars. As a pedestrian you can actually walk in the middle of the street. I think that they are trying to bring back this kind of pedestrian qualities into the cities and try to push the infrastructure up and down. That is why we refer to our west cultural pedestrian districts. Look at Foster's Masterplan for Hong Kong, where we are doing our theatre project right now. Foster's plan actually pushed all the vehicles below the ground to retain this ground plane of pedestrian walkways. It has created a total edict for designing the project.

CN: How difficult is it actually, technically, to go in the underground, because a lot of land in Hong Kong is artificial?

GH: That is the problem. The entire district is actually on the beach, it is on the claimed soil. So, the soil is not rigged. You have a high-speed rail, which is extremely problematic, because Foster created this continuous basement. All the buildings are connected to the basement You have to bring the cars down, but there is very little space, especially in combination with the other utilities in the basement. For our theater, which is a cultural project, you then also have the loading in the basement. That means that usually for a theatre project, the theatre stage is always on the same level as the loading bay, which then consequently forces the theaters to go underground. It messed up a lot of things. This results in our project in a stage that is 12 meters below. The reason why they keep this entire ground clear is, that they are going to establish some kind of EVA vehicles and self-driving buses that go up and down.

CN: Podium: Mixed-use tower clusters almost always rest on a shared podium. What are the future potentials of this part?

CN: Do we always need a podium?

GH: I think this is kind of breaking apart the whole thing. The podium is mostly retail or F&B. I think it has to do more with the future of what shopping malls are going to be, because you see it actually already, not just here in Hong Kong, but also in Singapore. Places that have warmer climate in general. You have to group commercial on the ground and make it really accessible. But nowadays what they are doing at least is, that podiums are no longer giant blocks, kind of black boxes you enter and you are kind of caught. They are actually becoming a network of little podiums. You see it in Japan, they have it too. For instance, the Canyon Project, still podiums, but they cut it across, which is also visually very strong. So, I kind of feel that the podium will always exist, but it will be able to become smaller volumes that allow people to experience more of the neighborhood quality. You see that a lot in Asian projects. I think in the States the podium doesn't exist this much, you don't have these big mega-projects. It is really more an Asian problem, solved with a truly Asian approach.

CN: It can be seen as kind of a further development of the skyscrapers of Chicago or New York?

GH: Yea, but they have podium of a tower too, but you don't get as many of these giant podiums that have multiple towers off of them and connecting them. They rarely have these really huge developments. The towers are usually separate and allow certain transit situations between them. You have sunken malls and other transitional spaces. For instance, Calatrava's World Trade Center with the transit center including a mall. There the towers are

also kind of split off. Americans don't have this big podium culture, it is less and less.

CN: Podium Deck: The majority of Asian cities have an open space and greening problem. What potentials do these places have to become an area-wide artificial landscape within the city?

GH: I don't know how often they are used to be honest. In Singapore, they have been quite a few projects that use it quite well. What they are good at is that they tie it together with F&B. You have restaurants and an open deck where people can walk around. These kinds of situations are possible. When you think of the Vanke office in Shenzhen, where there is all green and the whole building is sunken down. I think this kind of artificial greens are quite deductive and people are going to use them, but it also depends on where it is. For instance, in Hangzhou very few people go outside. When it has 40 degrees Celsius outside you are not going to be on the roof. Asians do have the idea and mentality of the garden, but I still feel the artificial ones only work when they are mixed with commercial and F&B elements. Going up there and just sit doesn't really happen. Usually nobody goes through a mall of 6 floors to go to a green. If you go to a restaurant and it has outdoor siting and people can be outside, that is a different situation.

CN: Other interventions are these huge parks at the waterfront, where the usability is also questionable. When it is kind of a tourist attraction like the Bund in Shanghai, then it has some potential.

GH: Right, for instance, when you go further south in Shanghai, where the old train lines are, there is South Bund and that is actually very successful. But they don't really have an artificial landscape, because they are on the ground. So, it is actually a landscape. They installed a continuing bike path and some additional amenities. Those kind of developments are very successful, but the Bund is definitely just a tourist area.

CN: The Yintai Center in Beijing offers kind of a mock-up of a cultural heritage village. Do you think this is causing a kind of Disney Land effect or is it one possibility to retain a certain kind of cultural awareness?

