URBAN ORNAMENT

a new traffic hub for Renmin Square Shanghai

DIPLOMARBEIT

URBAN ORNAMENT - A new traffic hub for Renmin Square Shanghai

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Univ.Doz. Mag.arch. Dr.techn.
Christa Illera

Institut für Raumgestaltung und nachhaltiges Entwerfen (E 253.3)

eingereicht an der Technischen Universität Wien
Fakultät für Architektur und Raumplanung

von

Markus Clodi
Matrikelnummer 0225103
Große Mohrengasse 39/8
1020 Wien

und

Severin Türk
Matrikelnummer 0225221
Große Mohrengasse 39/8
1020 Wien

Wien, am .....

Unterschrift ....
(Severin Türk) (Markus Clodi)

We want to thank our supervisor Professor Christa Illera for her personal support and her professional advice.
We also want to thank Mag. Sigrid Brell-Cockcan for her support and her patience during the design procss.

Special Thanks to

my dear mum and dad, because you always believe in me;
my grandma, because you always motivated me;
Thank you Max, for going with me together through all this craziness...

Sev

Special Thanks to

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Thanks to

Ulli and Fraundi, because you gave us wonderful inspiration;
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all our friends who helped us to realize this thesis;

for Lurchor, Hyr, Weing Weing and Tai Ming...

This thesis is based on the teamwork of Markus Clodi and Severin Türk with a clearly separated focus on the site analysis on the one hand and the design method on the other hand.

The urban and historical context as well as the specific site analysis including the analysis of the main architectural problems (chapters I - III) were written and compiled by Markus Clodi.

The design method including three different architectural designs according to the developed problems (Chapters IV - VI) were written and compiled by Severin Türk.

CONTENT

With its 19 million inhabitants and a human density of 2,729,9 / km² Shanghai is one of the fastest growing cities worldwide in terms of economy, architecture and, of course, population.[1] Due to the rapidly rising number of people, the public transport system and the coordination of heavy traffic within Shanghai, plays an essential role in its urban development.

The Shanghai subway network currently comprises 12 lines with 268 stations.[2] The government promises that after having completed the final stage of its expansion, people will have access to a subway station within a radius of 500 meters no matter in which part of the city they are.

Renmin Square, the city's main traffic hub and social meeting point, is located in the very center of Shanghai. With its huge amount of important cultural, political and historical buildings and one of the biggest park areas in Shanghai it probably represents the most important spot in the whole city. A widely ramified underground system underneath the urban level, including an interchange hub of three different subway lines, makes Renmin Square play a major role in Shanghai's public transport system.

The challenge of combining different types of traffic in one site, the high number of human density within the urban network and Renmin Park's important role as "the green lung of Shanghai" awakened our design interest. During a scientific research on site, we tried to reveal major disadvantages of Renmin Square's current situation. We mainly focused on the accessibility and connectivity between the subway hub and its surrounding urban network as well as on the park's integration into the hustle and bustle of the transport system.

This thesis presents a detailed diagrammatic analysis based on the research on site. Furthermore, it introduces three different design concepts ment to optimize the current situation. Two of those concepts were discarded later on in the design process and are therefore just briefly mentioned (see chapter VI). The third concept - our main design - (see chapter IV) presents a possible urban and architectural solution for this unique area, symbolizing an urban ornament within the city fabric of Shanghai.

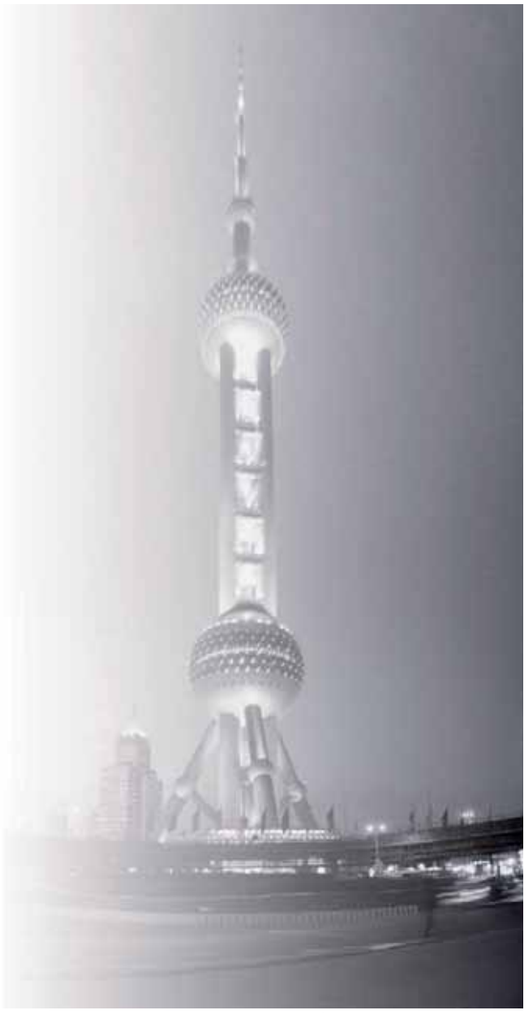


fig. 001_Oriental Pearl Tower

CHAPTER I - UNDERSTANDING THE SITE

In order to gain essential architectural and sociological information about Renmin Square and its environment we arranged a one-month-research on site in february 2010.

As a prevention of terroristic acts at the Expo 2010, all existing detailed digital information about the area was kept absolutely confidential. For this reason, neither the government nor the subway operation company of Shanghai supported our research and analysis.

Freely available street maps of Renmin Park and navigation plans of the underground system gave us general information about the proportions of the area. However, the data was not sufficient to generate detailed architectural drawings and a 3D-model of the site and its environment.

We therefore extracted all the relevant dimensions of the site and the rough geometries of the surrounding buildings via laser measurement.

The following chapter gives an overview of Renmin Square‘s architecture and its different unique areas by using a complete 3D-model and detailed architectural plans which are all based on our meticulous observation on site.

1.1 urban context and historical development

locating the site

fig. 002_panoramic overview (viewport Marriott Hotel)

fig. 003_urban viewport navigator

fig. 004_area viewport navigator

Renmin Square (People‘s Square), is an oval shaped, park-type open space, located at the very center of Shanghai in the Huangpu District. The park’s green area comprises a total of 80,000 m², which led to its nickname “the city’s green lung”.[3]

Besides the park area, Renmin Square is surrounded by facilities used for administrative, business and finance purposes on the one hand and for cultural activities, accomodation and shopping on the other hand.

locating the site

fig. 005_districts of Shanghai in comparison with Vienna

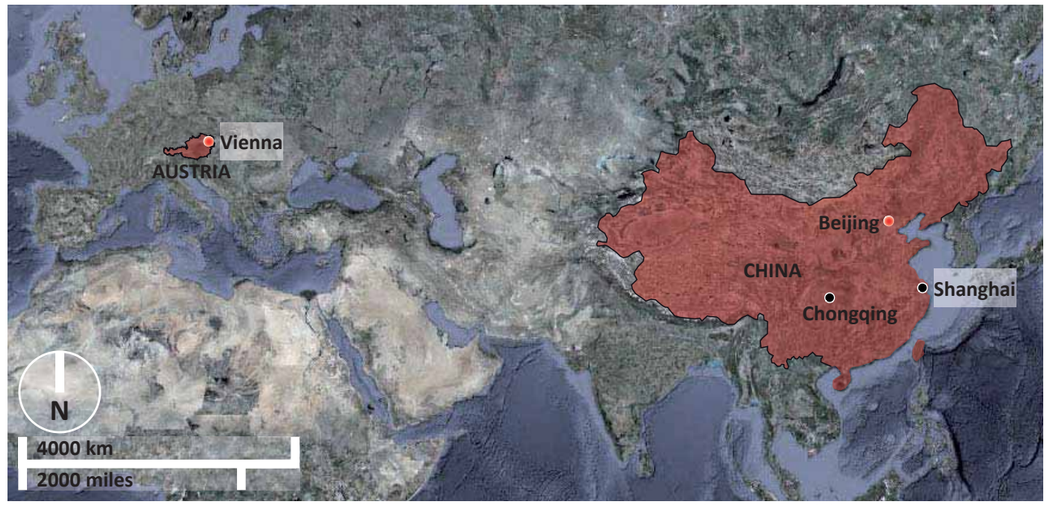


fig. 006_boarders of China in comparison with Austria

COMPARISON SHANGHAI / VIENNA		
Category	**Shanghai**	**Vienna**
Time zone	UTC+8 / no daylight saving time (DST)	UTC+1 / summer UTC+2
Coordinates	31°14'0"N 121°29'0"E	48°12'32"N 16°22'21"E
Measurements taken from	Renmin Square	St. Stephen's Cathedral
Elevation	4 m (13 ft)	190 m (623 ft)
Area	7037 km² (2717 sq mi)	414,90 km² (160,2 sq mi)
Districts	19	23
Population	19,210,000	1,698,822
Population Density	2.729,9/km²	4.094,5/km²
Climate	4 seasons, longer summer & winter	4 seasons, more or less equal
GDP per capita 2008	China: 4,900 USD (135. in the world)	Austria: 38,300 USD (22. in the world)
CO_2 per capita 2008	China: 3.9 t (80. in the world)	Austria: 7,8 t (32. in the world)

fig. 007_important data of Shanghai and Vienna[4]

China and especially its metropolises are world famous for going beyond the scope of familiar dimensions.

According to its population Shanghai is the 2nd biggest city in China. Only Chongqing with its 31,442,300 people is even bigger and at the same time actually the biggest city in the world. The population of Beijing with, about 22,000,000 people, is slightly beyond Shanghai's, but its area of 16,801 km² is nearly 2.4 times bigger.[5]

It is obvious that those facts about China when compared to the dimensions of Austria are telling their own tale in an astonishing and fascinating way.

1.1 urban context and historical development

locating the site

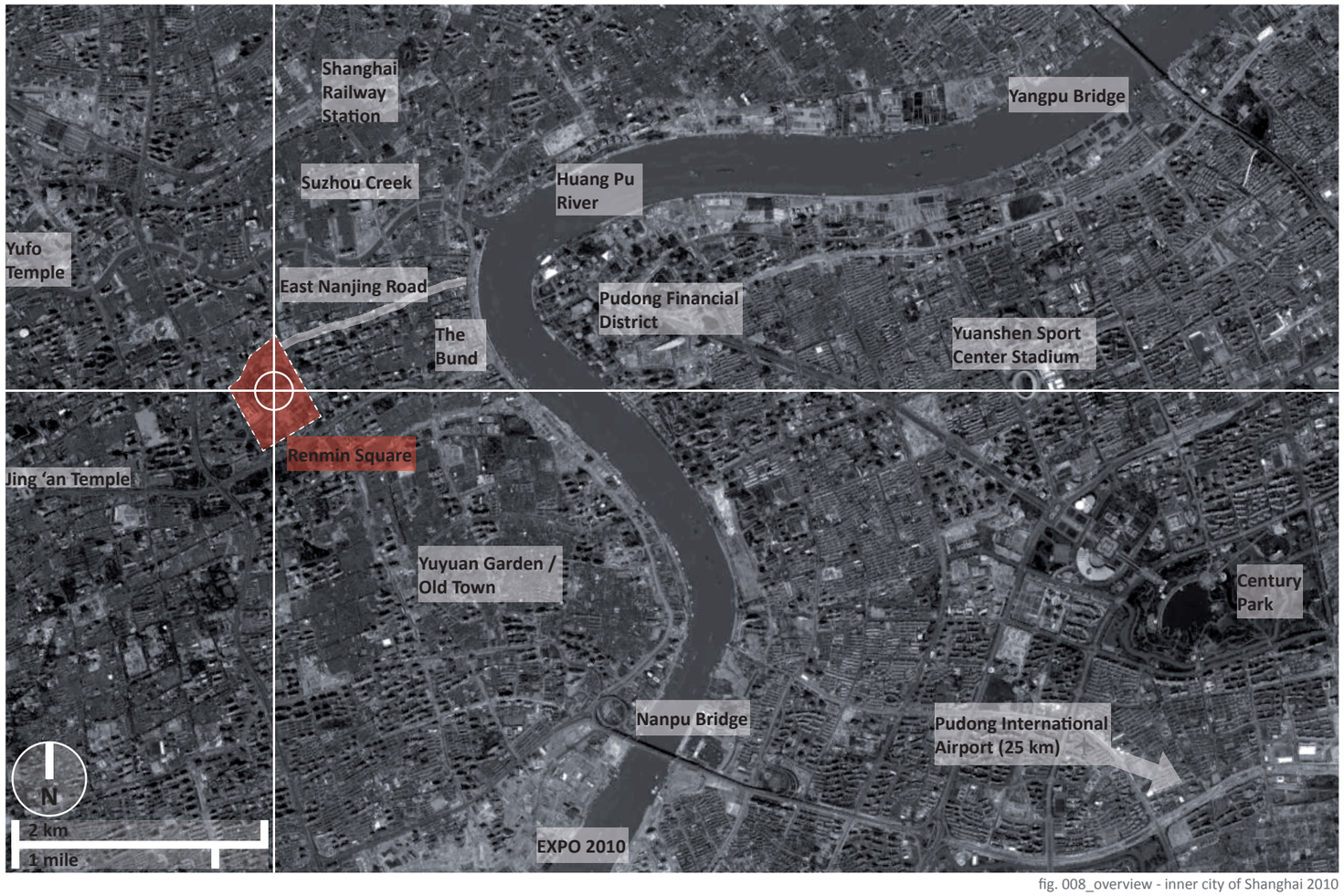


fig. 008_overview - inner city of Shanghai 2010

fig. 009_Pudong Financial District from The Bund

fig. 010_East Nanjing Road Pedestrian Area

Renmin Square is a very important place for traffic and public transportation.