GH: It is hard. China destroyed so much of its historic projects. When a development is established, it is all about growth, industry and money. Once they have the money, they lost everything cultural because they knocked everything down and they didn't preserve anything. They try to recreate it and often it comes across very artificial. But I think it is a historic preservation issue around the world. It's very clear.

When you look at the preservation strategies how Italy versus Austria deals with historic preservation. You can see a very strong difference and the different strategies are very interesting to me. Italy is kind of keeping it and allowing it to fall apart. You live in a ruin, like a big mass with cracks. It is supposed to look at it, but you cannot touch it. Every culture has its way to deal with heritage preservation. I think here in China they just overkill it a bit. It is like going to the Forbidden City in Beijing. It feels like Disney Land, because everything is optimized for tourist attraction with these bright colors and nothing feels authentic.

CN: Public Space in the Sky: Linkage strategies of different public space levels, which are really far away from the ground, remain a major weakness. How can these public spaces be further integrated in our everyday routes?

GH: Well, I think it comes down to, how you get there. When your ground plane is always your reference point, you rarely are higher or lower or almost never going up. I think that's the problem. It is about connectivity of the public. You are not going there just arbitrarily. If you have transits that are elevated, it gives you a reason why you are up there in the first place and the people are already used to this system. In Hong Kong, to get to the bus station, you need to cross the street. If a city always has all the crosses on the main road then everything is interfering it. If you go up and you stay on this upper level, then once accessed that level you can stay on it and is your new reference point now. This is also connected to your question about ground planes. So, when you create artificial ground planes, then you can create public situations in the sky. It is about the draw and the reason why you are there. I mean that is the basic point.

CN: When we look at the shift of the whole program, the amenities and also the reasons why people spend their time outside, are vertically stacked. Is there a solution for the connectivity issue to solve this major problem of the vertical city concept?

GH: When talking about the vertical city concept, it is basically a residential mixed-use development. The reason why Hong Kong people are almost always trying to be outside is because essentially their houses are so small. Food is also cheap so you don't cook at home. But mixed-use developments, consisting out of multiple towers and connecting bridges generate and stack program and help to generate space. If you are already in the sky, you live up there, instead of having to go down all the way to the podium to the ground floor. Instead, you go to your club house level which is probably just half way of your tower and much closer. It is about proximity.

When a hotel lobby is at the seventieth floor, you start to pull people up by having your amenities there. First, you have to get your interfaces dispersed vertically to create

connectivity points with amenities. In the future, for instance, the new interface between hotel and commercial project is no longer on the ground plane, it is actually in the sky.

CN: Public Space in the Sky: The two signature developments, Marina Bay Sands (Singapore) and Shanghai Tower (China), both provide a number of public space layers. What are, in your opinion, the strengths and weaknesses of these two different understandings of public space?

GH: Well it comes down to what you are defining as public space layers. When you look at the two projects very soberly, we can break them down to a little number of crucial elements. The Shanghai Tower has the observation deck, viewing decks as sky gardens and the podium bellow. A big problem remains the double facade, which acts as a green house and deals with overheating. In this sense I doubt that the double facades qualities could be fully used for benefiting the building. In contrast, besides having a bar, a swimming pool and this amazing look, Marina Bay Sands is technically a hotel.
In Asian projects, everything is about the very top. You can provide views, an observation deck and restaurants. The 'cool'-factor is up there. In Kuala Lumpur they have quite a few projects like that too. It is kind of a trend having a clubhouse and an infinity pool on the roof nowadays. I feel like it is not pushing the idea of the public layered space enough. The public is still just in the podium and on top of the tower. Current project, mainly hotels like in the ICC in Hong Kong, the restaurants are tied to the hotel lobby on several floors and you lose the sense of actually what type of program you are passing. It causes kind of a disorientation in terms of public layers, because of the different floors. You don't know where you are anymore in this tower, but you are so high up it's kind of irrelevant. So, I kind of feel we should be able to go further, because the thing we do right now, the layers that we have, they are still the same thing in my opinion.

It's always about accessibility and knowing about it. That is the problem with these layers, but the change of our hierarchy and change of the stacking of program allows us to get a little bit more interesting now to what public layers are. Public layers can certainly become interfaces between the stacking of different programs. We should not just rely on the top of a tower and the roof of the podium. Of course, you have limitations like transportation. It just feels disconnected whenever you are in the mall and you have to go up an escalator. It is something very simple and stupid, but that is why retail is there. They always want you to have a visual connection between vertical connection. They don't want you to break your sense of shopping and that is the problem with vertical spaces in the sky.

CN: Rooftop: Previously, the top of a major high-rise development was mainly occupied by facilities for tourism. What are the duties of this part of the skyscraper in

the future?

GH: For instance, the KL Tower, the viewing deck is mostly a tourist destination, but they also use it for sky diving. They have an annual skydiving event and they also use it as an astronomy observation deck to verify locations of planets. It is also used as a communication tower, for the signal for the city. It is a very interesting building, this tower, because of its height above the rest of the city, it is used for a number of different things. I don't know about the future, I find it kind of quirky.
Certain concepts try to establish new forms of skyline tourism. In Stockholm tourist groups can experience the historic city center from above. They have set fall wires all the way from roof to roof and then all the tourists hook up to it at different places. I feel like that is one thing that might come out of the roof tops. In Singapore projects there are all club houses on the top. It's not used for tourism it's used for amenities to give a better quality to the people who are living there.

CN: Publicness: Already today public space is not always public to everyone, but restricted to closed societies. How can certain strategies ensure a balance of social stratification within multidimensional tower clusters?

GH: That's a bigger issue. One is of course the definition of what public space is. What it is and where it is serving. It is about accessibility. For example, we are talking about amenities where it is fully pubic, so it is not controlled. Then it is about how you get there. Even if we don't have all the answers for these questions today, in the past we already solved questions of comparable scope. In New York City, there were public beaches and they were primarily white people during the 60s and 70s and they actually achieved that by preventing buses from reaching the beach. The only people who could go there where the people who could afford to come by car. Immediately you cut out the lower economic bracket. It actually cleared the beach from having any minorities. These kinds of public zones, where you have to go through another program, constitute a situation where certain people get filtered out. This is important to understand social consciousness of the instinctive operating public. The same mechanism can be seen also here in Hong Kong in the very high-end malls. Most local people feel pretty comfortable about going through malls, but when it is actually extremely high end and your public spaces have to go through this mall people who don't shop there not necessary are going to go there. It is about social acceptance of mixing. Maybe that is the way, allowing access that might not be so tight with class orientated program. In this case retail doesn't make any sense. Public access and connectivity, I think those are the bigger wrongs. The problem is that society self-segregates. That happens naturally and that is the issue. Especially here in Hong Kong, people draw a lot of class lines. You don't see them, but they are very present and you feel them. It is getting around to understand kind of where

different groups hang out and how they behave to kind of integrate.

CN: The human scale defines the evolution of our cities and buildings. The high-rise building gives the city its volume, but how can tower clusters meet the needs of humanity?

GH: When we were talking about the podium before, that's the reason why podiums are breaking up, right. I mean, in the United States malls are kind of disappearing, because people prefer this small town, small shop frontage kind of feeling. Reference examples like in Los Angeles basically work like an outdoor mall podium, but essentially it looks like more individual shops. I think, the podiums here in Asia also want to have this small scale as well. You start seeing it already. Instead of one giant box for a retail podium you start having break up the facade to reflect each of the shops that are along the inside. They start to reorient the retail shops to the exterior, supposed to having the entry in one building and all your shops are in the inside. It doesn't read as one podium of a giant scale. I think they also do that with towers. That is the reason, why you don't have these mega towers that often anymore. When you have individual towers, it helps also with the zoning and green percentages. Smaller clusters are put around, to kind of break the scale. It is still one big development, but you can have a relationship with where you are living and the feeling of a personal environment.
In the past, we tried to break up the facade so people can actually identify also from the outside on which floor they actually life. But I think it's always a problem. I mean the bigger you go, the smaller we have to go too, but the user never changes size. You are serving the masses or the individual, but I think, it is also kind of self-balancing it. If we go too big, then people are breaking it down by themselves, because they feel they need to. You feel very lost.

CN: The sky is the limit: Can you outline your vision of the concept of layered public space at the end of this century?