The picture to the left shows the most important places in Shanghai and their location related to Renmin Square.

The well known view to Pudong Financial District, nicknamed „Manhattan of Shanghai", from The Bund (fig.009 upper right corner) is maybe the first place to visit for everyone who travels to Shanghai for the very first time. East Nanjing Road is one of the main connections between The Bund and Renmin Square. A major part of the heavily crowded road serves as pedestrian shopping area.

1.1 urban context and historical development

same place different era

fig. 011_Pudong - East Shanghai from west (1930s) [1]

fig. 012_Pudong - East Shanghai from west (2009) [2]

fig. 015_urban viewport navigator

Shanghai is definitely one of the fastest developing cities in the world. The chronological comparison between two very important spots of the city demonstrate the enormous architectural changes within the last century.[6]

Around 1930 the eastern part of Shanghai along the Huang Pu-River was characterized by fishing villages. Now, just 70 years later, the country's tallest skyscrapers transform this area into China's most important gate to the world financial market.

East Nanjing Road (shopping street)

fig. 016_urban viewport navigator

fig. 013_Nanjing Road (1908) [3]

fig. 014_Nanjing Road (2009) [4]

1.1 urban context and historical development

same place different era

fig. 017_Park Hotel 1934 [1]

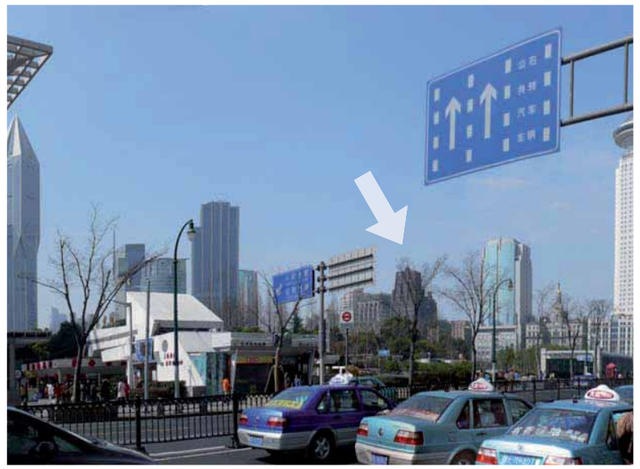


fig. 018_Park Hotel 2010 [2]

fig. 019_Yu Ya Ching Road 1930s [3]

fig. 020_Xizang Zhong Road 2010 [4]

fig. 021_area viewport navigator

Prior to 1949, year of the establishment of the People's Republic of China the square's oval shape was used as a race-track for horses.

When gambling and horse riding were banned by the new communist government the area became - and still is - the representative spot of Shanghai's urban network.

fig. 022_area viewport navigator

1.1 urban context and historical development

rapid urban development

year 2000

fig. 023_People's Square 2000

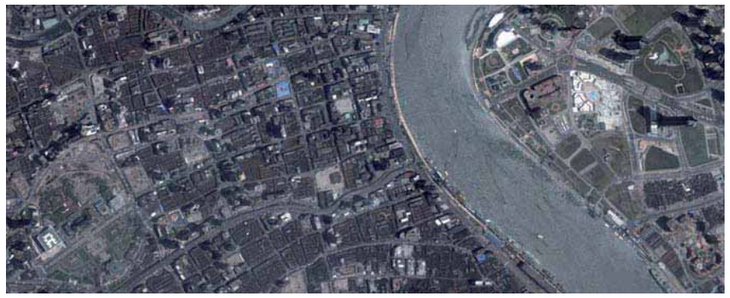


fig. 024_Shanghai city center 2000

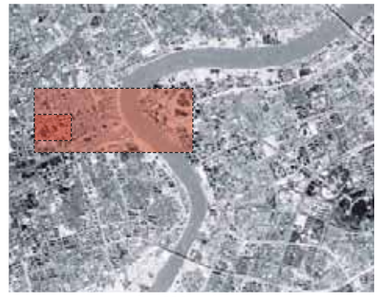


fig. 029_urban viewport navigator

year 2010

fig. 025_People's Square 2010

fig. 026_Shanghai city center 2010

structural alteration between 2000 & 2010

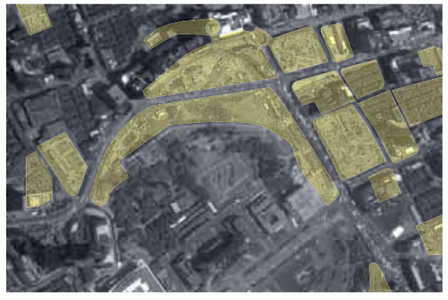


fig. 027_People's Square changing areas 2000 - 2010

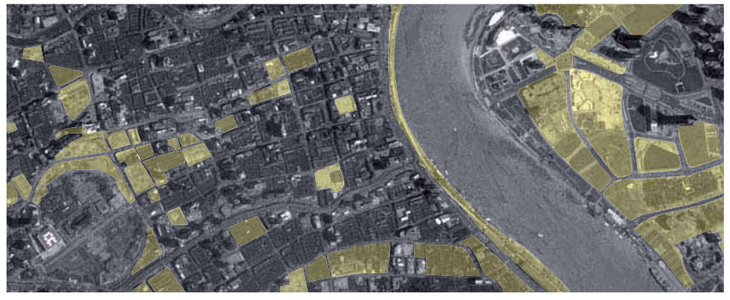
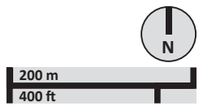


fig. 028_Shanghai city center changing areas 2000 - 2010

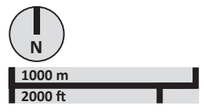


The pictures to the left show the gigantic architectural and urban changes in the city's center within the last ten years.

The huge amout of new buildings and infrastructure are a demonstration for Shanghai's declared intention to become one of the highest developted cities in the world.

Although the government's focus lies on constantly expanding the city limits Renmin Square and Pudong Financial District are still the touristic and economic center points of Shanghai. And yet, the final stage of development has by far not been reached.

structural alteration areas



1.2 traffic system

urban context

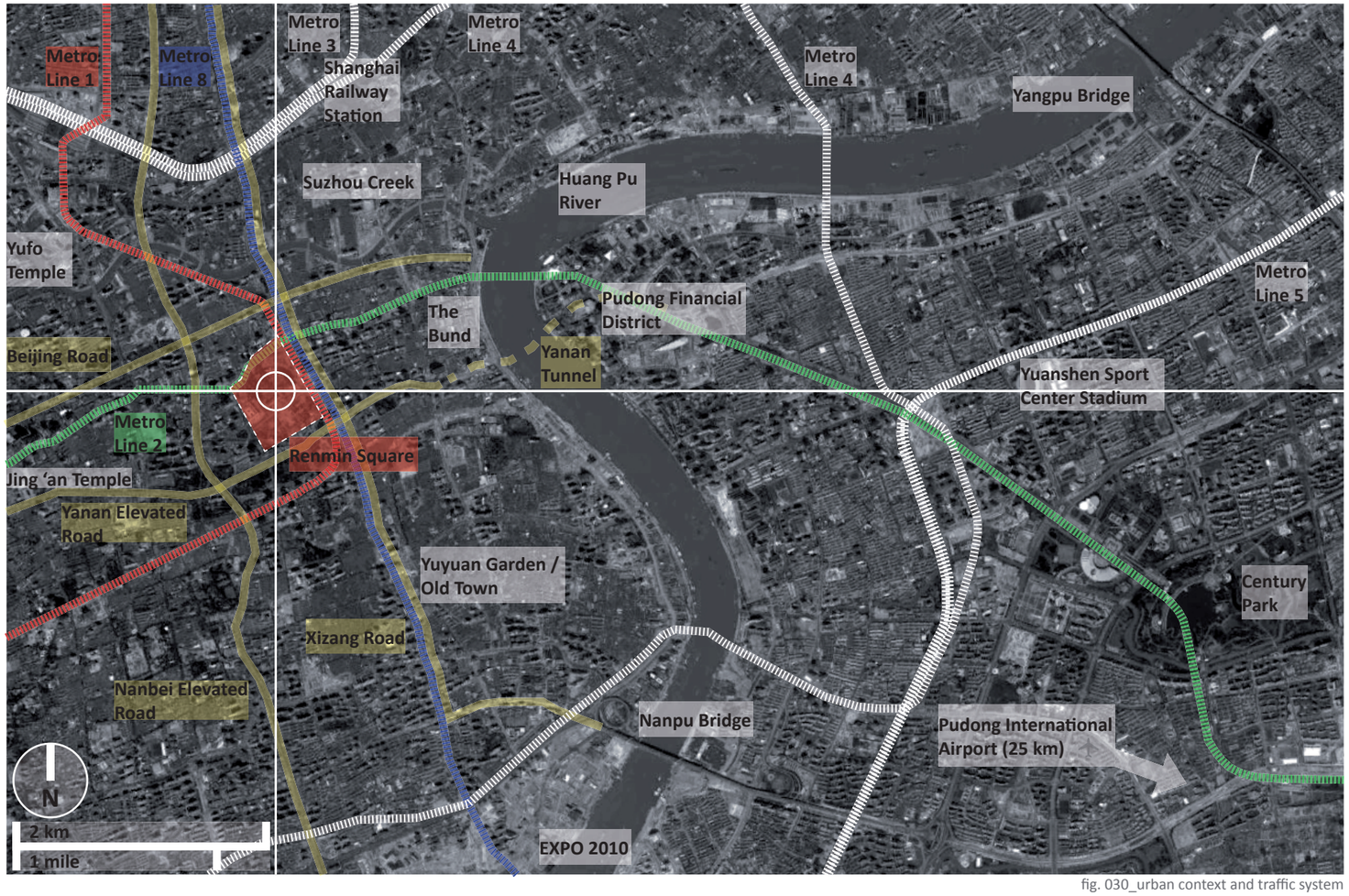


fig. 030_urban context and traffic system

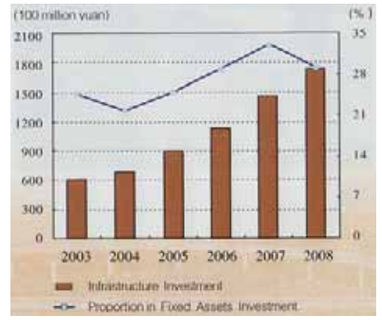


fig. 031_investment in urban infrastructure

main traffic routes near Renmin Square

subway lines passing through Renmin Square

other subway lines

The city has speed up the construction of hub-orientated, functional and inter-connected infrastructures. From 2003 to 2008, Shanghai invested 648,799 billion yuan in its urban infrastructure projects, accounting for 29.1 % of the total investment in fixed assets during this period.[7]

The infrastructure network has contributed greatly to further improving the city's investment environment, opening Shanghai even further to the outside world and enhancing its comprehensive function.

Special focus lies on the development and extension of the subway lines as well as on new street networks like elevated roads or city tunnels in order to improve the traffic circulation.