GH: That is a long way to go, right. I am wondering how public space will evolve. I personally think that, because of the space we have, we are taking the idea of the ground plane and shifting them and stacking them in the sense … it's very funny, because it's very much an artificial green or landscape you can call it. We will be blurring the definition of inhabited space, where we will live and work even further and the functions that we need are getting intertwined to a complex inhabited space.
I am wondering if the public parks also can intertwine with the program and become a more important part of living, working. It happens a lot in Europe and the States. So, you have these public parks and then they become kind of a merged piece of these clusters. So, maybe you layer with the program layering. Each of our main amenities,

commercial/office/residential, require green. So, we should make sure that we are not running out of green by increasing the importance inside developments and rise the efficiency. People already started to value green more and with this awareness comes the personal will to obtain it for themselves. Maybe offices will have their own green courtyard or you know each of the restaurants. Maybe public space and green are not treated as a separate entity. It needs to be treated as part of your layering system too. So maybe there is a floor just green and it happens in towers. You have seen these competitions where you have a floating green element like the tower in Vietnam of Ole Shereen.

I think layered public space doesn't need to be vertical either, but layered public space on the ground floor. You know the idea of layering not literally, but defining different qualities of public space and how they merge. The definition of layered qualities and how you access different public areas could change as well. We were talking about accessibility, which I think will happen naturally on its own. Even if it is one green these different functions of the public then will dictate kind of how they are intertwining themselves. I think that will be also very interesting and will happen in some way. It is in a more abstract sense and not really a defined approach.

CN: That's very fine! Thank you very much!

11.4 3rd Interview with Hannes Pfau

date: 2018 – 09 – 15
location: UNStudio Office, Raffle City, 268 Xizang Middle Road, Shanghai, China

CN: First, I would like to ask you about your education in undergraduate and graduate school and your professional career.

HP: I studied at the TU Vienna and went one year to Michigan as an exchange student during my graduate program. After I graduated, I sent out my application letters to the three offices that I most admired at that time and with the reaction of the first office, not waiting for the answer of the other two offices, I just grabbed my backpack and left the country. That was 1997. I started working for van Berkel & Bos', which later on changed to UNStudio and I haven't stopped working ever since for them.

CN: Let's get started with the first question:

CN: Your office is well known for large mixed-use developments including high-rise buildings. What do you see as the major drivers of these projects and how can the general public benefit from them?

HP: I think mixed-use is something which is mainly driven by the needs of the society. Basically, it is what most people request in order to follow their actual lifestyle they have at that time.
The social awareness changed radically during the industrial revolution, when big factories where built outside the cities. By moving a monofunctional structure to the periphery the demands of the employees moved too and gained the need for several uses like housing, food and bathing nearby the working places. This mix of amenities was necessary to establish a basis to support a developed society, an accidental prototype of mixed-use developments. This evolved from a previous society of manufacturing, producing physical products, to a service industry society and allows a totally different lifestyle than 200 years ago. If we would still think of ordering the urban environment according to single use, we would waste most of the time by moving from place to place.
When you look into how people live today, they need to bring their kids into school, want to work for two hours, then they want to meet friends, then they have a business meeting and meet people of other clientele, after work they need to do their laundry, do their grocery. All of that needs to be possible within the 24 hours a day has. Therefore, you really need to offer this and because we, as architects, are also in the service industry, we don't really produce pollution or noise or other less adequate stuff that does not allow people work and live next door to each other. So, in that sense mixed-use comes basically from making the life of people more convenient.

CN: The "three-dimensional city" concepts of the last century are highly controversial ideas, while modern "neighborhood in the sky" concepts are put into practice. What is

your opinion of the contemporary situation?

HP: When you talk about 'neighborhood in the sky concepts', we have already built projects that are part of this subject. For instance, the Scott Tower, a residential project in Singapore, where we actually used this kind of concept of creating neighborhoods in the sky. On the one hand, when we look at the initial boundary conditions of the project, due to the small plots, for maximizing usability it was necessary to go vertically. On the other hand, we had to be very economical in a way that the apartments are affordable and the apartments had to be quite constrained in terms of the size. In that sense, it was designed to attract especially young families and young entrepreneurs.

We placed actually public spaces, amenities and shared facilities on different levels of the tower. In these places of the development, you have the possibility to meet and actually get to know your neighbors. You have also the possibility of inviting people, who are actually not living there, into your home without necessarily driving them into your apartment. So, you can spend your time in these additional communal areas and not being confined in your small apartment. This is something which is really necessary to do, because this kind of semi-public spaces for the people allow them to structure this kind of development and offer additional quality to them. It can also be an area for arranging business opportunities within our everyday life. It is something which is needed, especially when the city is very dense.