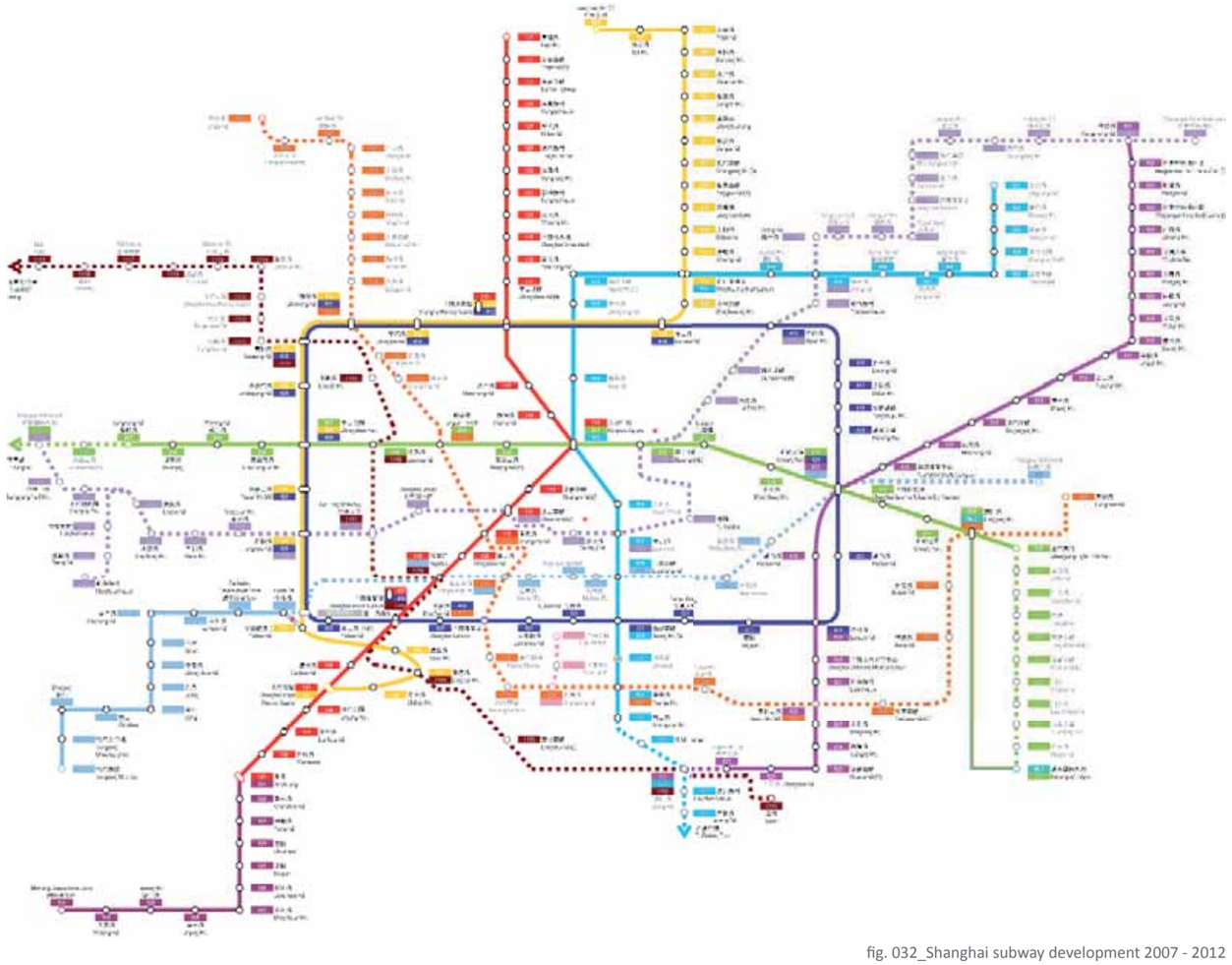


fig. 032_Shanghai subway development 2007 - 2012

1.2 traffic system

Shanghai subway system

fig. 033_Shanghai subway development until 2020

In 2009, the city completed phase one and initiated phase two of the three-phase Yangshan Deep Water Port project. The same year, Terminal Two of Pudong International Airport, and projects designed to expand and renovate the Shanghai-Nanjing Expressway were completed.

These big infrastructural improvements also speed up the expansion of the city's subway network, line 7, the second phase of lines 8 and 9 and the first phase of the northern extension of line 11 were all completed the same year.

Today, there are twelve metro lines (excluding the Shanghai Maglev Train), 268 stations and over 420 km of tracks in operation, making Shanghai's subway the longest network in the world.[8]

The subway system is still growing, more new lines and extensions are under construction. Until 2020 Shanghai plans to have a subway system comprising 22 lines and 877 km of track.[9]

fig. 034_topview Renmin Square area

1.2 traffic system

close-up Renmin Square

fig. 035_urban viewport navigator

fig. 036_Yanan Elevated Road [1]

In this map only important roads with a direct relation to Renmin Square were taken into account and colored according to our subjective impressions on site. The street's traffic intensity values are based on empiric observations and do not necessarily conform with the exact traffic volume. The pedestrian area of East Nanjing Road is the only exception: no cars are allowed in this area and its intensity value is exactly coherent to its actual motor vehicle traffic volume, i.e. zero.

Apart from Shanghai's elevated roads, Xizang Road - a four-lane road in both directions - is, one of the main north-south connections of the city. On the other hand Jiujiang Road and West Nanjing Road establish the connection between east and west. Fuzhou Road is a four-lane road, coming directly from the Bund.

1.3 area overview
surrounding buildings

fig. 037_panoramic overview (viewport Marriott Hotel) [1]

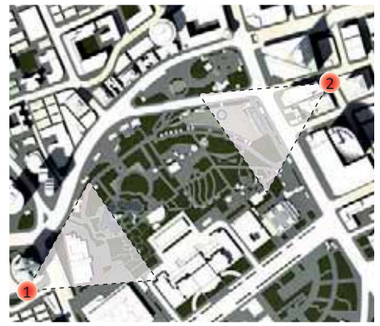


fig. 038_area viewport navigator

fig. 039_Marriott Hotel [2]

1.3 area overview

panoramic views - Renmin Park

fig. 040_panoramic overview (viewport Urban Planning & Exhibition Hall) [1]

fig. 041_panoramic overview (viewport Botanical Gardens) [2]

fig. 042_area viewport navigator

The photo on top was taken from the 4th floor of the Shanghai Urban Planning and Exhibition Hall, the picture below from the botanical garden inside Renmin Park.

The huge skyline in the background of both pictures is significant for the site and permanently visible from every vantage point inside the park.

1.3 area overview

panoramic views - subway hub

fig. 043_panoramic overview (roof garden) [1]

fig. 044_panoramic overview (main subway entrance hall) [2]

fig. 045_area viewport navigator

The two panorama photos to the left show the main subway entrance hall and the roof garden on top of it.

Both architectural objects are quite new and were built about five years ago. Nevertheless, the subway hub has a few weak points, especially when it comes to its connectivity to the surrounding urban environment.

In the course of the following analysis and the design process we will further discuss this special location on Renmin Square in order to find solutions for some specific problems.

1.3 area overview

panoramic views - urban planning & exhibition hall

fig. 046_panoramic overview of the urban model in the scale 1:500) -1

fig. 047_panoramic overview of the urban model in the scale 1:500) -2

fig. 048_area viewport navigator

The Shanghai Urban Planning & Exhibition Hall is located in the south-east part of Renmin Square.

The six-story building, with two basement levels, displays Shanghai's urban planning history and recent development. Exhibitions include models of future and current developments, as well as Shanghai's architectural history.

The main attraction of the exhibition is a huge model in the scale 1:500 which represents Shanghai's inner city including all planned developments of the near future.

Visitors can view the model from alongside or ascend to a gallery for views from above.

1.3 area overview

urban environment (level 0)

fig. 050_area viewport navigator

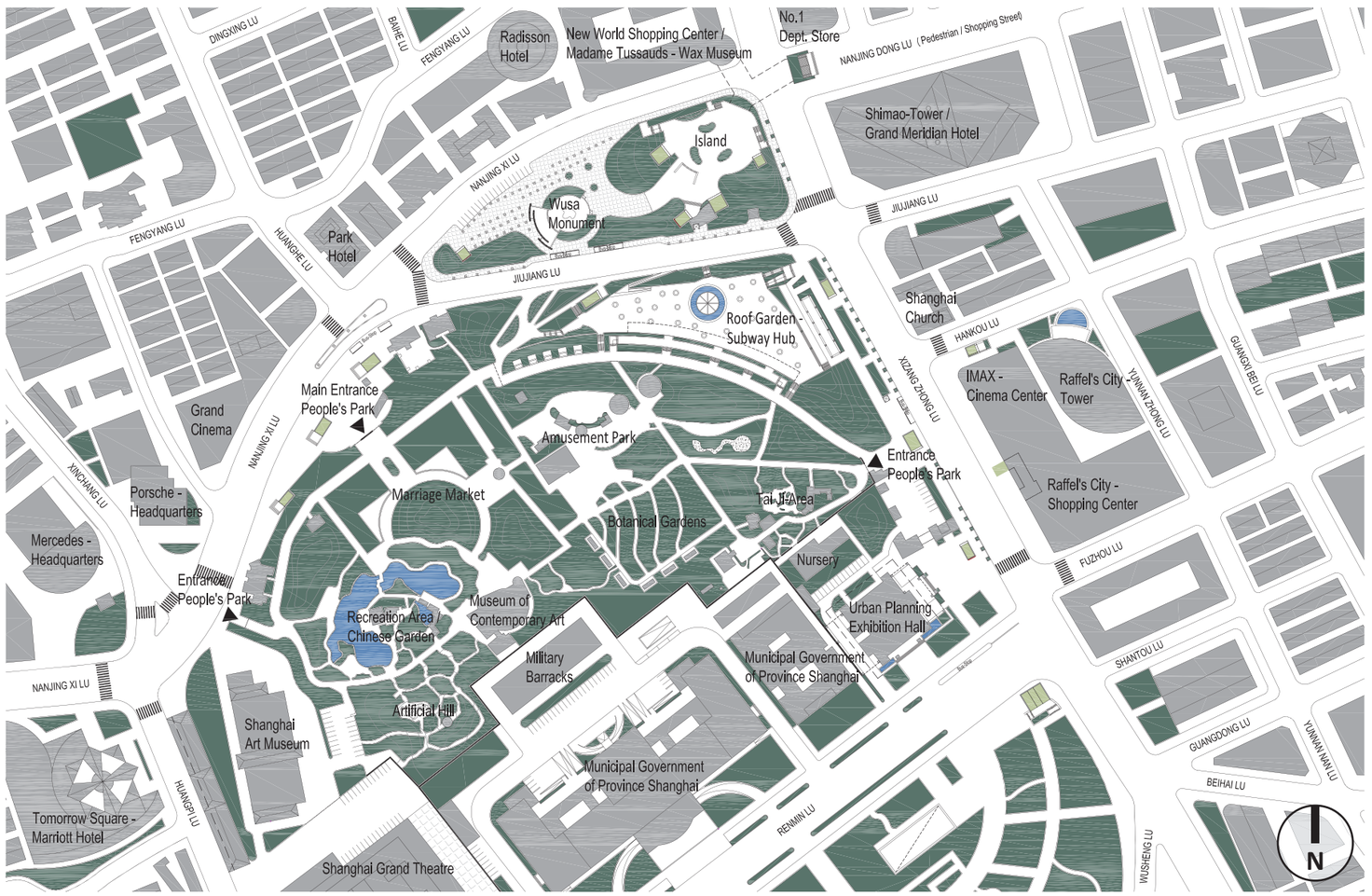


fig. 049_plan - level 0 m = 1:3000

- green zones
- subway entrances / exits
- existing buildings
- water areas

The plan gives an urban overview of important urban areas and structures above ground on Renmin Square as well as of the street system that surrounds the site.

The light-green marked spots that are spreaded all over the site, represent the 18 entrances to the underground subway system.

Areas of special interest are shown seperately on the following pages in order to illustrate more detailed information in a smaller scale.

1.3 area overview

3D model

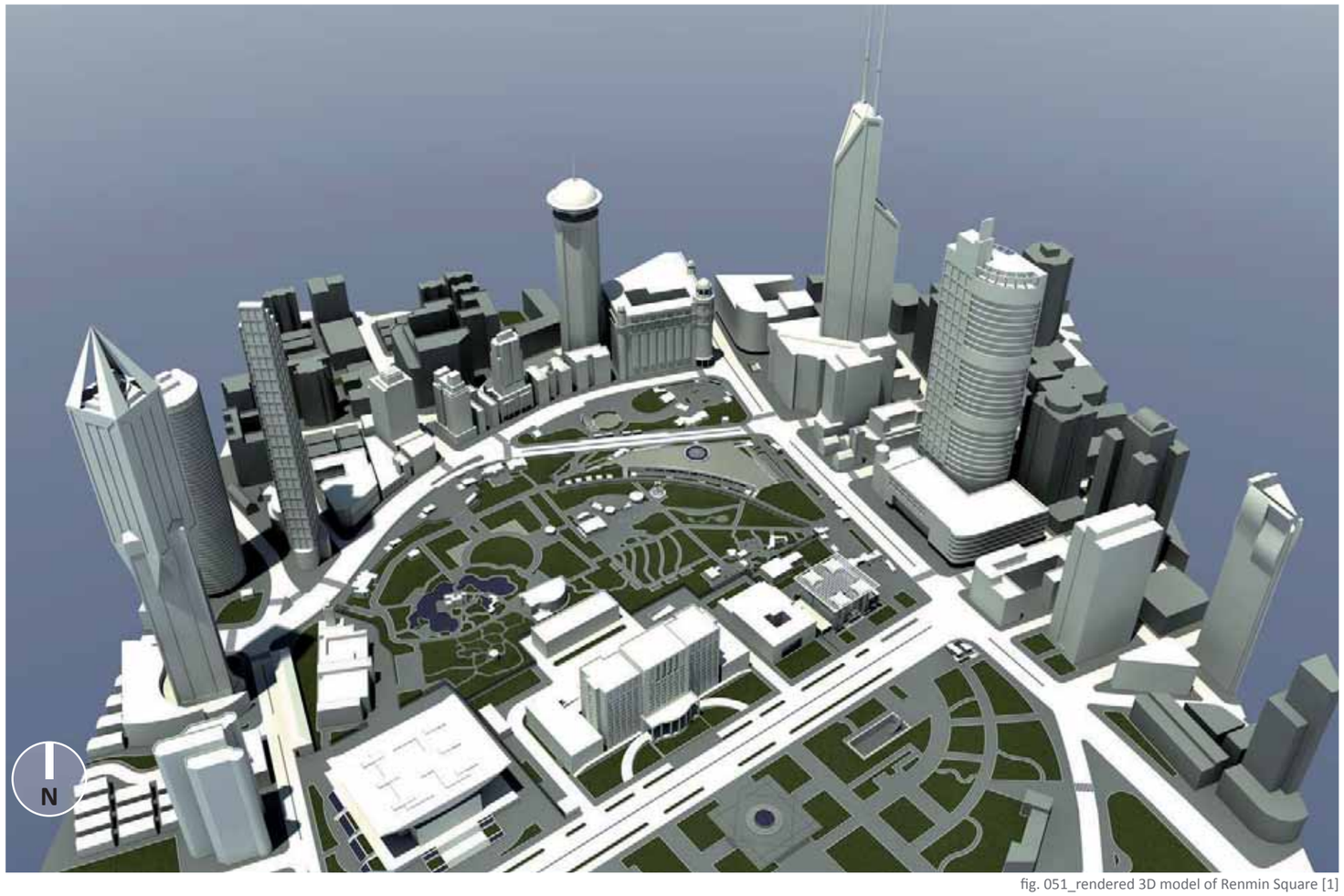


fig. 051_rendered 3D model of Renmin Square [1]

fig. 052_area viewport navigator

fig. 053_sideview Renmin Square

A three dimensional model of the current site including its proximate urban environment was absolutely essential to understand the geometries and the specific urban system of the area.

It also allowed us to examine the site from every perspective in order to prepare a founded 3D-analysis.

The location of the surrounding buildings, the heights and the different geometries are based on a detailed research on site and additional publically available plans of the area.

1.3 area overview

3D model - elevation

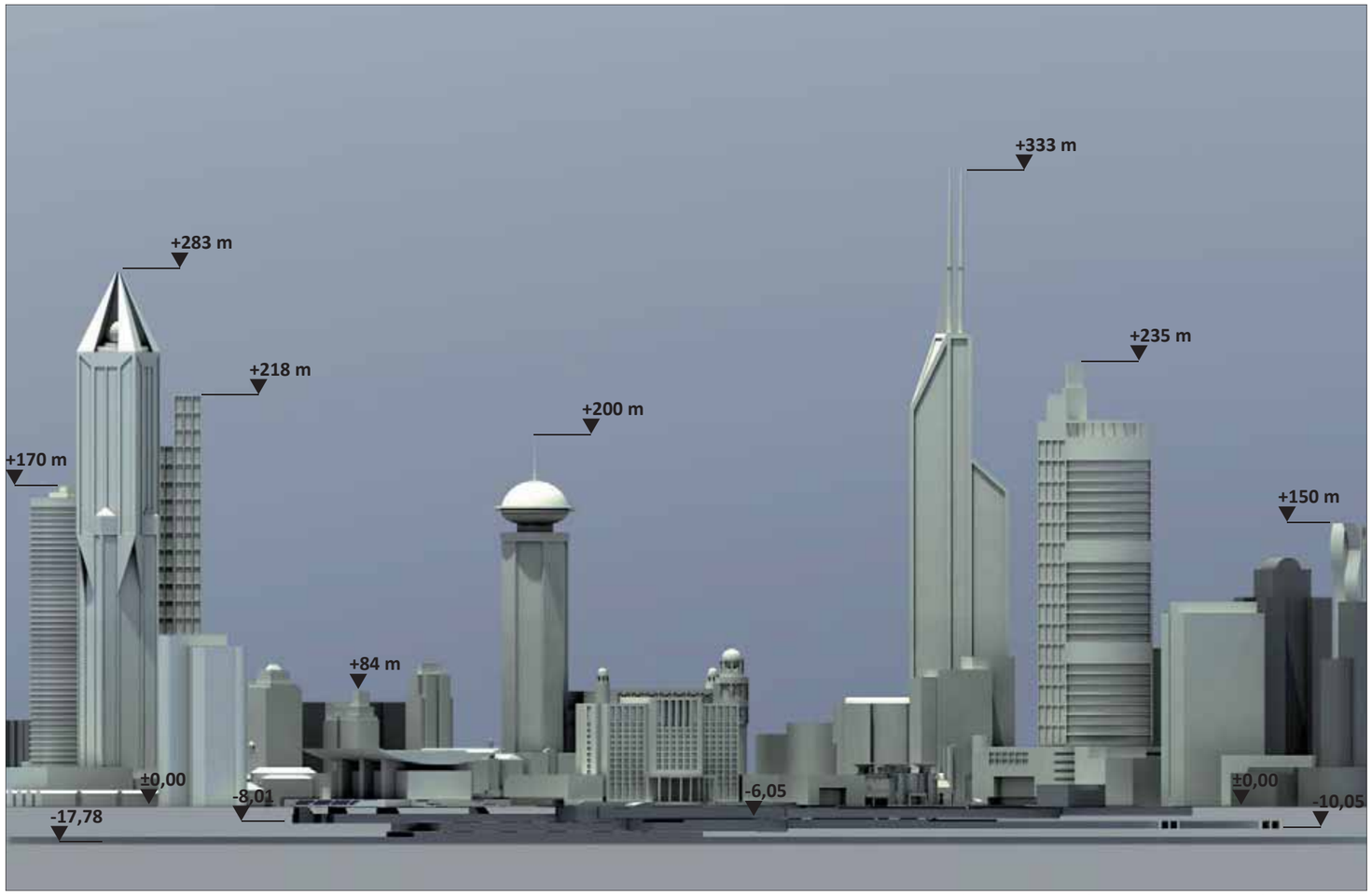


fig. 054_sideview of the rendered 3D model of Renmin Square

fig. 055_area viewport navigator

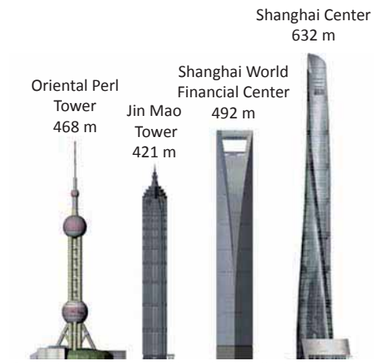


fig. 056_comparison - Shanghai's tallest skyscrapers

The rendered side view of Renmin Square shows the heights of its surrounding buildings in comparison to Shanghai's tallest skyscrapers which are all located in the Pudong Financial District.

Vienna's currently tallest freestanding structure is the Danube Tower with 252 metres.

1.3 area overview
data collection and basic research information

fig. 057_subway area navigation plan

fig. 059_Renmin Park navigation plan

fig. 058_3D overview - Renmin Square

fig. 060_3D overview - subway system

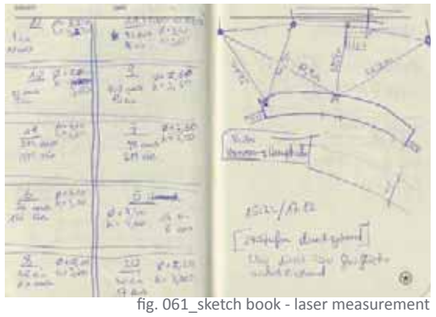


fig. 061_sketch book - laser measurement

fig. 062_sketch book - acoustic measurement

fig. 063_sketch book - height measurement

fig. 064_tools for collecting different types of data

As already mentioned in this chapter‘s introduction, detailed plans and elaborate information about the site were not available.

Therefore the one-month research in Shanghai was absolutely essential for us to gain important information about the current situation of the area.

Starting with rough navigation plans of the subway system and Renmin Park, we later on used a laser measurement tool to get the specific detailed dimensions. After overlapping the plans with the measured real dimensions of the area, we were able to draw a correctly scaled blueprint of Renmin Square.

Further tools were used to get information about the site‘s noise level and the entrance / exit frequencies of the subway system.

1.3 area overview

urban environment (level 0)_detail Island

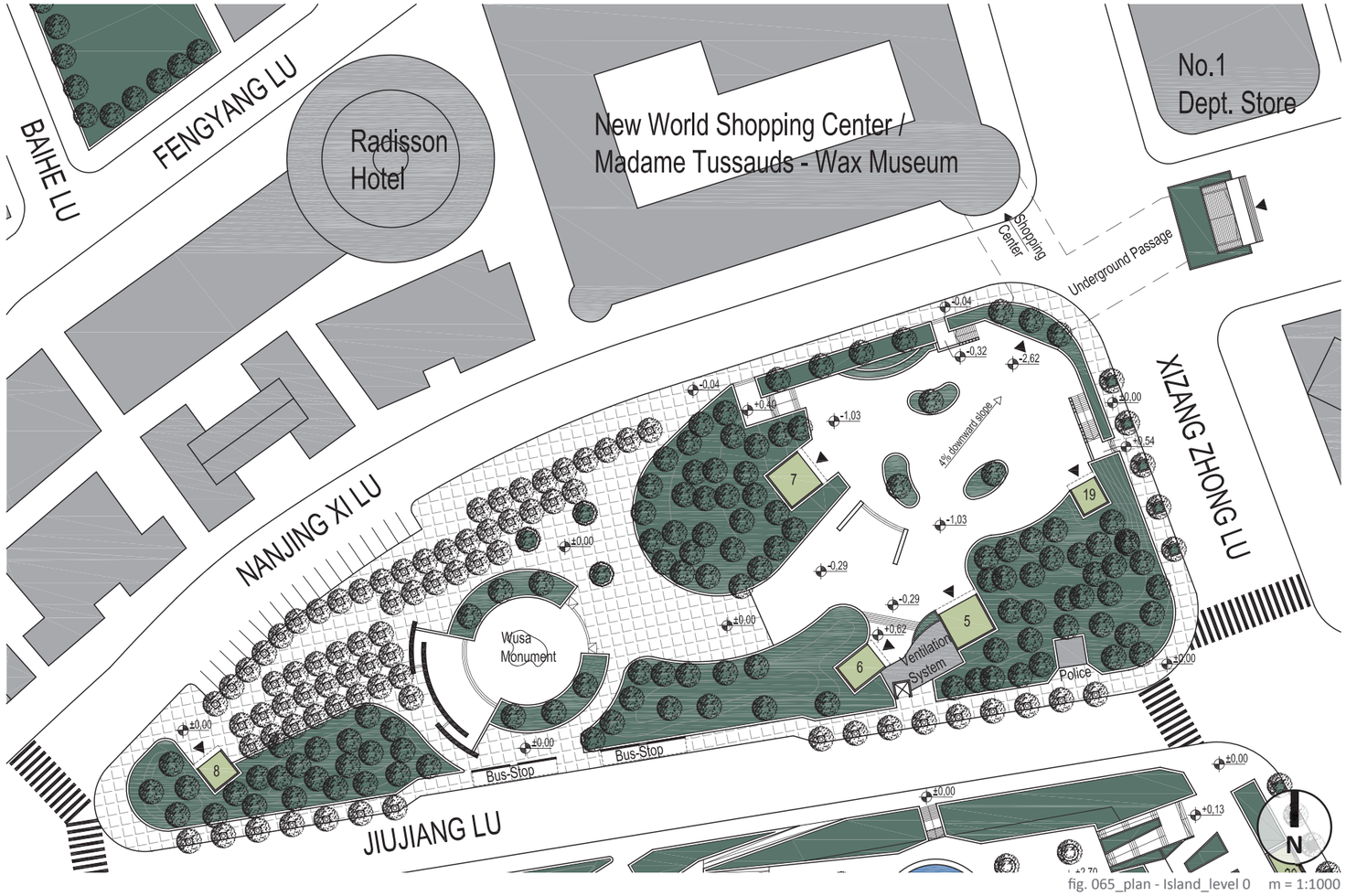


fig. 065_plan - Island_level 0 m = 1:1000

fig. 066_area viewport navigator

- green zones
- subway entrances / exits
- existing buildings
- water areas

„The Island“ gives access to five subway entrances and is linked to the urban environment through an important underground passage and several crosswalks.

A slope lowers one half of the total area down to 2.62 meters below the urban level in order to guarantee access to the underground passage.

The Wusa-Sculpture is an important political monument and sight-seeing spot, commemorating the „May 30th Movement“, one of the biggest anti-imperial protests in the history of the city.