This strategy freed the ground floor and we had more space to arrange bigger pools on different levels and consequently it is more dedicated to young social climbers and the raise of their next generation. On the mid level of the tower, we could then for example find other kinds of pools and a bar seeing it as an area for enjoyment. You have actually a really nice view towards the city. On another level higher up, we had less usable space. So, we created kind of a relaxing zone with jacuzzi and for sun bathing.
In the past, let's say 60s, 70s, the visionaries who developed this kind of three-dimensional cities, have taken these ideas on and they already got a small glance onto the problem we are facing now. When you look at Japan, which was actually one of the first nations that faced the necessity to think about how to use space more efficient. For instance, the projects of Kenzo Tange. He has designed concepts of cities out in the bay on places, where probably other typologies, which did not waste the necessary space needed for agriculture or leisure, would have been more reasonable.

CN: Basement: Metro stations turn into complete transit centers. Can you make a suggestion of how the demands of (public) transport will change in the near future?

HP: I don't consider transportation hubs as something negative. They really have the

potential of being something innovative due to a high fluctuation rate of people getting pumped through them every day and need to serve best for the people. When you look at cities like Montreal, according to the local climate, a big part of the city is underground. When you get off a metro and go up, you are still a certain level below ground. The underground is actually a complete network that allows you to get completely protected from extreme natural conditions from your living to working place. Additionally, these transitional spaces can also serve specific needs. During our everyday life the people need to buy your breakfast, shop for some clothes or simply meet a friend and all these facilities can actually be along this transportation hub. But it is not necessarily restricted to be in connection with shopping. You can also have cultural or leisure facilities connected to transportation hubs. I think the limit is only what we can imagine.

The problem at the moment is that most projects are driven by developers and less by policy makers. This is a situation of course which is not sustainable, because under these circumstances, economic interests are the driving forces. In the future, we need to create better opportunities which allow us to think of the long run and not just 10 to 20 years.

CN: Ground floor: By shifting the major pedestrian routes above and below the ground, what is the future of the ground floor and how can it be protected from being completely engrossed by infrastructure?

HP: I remember in the 80s, cities had this kind of strategy to push the individual traffic out of the city and inner urban pedestrian zones were established. I personally don't believe that this kind of strategy will work for each city. Instead, the individual traffic needs to coexist with the public transportation system within a project. Everyone wants to travel individually and as long the public transportation system does not offer the convenience of a private transportation system, you will never be able to eliminate the one over the other. In that sense, I also don't believe that the ground floor necessarily needs to be free of transportation. I would instead question what the ground floor is nowadays and how to define it. The accessibility can be guaranteed on various levels below or above ground. As a result, these additional entrance levels receive ground floor characteristics and have the opportunity of having similar commercial value as the original ground floor. These "new" ground floors make it possible to go from one tower to the other or even from one side of the city to the other one without even touching the ground. This is something you see already in more dense regions like Hong Kong or other Asian cities like Tokyo. Chongqing's city center is therefore also a very interesting example. Due to its geographic circumstances situated almost on an island which is framed on three sides by the rivers Jailing River and Yangtzekiang, which was also the economic driver of this region. Everyone wanted to build close at the river. Additionally, Chongqing is in an almost mountainous region causing a

terrain varying quite fast with differences in altitude. It's basically built on a hill and can be seen as a special kind of transformation typography. That means, when you enter a tower on one side on a specific level, the entrance from the opposite side is several floors higher. The definition of the ground floor itself is not adequate in the sense that you only have one. It really depends on the typography of the terrain.

CN: Podium: Mixed-use tower clusters almost always rest on a shared podium. What are the future potentials of this part?

HP: Again, it is the way how you look at certain things. For instance, when you look at cities like New York, the whole city seems to rest on a podium. Even when you go back in history. You could argue that Rome was also built on a podium of different infrastructure like water supply, sewerage and heating systems.

The podium itself is just a necessity in order to allow the connection of different developments. I don't believe that the podium will look the way it does now in the future. We have to tackle all functions and needs that have to be addressed. Therefore, it is not necessarily defined by the podium itself, but really think of it as a network of multiple developments. Already today we see more and more changes happening. Especially in high dense environments you are dealing with distances that are too long to actually go into the nature causing the average inhabitant to not have the possibility to leave the city anymore.