1.3 area overview

urban environment (level 0)_detail Island

fig. 067_Wusa-Monument [1]

fig. 068_lowered part of the Island [2]

fig. 071_area viewport navigator

fig. 072_rendering Island_1

fig. 069_north-west park area [3]

fig. 070_entrance underground passage [4]

fig. 073_rendering Island_2

1.3 area overview

urban environment (level 0)_detail subway hub

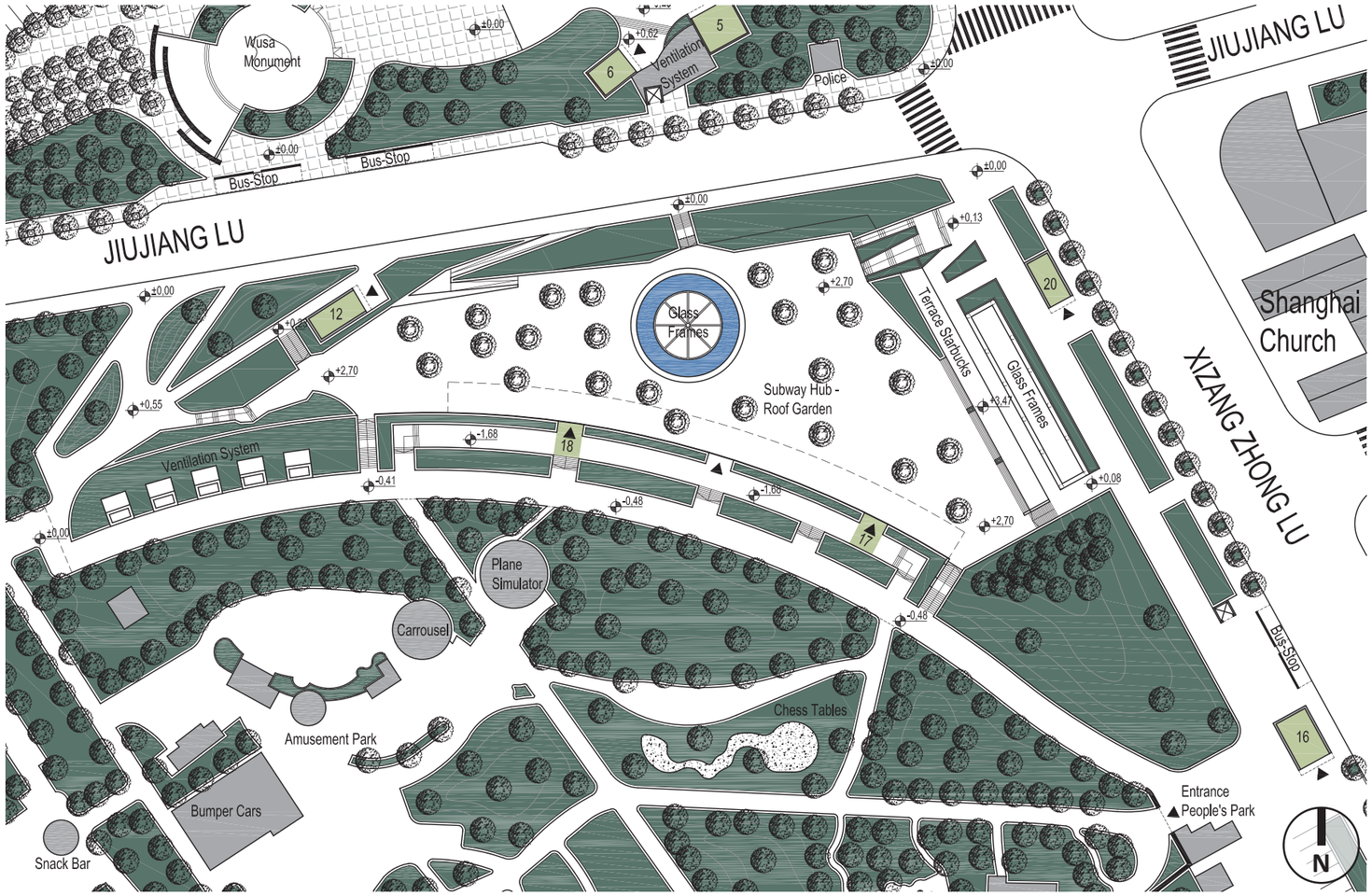


fig. 074_plan - subway hub_level 0 m = 1:1000

fig. 075_area viewport navigator

- green zones
- subway entrances / exits
- existing buildings
- water areas

The area around the subway hub and the park on top of it represent one of the main focus points of our site analysis.

Six entrances lead you directly to the main subway hall situated underground. A circular glass frame in the center of the roof is the only vertical connection between roof garden and the hall below.

The acoustic influence of the surrounding environment (the amusement park in the south-west or the heavy traffic of the nearby roads) strongly affects the quality of public functions like the roof terrace at Starbucks café.

1.3 area overview

urban environment (level 0)_detail subway hub

fig. 076_entrance nr. 17 & 18 [1]

fig. 077_café roof garden [2]

fig. 078_roof garden [3]

fig. 079_entrance nr. 18 [4]

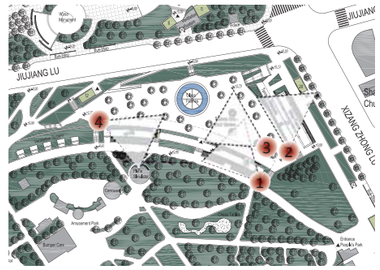


fig. 080_area viewport navigator

fig. 081_rendering subway hub_1

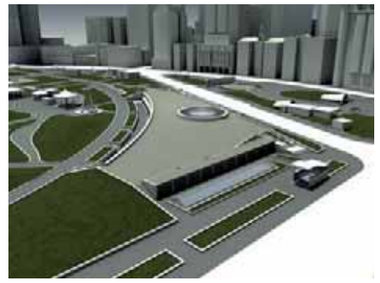


fig. 082_rendering subway hub_2

1.3 area overview

urban environment (level 0)_detail Renmin Park

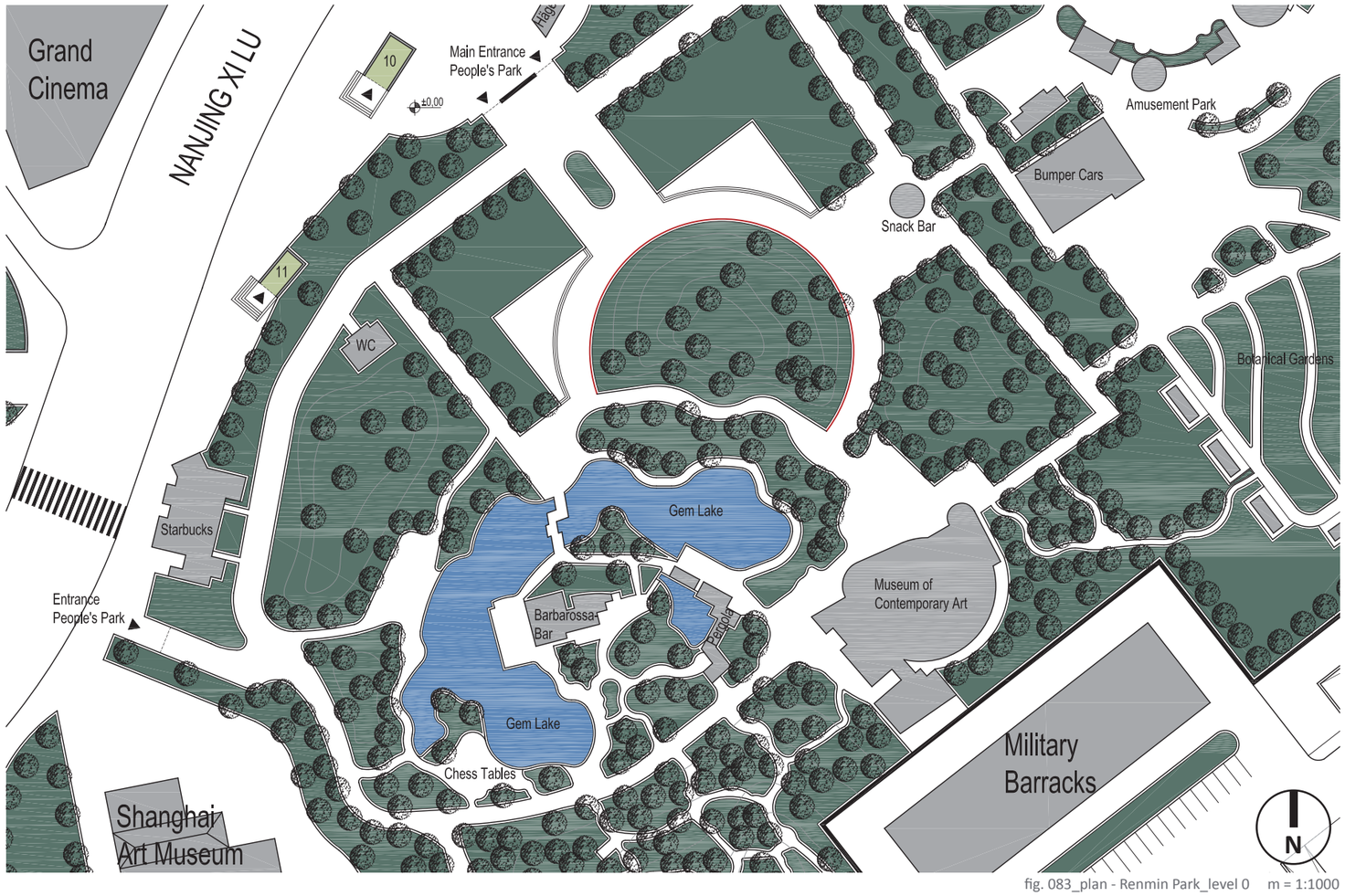


fig. 083_plan - Renmin Park_level 0 m = 1:1000

fig. 084_area viewport navigator

- green zones
- subway entrances / exits
- existing buildings
- water areas

The western part of Renmin Park serves as the main recreation zone of the site. With its carefully designed pathways, landscapes and water areas the whole design follows the principles of the traditional Chinese garden.

Two important museums and a famous bar are situated in the midst of this area.

Generally a lot of special functions can be found in this part of Renmin Square. People playing Majong near the waterside or attending the “marriage market“ close to the park’s main entrance gates.

1.3 area overview

urban environment (level 0)_detail Renmin Park

fig. 085_Chinese Garden area_1 [1]

fig. 086_Chinese Garden area_2 [2]

fig. 087_Chinese chess and Majong tables [3]

fig. 088_„marriage market“ [4]

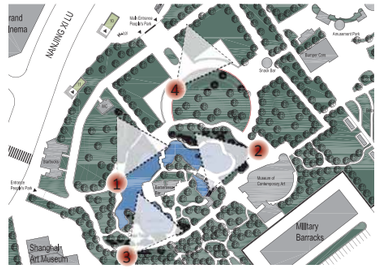


fig. 089_area viewport navigator

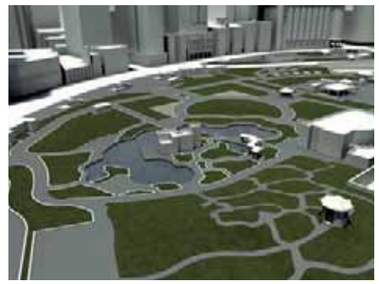


fig. 090_rendering Renmin Park_1

fig. 091_rendering Renmin Park_2

1.3 area overview

urban environment (level 0)_detail Urban Planning & Exhibition Hall

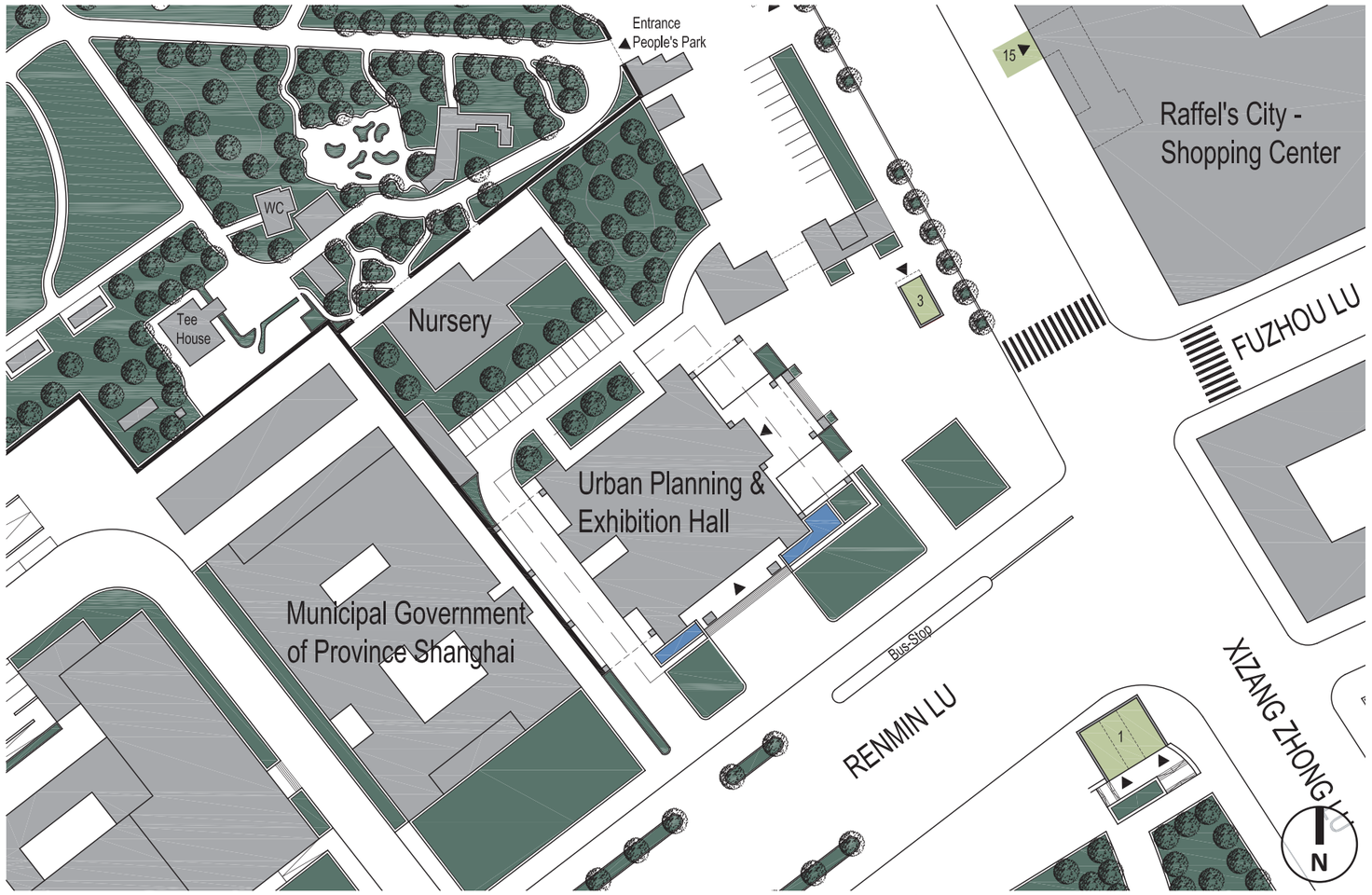


fig. 092_plan - Urban Planning & Exhibition Hall_level 0 m = 1:1000

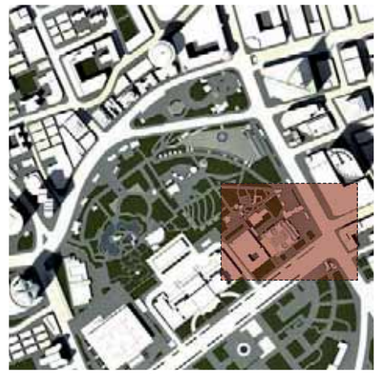


fig. 093_area viewport navigator

- green zones
- subway entrances / exits
- existing buildings
- water areas

The Urban Planning & Exhibition Hall is one of Shanghai's most famous tourist attractions. Together with the Raffle's City Shopping Center on the opposite side of Middle Xizhang Road the museum is the main reason for high human density in this area. Therefore, the exhibition hall as well as the shopping center have their own access to the subway system.

An underground passage between subway entrance 3 and 1 helps overcoming the problem of the urban barrier of Renmin Avenue. Various food stores are spread randomly across the area in front of the park.

1.3 area overview

urban environment (level 0)_detail Urban Planning & Exhibition Hall

fig. 094_square in front of the Urban Planning & Exhibition Hall_1 [1]

fig. 095_square in front of the Urban Planning & Exhibition Hall_2 [2]

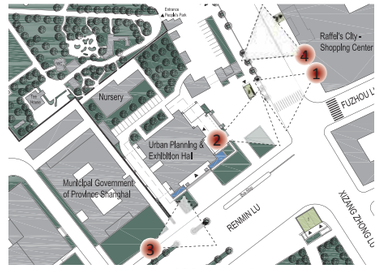


fig. 098_area viewport navigator

fig. 099_rendering Urban Planning & Exhibition Hall_1

fig. 096_pavement Renmin Avenue [3]

fig. 097_food stores in front of the park entrance [4]

fig. 100_rendering Urban Planning & Exhibition Hall_2

1.3 area overview

3D model_level 0 & level -1

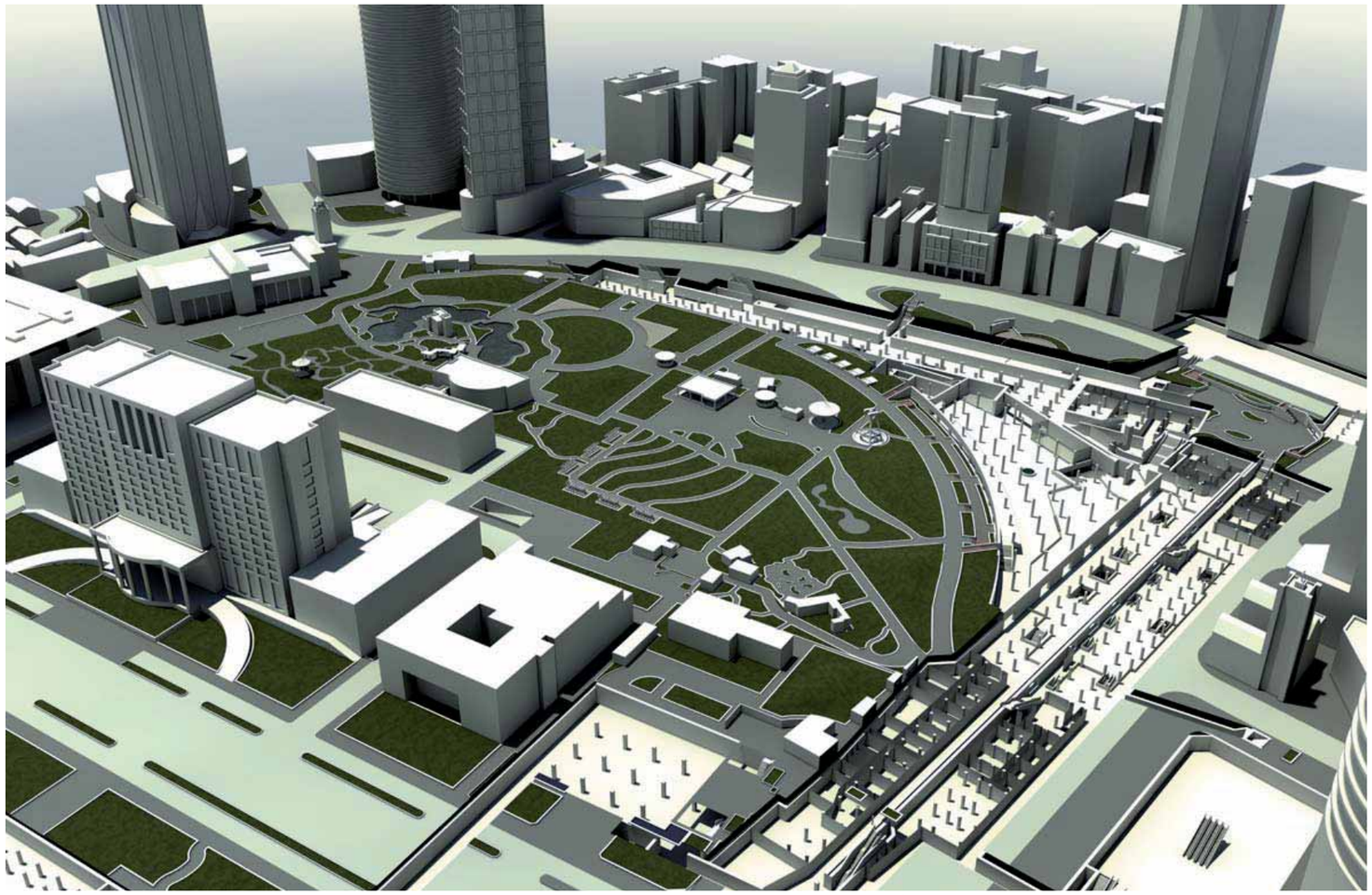


fig. 101_rendering underground system (viewport Middle Xizang Road)

fig. 102_area viewport navigator

The rendering shows the enormous dimensions of the underground system beneath Renmin Square.

The main subway access area (level -1) is linked to several underground markets as well as to the two shopping centers at the site.

The general location of the subway area on the periphery of Renmin Square is significant.

1.3 area overview

subway area (level -1)

fig. 104_area viewport navigator

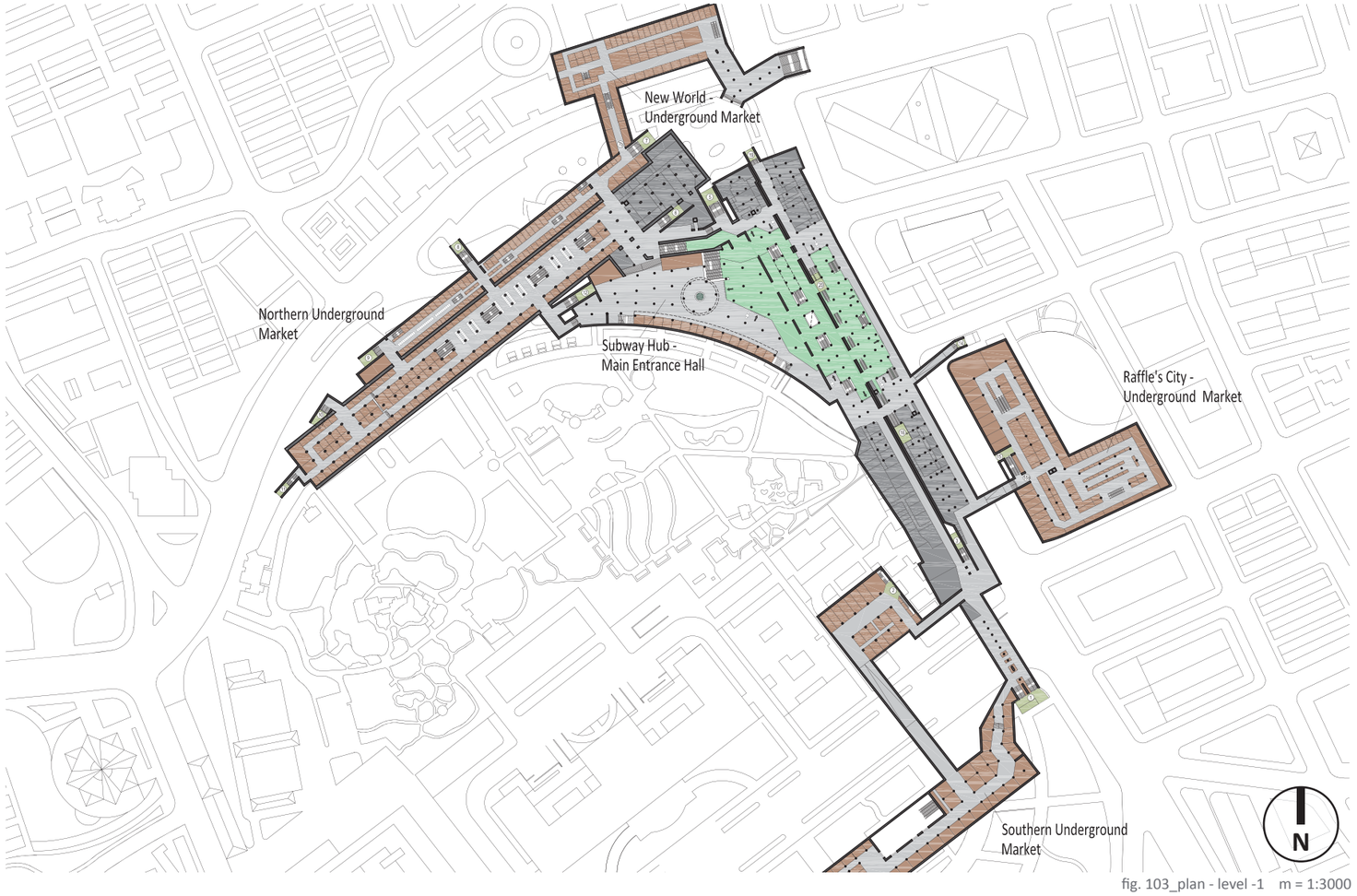


fig. 103_plan - level -1 m = 1:3000

- subway entrances / exits
- restricted areas
- semi-public space (only with ticket)
- public space (without ticket)
- shopping areas

The underground system below Renmin Square does not only consist of the subway station.