Urban planting needs to be considered crucial to the modern city, not just because of greening issues and emission reduction, but also because of the cultivation of agricultural crops, with the goal to generating food, supply local demand. Plants nowadays get integrated into projects for convenience, but also generate a new lifestyle. A lot of unused space within the city, like certain parts of the podium and surrounding, can be transformed into outside bars and urban farming areas, where people can have their social central point and can cultivate their own food. Since we consume more and more spaces for our developments, we face more and more shortages for areas for leisure purpose and local agriculture areas. In that sense the buildings will change radically in the near future.

CN: Podium Deck: The majority of Asian cities have an open space and greening problem. What potentials do these places have to become an area-wide artificial landscape within the city?

HP: I don't necessarily see it as an artificial landscape, especially not in areas with tropical climate. Concrete plates do not stop the growth of plants there. The nature will always try to take back cultivated soil.

In that sense, when talking about urban landscape, the podium deck is the obvious area to investigate, because it was an under-rated part of a development in the past. Current developments in density and urban spread make it necessary to think differently about certain areas in the city and make it more accessible to the public. The need for open space is a strong, rising demand and needs to get implemented by creative interventions with a big variety of programs and activities.
Since the roof itself has become the potential to become an outdoor space, there is of course a big variety of how to use and program them. I think it's a good opportunity for people to get in contact with our natural environment and gives also the next generation the ability to understand by personal experiences why it is important to take care of our natural surroundings. We spend most of our time in indoor spaces. By our lifestyle we have lost how it feels to be in the outside environment. I think this is really a big potential for architects to engage and design the roof scape of cities in a more sustainable way.

The same attention we give the roof we should also think about how we design the facade of the future. Just using the roof for greening doesn't allow us to reach the international goal of CO2 reduction. We know vertical green is 6 to 7 times more efficient than horizontal green. When it comes to leisure, having water for engaging people with water allows people to relax 5-7 times faster than having just greenery surrounding them. Nature really affects us and we should take it into account when we design buildings. In the same way we need to think about functionality of a building and maybe how we look at our buildings to also allow all the technical spaces to be placed logically integrated and therefore reconfiguring the roof.

CN: Public Space in the Sky: Linkage strategies of different public space levels, which are really far away from the ground, remain a major weakness. How can these public spaces be further integrated in our everyday routes?

HP: It really depends on the circumstances how we define public spaces. Public spaces not necessarily need to be on the ground, they can be in the sky in these towers having connections to other buildings on multiple levels. However, even in really well-defined private buildings, in order to allow people to meet within and experience these buildings is a difficult question when it's coming to ownership and policies.

Look at higher density places, where you as a foreign person can enter buildings which then allow you to go up with the vertical transportation system and you finally come to a public space like the viewing platform of a tower. It is becoming a little bit of a semi-public space because of the fee you have to pay to get up there, but at least it's not a restricted place. It allows the visitor to have a different view on the city and allows the distribution of a program

within a vertical framework where you don't necessarily need to have retail or restaurants close to the ground floor. You can also have it on higher levels. It will depend on how you can motivate people to go up. It also comes to the point of how people live nowadays. When people work in a tower and need to have a break, the transportation system also needs a certain capacity and you need to spend a certain amount of time to go from a specific higher level to the ground floor. Instead of going up and down, the tower should allow people to spend their break time inside the tower on a certain level close to where they are working.

For the 9/11 proposal we worked together with several other architects and came up with a design of a series of towers, which had on different levels public spaces which connected the towers. The towers were leaning on each other and where actually connected not only by bridges but really physical connections and created a horizontal street which allowed that people can go from one end of the development to the other side without going down to the ground floor. You can see this principle especially in Hong Kong where you have a lot of different levels and bridges, where you can go from one side of the area to the other. You go over bridges, through towers and different programs without touching the ground floor. This kind of spaces are of course then public spaces which have the possibility to include and connect different programs with each other. This is something which is a necessity for architects to think about especially when it comes to high density. We need different forms of public space on different levels in order to support and cover the needs of people's everyday life.

CN: Public Space in the Sky: The two signature developments, Marina Bay Sands (Singapore) and Shanghai Tower (China), both provide a number of public space layers. What are, in your opinion, the strengths and weaknesses of these two different understandings of public space?