Several underground markets are linked to the subway access zones, transforming the whole area into a widely ramified labyrinth of different shops without any natural illumination.

The far-ranging underground pathways also make it possible to reach different parts of Renmin Square without getting impaired by urban barriers above ground.

1.3 area overview

subway area (level -1)_detail main entrance hall

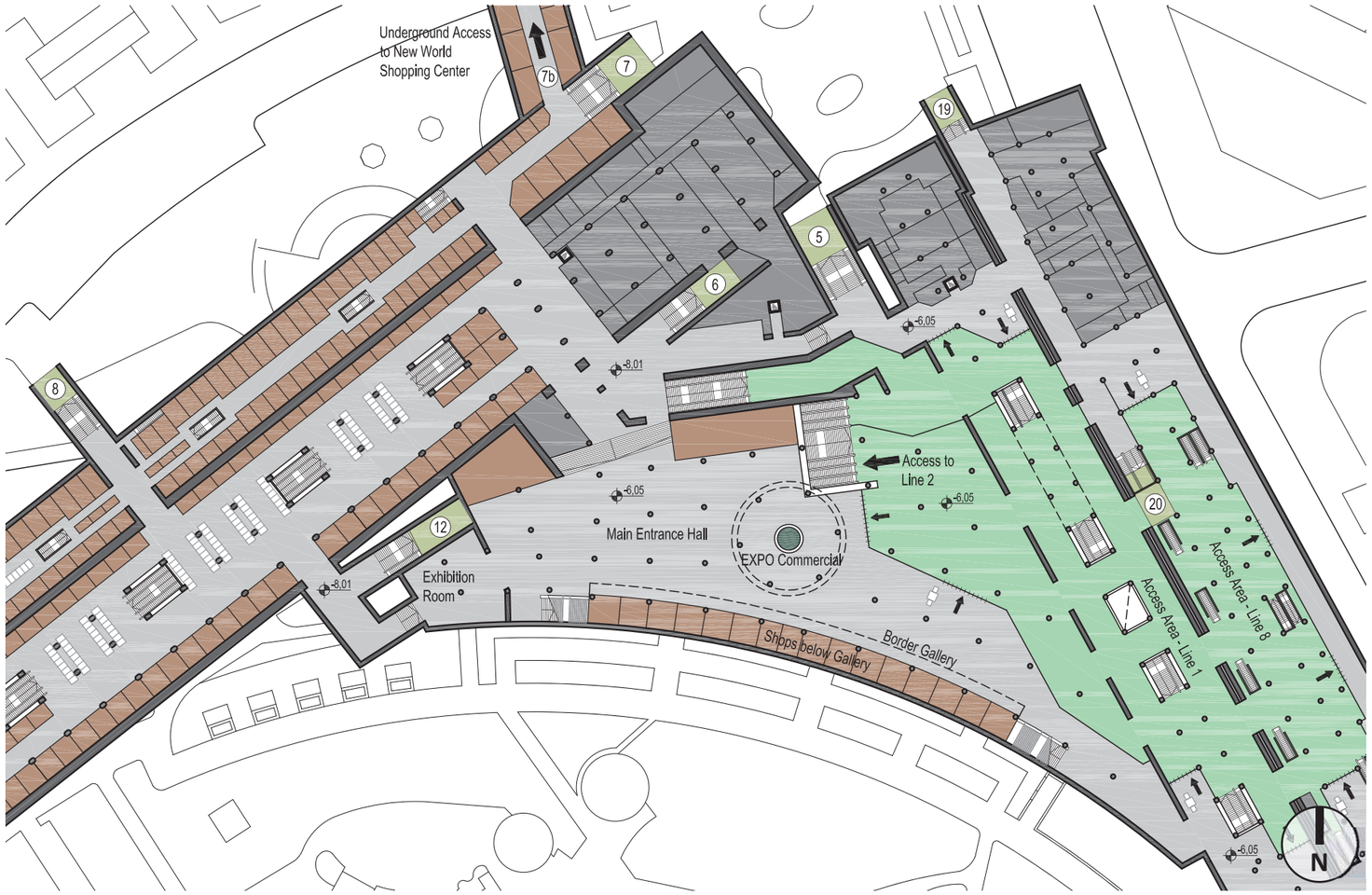


fig. 105_plan - level -1 (detail main entrance hall) m = 1:1000

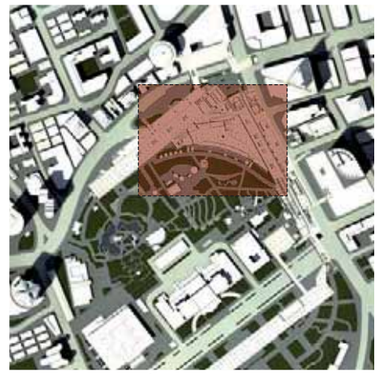


fig. 106_area viewport navigator

- subway entrances / exits
- restricted areas
- semi-public space (only with ticket)
- public space (without ticket)
- shopping areas

The plan to the left shows a close-up of the subway's main entrance hall. The area is centered between the subway access points of line 1, line 2 and line 8, but fails in terms of establishing at least a visual connection between Renmin Park and the underground subway area.

The circular glass frame above the EXPO commercial spot is the only vertical connection to the roof garden above. A gallery unnecessarily connects the park level with the subway area, symbolizing a gray space without any special function.

1.3 area overview

subway area (level -1)_detail main entrance hall

fig. 107_north underground market [1]

fig. 108_main entrance hall [2]

fig. 109_gallery main entrance hall [3]

fig. 110_access area line 1 and 8 [4]

fig. 111_underground area viewport navigator

fig. 112_rendering main entrance hall_1

fig. 113_rendering main entrance hall_2

1.3 area overview

subway area (level -2)

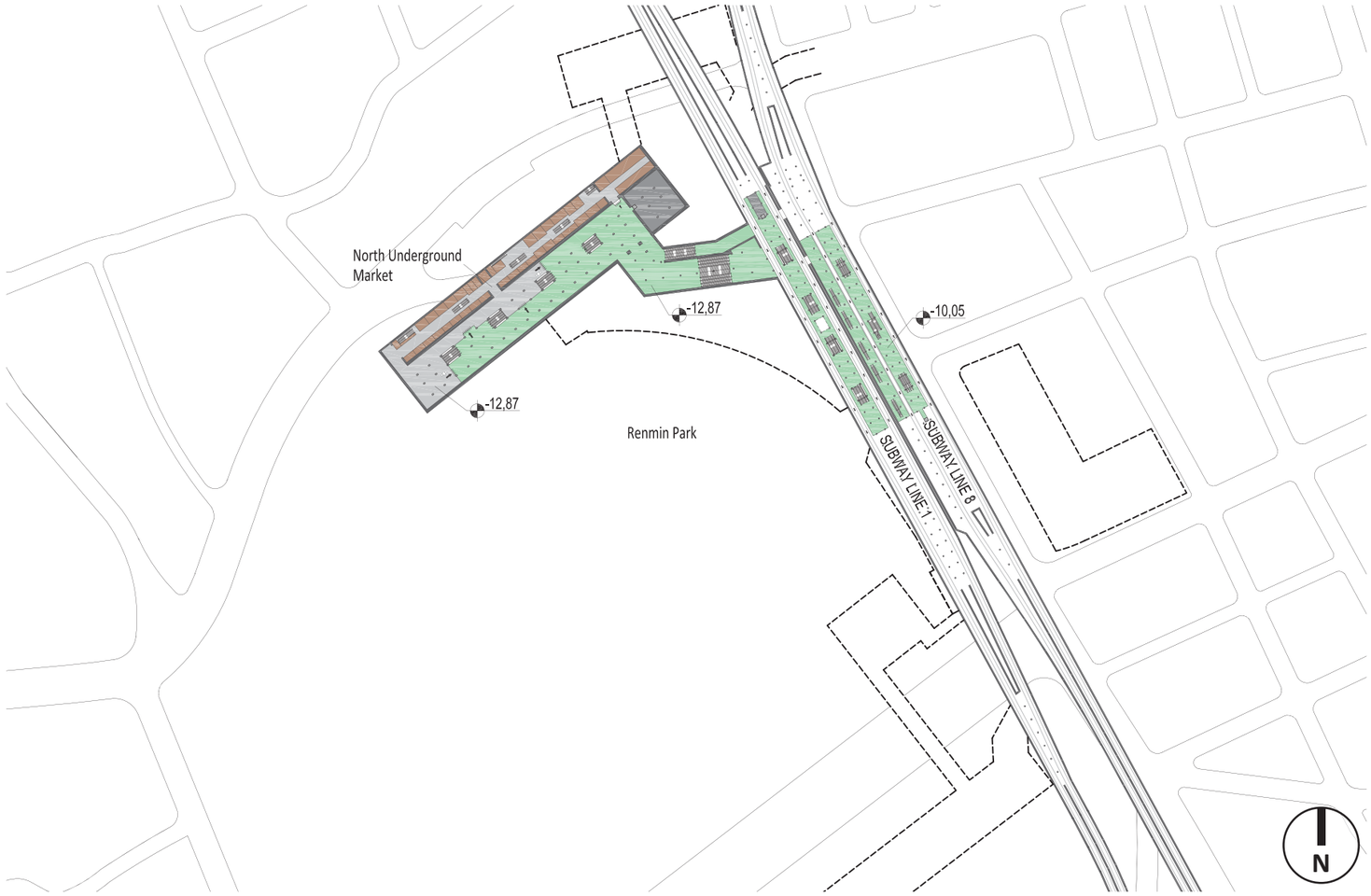


fig. 114_plan - level -2 m = 1:3000

fig. 115_area viewport navigator

- subway entrances / exits
- restricted areas
- semi-public space (only with ticket)
- public space (without ticket)
- shopping areas

Level -2 consists of the access platforms of subway line 1 and 8 and an additional level of the northern underground market with a special focus on selling wedding dresses.

From this shopping area people can directly reach the semi-public space of line 2 which is only accessable with a valid ticket.

1.3 area overview

subway area (level -3)

fig. 116_plan - level -3 m = 1:3000

fig. 117_area viewport navigator

- subway entrances / exits
- restricted areas
- semi-public space (only with ticket)
- public space (without ticket)
- shopping areas

Level -3 is located 17,78 m below Renmin Park and contains the access platform of line 2 which connects the western part of Shanghai with the Pundong Financial District in the east next to Huang Pu River.

Generally, the three subway lines which are interchanging at Renmin Square are very important connections between east and west as well as between north and south. They enhance the area's importance as one of the main traffic interchange hubs in Shanghai.