HP: As far as I remember Marina Bay Sands has only a very small part of the floating ship accessible to the public, which is a view platform. The rest is actually gated community because it is assigned either to the restaurant or the hotel itself. In contrast, in the Shanghai Tower there is a public space around every 50th floor where you have the possibility of a common space. The negative side is that you already need to have an address or a visitor card to be able to actually enter these places. So, both of these places are for me semi-public spaces, where you do not really have the opportunity to freely use these spaces. I would really like to see that in future developments that we have the opportunity to generate public spaces, which are really public in its sense. You can see this of course a little bit in Hong Kong. There, the connecting bridges have the possibility to go through developments, which are then of course only related to retail program. It would be great, if we could really connect all these different programs with different layers of public space. To take full

advantage of these ideas we also need to push the limits of mixed-use programs to avoid zones with a “dead program.” This means that a common office tower is active from 06:00 to 21:00 and actually in the rest of the time, until the next morning, the zone is “dead.” When you mix this zone with other programs, like retail which has an opening time from 10:00 to 22:00, the usability of the space already got extended by one hour. These zones are much more activated, but it also creates places with a higher social safety. On the other hand, you reach a much higher efficiency, because the space is not only used for people going to their offices but also for activities like going to the mall, museum or the education center.

CN: Rooftop: Previously, the top of a major high-rise development was mainly occupied by facilities for tourism. What are the duties of this part of the skyscraper in the future?

CN: Will it still be necessary that we have a viewing platform on top, because when we look at Lujiazui, (Shanghai Tower, Jin Mao Tower, Shanghai Finance Center) each of the major towers as a viewing platform. It’s not cheap and does it make sense that every tower has one?

HP: It is a problem that is not only happening in Asia. You can see this in London as well. It’s of course a commercial aspect to generate more income, but I believe the roof itself, depending on the height, has to cover certain interests. One is of course that it looks appealing from other developments and viewing platforms, so you have of course the interest to design it in a specific way. On the other hand, I believe that the roof of the tower is also a little bit overrated since we have the possibility of generating almost rooftop conditions on almost any other floor we want. It is really a matter of the program distribution and the model we want to generate. In terms of function, the roof is of course the part, which allows you to use it for needs of escape where people can really get together and at this point this possibility is technically a little bit difficult to achieve on the other levels of the tower. But in terms of function we are not bounded to the roof anymore.

CN: Publicness: Already today public space is not always public to everyone, but restricted to closed societies. How can certain strategies ensure a balance of social stratification within multidimensional tower clusters?

HP: Of course, we architects are interested in generating public accessibility throughout the different programs, because we want our buildings to operate properly for all the different users. It’s kind of an evaluation. Nowadays publicness is becoming more and more of interest not just to developers, but also to rule makers, advertisers of competitions and policy makers. They are needed to support us as architects to generate something with additional

qualities and to convince the client to allow the public to enter in their either gated program or even very private program.

We can distribute the use of land and the use of space more evenly. This is something, which really inures to the benefit for the whole society and how it is structured. We need to allow different levels of not only commercial power, but also a differentiated social structure.

CN: The human scale defines the evolution of our cities and buildings. The high-rise building gives the city its volume, but how can tower clusters meet the needs of humanity?

HP: I believe it has a lot to do with perception. When you look at new developments, they are defined by masses and building off set regulations where we not necessarily allow volumes to be generated in the spaces. This is where I believe policy makers failed greatly. Most people talk about the human scale to define an approach to overcome the long way from the streets to the actual building.
We of course have to secure daylight condition and natural ventilation. Especially wind going through the cities is vital to allow the city especially in regions with higher temperature to cool down throughout the night. We have to ensure that, but it doesn't mean that we have to bring a dimension into these spaces that we can find the human scale back. I don't think the missing of the human scale has to do with tower developments itself. It has more to do with how we design those spaces in-between the towers.

CN: The sky is the limit: Can you outline your vision of the concept of layered public space at the end of this century?

HP: I would really wish that the spaces we generate as architects would allow us to bring as many people as possible together and generate again public spaces where people can meet an enjoy their everyday life. It generates not just a better communication throughout our society, but also a lot of opportunities to improve our mutual social understanding.

CN: Perfect, thank you very much Hannes.