1.4 specification of Renmin Park area

3D model - zones of special interest

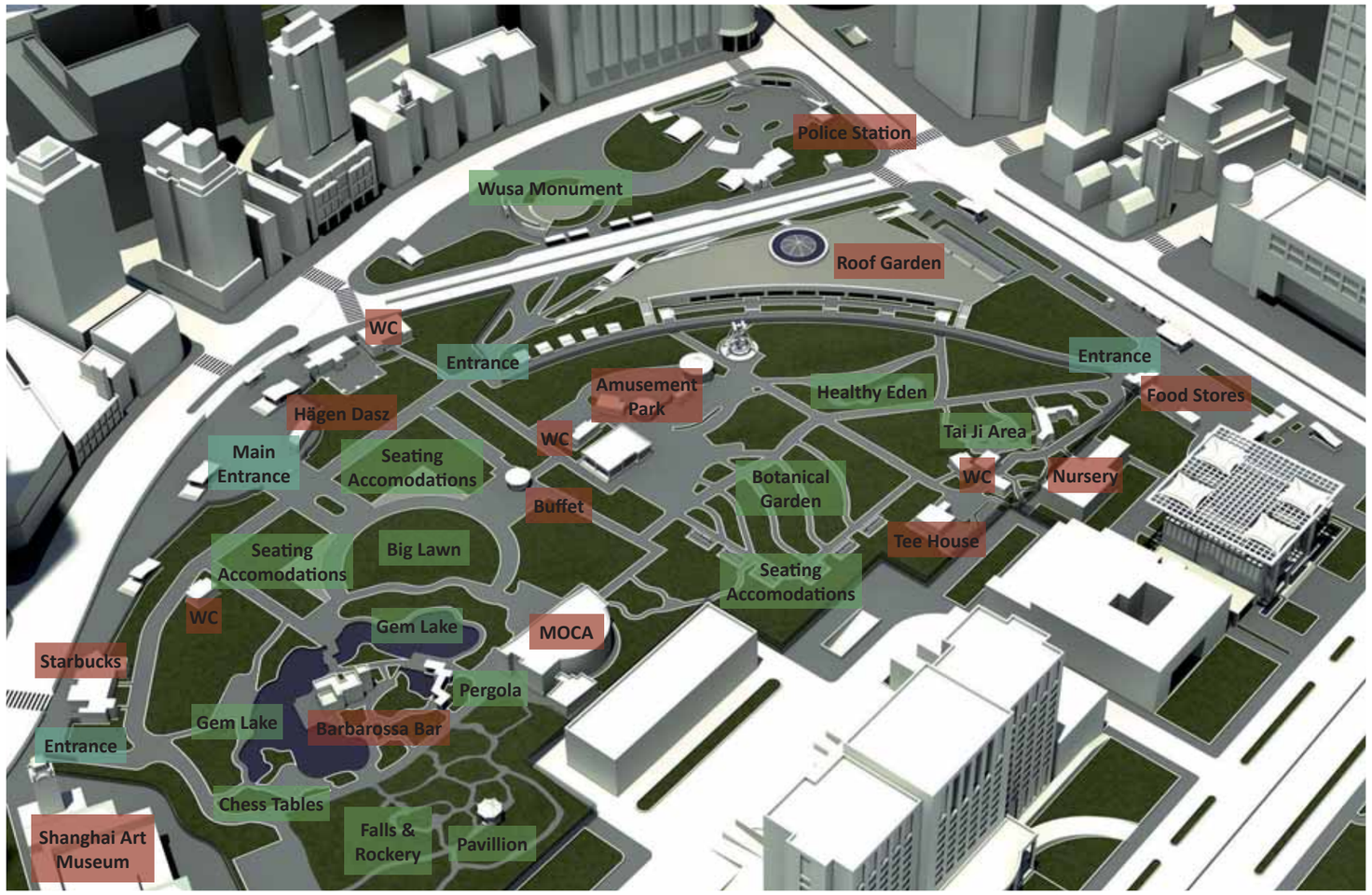


fig. 118_3D diagram - Renmin Park specification

fig. 119_ traditional Chinese Garden areas

fig. 120_problematic space - Botanical Garden

park entrances

fixed structures inside the park

special park areas

The 3D diagram to the left gives an overview of all the different functions of Renmin Park including fixed structures like museums or gastronomy infrastructure and special functions within a certain area like the Tai Ji area in the east.

Figure 119 highlights well working areas designed on the basis of the traditional Chinese garden while figure 120 shows the problematic botanical garden with its loveless appearance.

1.4 specification of Renmin Park Area

special functions

fig. 121_special function - Tai Ji excercises [1]

fig. 122_special function - public entertainment [2]

fig. 123_special function - physical excercises [3]

fig. 124_special function - „marriage market“ [4]

fig. 125_special function - Ma Jong and card games [5]

fig. 126_special function - „cable tennis“ [6]

fig. 127_area viewport navigator - special functions

Besides the regular recreation zones of Renmin Park, several quite interesting special functions are hidden within the area. According to the Chinese philosophy, physical training has a strong relationship to mental fitness. Therefore, it is very common in China to find simple gymnastic machines in nearly every park where people - even if they are very old - are doing their daily excercises.

Tai Ji, an ancient Chinese martial arts form, is a special kind of physical excercise. People of all ages gather to practice this kind of defense training and to profit from its health benefits. Preferred areas for practicing Tai ji are quiet places surrounded by nature.

From a European point of view, the “marriage market“ is maybe one of the most curious special functions of Renmin Square. On weekends parents from all over the city meet each other close to the main entrance of Renmin Park in order to exchange dating profiles of their children.

Public entertainment at certain spots of the park symbolizes the modern China and addresses mostly young people.

1.4 specification of Renmin Park Area

traditional Chinese Garden elements on site

fig. 128_element - pavilion (sketch) [1]

fig. 129_element - pavilion (on site) [1]

fig. 130_element - path (sketch) [2]

fig. 131_element - path (on site) [2]

fig. 132_element - steps (sketch) [3]

fig. 133_element - steps (on site) [3]

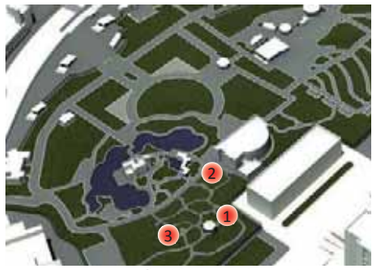


fig. 134_area viewport navigator

In Chinese Gardens humans and nature are equal partners. They are designed accoriding to the Taoist principles of harmony with nature.

For a decent garden design special attentention should be paid on the varying relations between dense and scarse, positive and negative, curvy and straight as well as on high and low. These attributes symbolize a spontaneous irregularity and are the opposite of the European garden symmetries.

The typical octagonal pavilion is very often located at the highest point of the garden. That way visitors can enjoy a perfect view of the wide horizon in all directions.

Paths are the skeleton of a Chinese Garden and their irregular forms support the Taoist principles of harmony with nature.

Rock piles are often used as natural stairs in order to avoid common artifical staircases which are following the Confucian priciple to regulate human society.

1.4 specification of Renmin Park Area

traditional Chinese Garden elements on site

fig. 135_element - bridge (sketch) [4]

fig. 136_element - bridge (on site) [4]

fig. 137_element - recreation platform (sketch) [5]

fig. 138_element - recreation platform (on site) [5]

fig. 139_element - plants - lotus (sketch) [6]

fig. 140_element - plants - lotus (on site) [6]

fig. 141_area viewport navigator

The Taoism speaks from a fundamental unity of all things which can be interpreted as an escape from Cofucian control.

In the Taoism a human being is not the measure of all things but an inseperable part of the great universe in which he exists.

Bridges in Chinese Gardens mark the crossing of the three dimensions - water, land and sky. They should not conquer the water, but draw attention on and embellish natural scenes.

A waterside recreation platform is a vital architectural element, allowing visitors to appreciate beautiful views and the important element of water, which is reflecting the colors of its surrounding environment.

Plants help to split the garden into different zones and vary the height of the topography. Density and height, as well as the relationship between flowers and trees provide flexibility in using space

1.5 areas of urban influence
south-east direction

fig. 142_3D overview - urban influences south-east


fig. 143_Raffle's City Shopping Center


fig. 144_Fuzhou Road - shopping area


fig. 145_Shanghai National Museum - park area

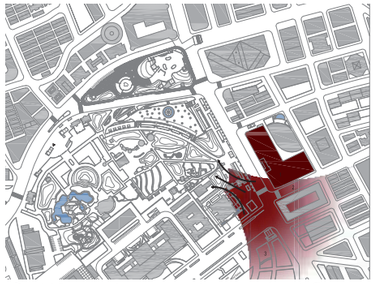


fig. 146_area viewport navigator - urban influences

Renmin Square is surrounded by different urban influences which generate certain spaces of high human density within the areas above ground as well as the subway system below.

Marked with No.1 in the visualization to the the left, Raffle's City Shopping Center is probably one of the most crouded shopping areas in Shanghai. The building is directly linked to the subway system via entrance No. 15 b and is therefore one of the main reasons for the high human density around Renmin Square during the rush hours.

Additionally to the Raffle's City Center, Renmin Square area is influenced by the shopping areas on Fuzhou Road and the recration zones accross Renmin Avenue in front of the Shanghai National Museum, where people have direct access to the subway system via entrance Nr. 1 and the south underground market.

1.5 areas of urban influence

north-east direction

fig. 147_3D overview - urban influences north-east

fig. 148_New World Shopping Center

fig. 149_Orient Shopping Mall

fig. 150_West Nanjing Road pedestrian area

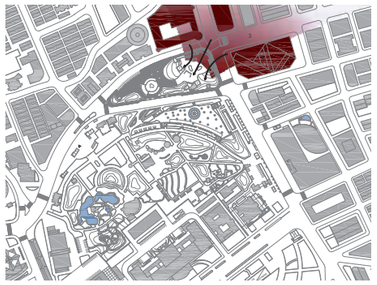


fig. 151_area viewport navigator - urban influences

fig. 152_Shimao Tower

The north-east area of Renmin Square is mainly influenced both by the New World Shopping Mall which has, similar to the Raffle's City Center, a direct link to the underground system and by East Nanjing Road pedestrian area which connects the bund with Renmin Square.

The road is the number-one spot for high quality shopping in Shanghai and is therefore one of the most crowded places in the entire city. An underground passage links the pedestrian area with the island and causes high human density around its subway entrances.

1.5 areas of urban influence

north direction

fig. 153_3D overview - urban influences north

fig. 154_Park Hotel

fig. 155_Grand Hotel

fig. 156_Commercial Bank

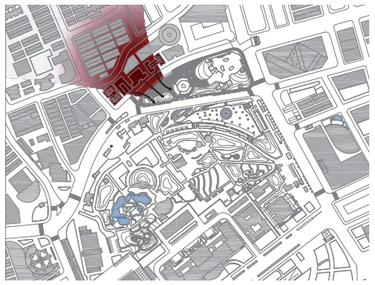


fig. 157_area viewport navigator - urban influences

fig. 158_National Bank

One of the main reasons for high human density at the northern periphery of Renmin Square is the very famous Park Hotel (marked with No. 1).

Built in 1934 and designed by the Hungarian architect Ladislav Hudec, it is a prime example of Art Deco architecture. Until 1952 it was the tallest building in Asia counting 22 floors / 84 m (275 ft). It remained the tallest building in China until 1966 and in Shanghai until 1983.[10]

1.5 areas of urban influence

north-west direction

fig. 159_3D overview - urban influences north-west

fig. 160_Marriott Hotel

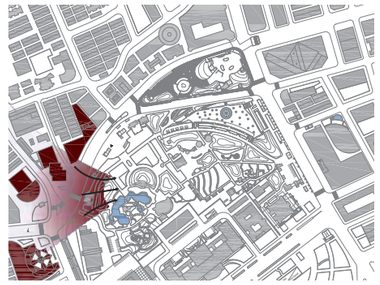


fig. 163_area viewport navigator - urban influences

fig. 161_Mercedes Headquarters

fig. 164_Grand Cinema

fig. 162_Porsche Headquarters

The north-west margin of Renmin Square is dominated by tall skyscrapers, including the rocket-like futuristic Tomorrow Square Tower with its five star Marriott Hotel and the Mercedes Benz and Porsche Headquarters.

The Grand Cinema (marked with No. 4) is one of the oldest cinemas in town and therefore an important historical monument of Shanghai.

1.5 areas of urban influence
south-west direction

fig. 165_3D overview - urban influences south-west


fig. 166_Museum of Contemporary Arts


fig. 167_Barbarossa Cocktail Bar


fig. 168_Shanghai Art Museum

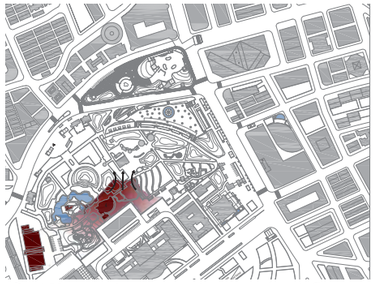


fig. 169_area viewport navigator - urban influences

The south-west area of Renmin Square contains three spots of urban influence within the boarders of Renmin Park.

The Museum of Contemporary Arts (marked with No. 1) focuses on Chinese contemporary art and discusses the art's directions and tendencies within a broad scope.[11]

The Barbarossa Bar (No. 2) is one of the main icons of Shanghai's nightlife. The Moroccan-styled lounge is located in the middle of a pond within the Chinese Garden of People's Park. It attracts a glamorous crowd to its three floors for cocktails, dinner, DJs, and its serene, oasis atmosphere.[12]

In the past, the Shanghai Art Museum (No. 3) was the former clubhouse of the Shanghai Racing Club. Today, it is the home of the very famous art gallery and stands adjacent to People's Square. Located on top of the museum is Kathleen's 5, a well-known restaurant in the city.[13]

1.6 résumé

The fact that neither the government of Shanghai nor the subway operating company supported us with any detailed information about the area during our one-month research stay in China, forced us to examine the site and its urban environment on our own in an extremly detailed way.

Drawing all the plans by ourselves and building a complete three dimensional model of the area, which was mainly based on our own measurements on site, helped us to elaborate the essential parameters for the specific site analysis (see chapter II). The following two facts caught our special interest and were described in more detail.

On the one hand we have Shanghai‘s subway system, which is due to the city‘s constant expansion, probably one of the most complex traffic systems in the world. The fact that the subway station of Renmin Square is located in the very center of the city and contains three different lines, converts the site into one of the main traffic interchange areas of the city.

On the other hand we have Renmin Park, Shanghai‘s symbol of a “green city“, and one of the largest outdoor leasure zones. We also put special emphasis on the Chinese garden within the park, as Taoistic gardens suppose a form of recreation in China. The research on Chinese traditions not only gave us philosophical background information but also interesting facts about certain elements of Chinese landscape architecture.

If we combine those two parameters - the high human density due to heavy traffic and the silent recreation areas of the park - the site becomes very unique in terms of hybrid architecture.

In the end, all these difficult circumstances actually helped us to fully understand the different sociological layers of Renmin Square as well as its architectural and structural system and its continously changing urban relation to the city over the last century.

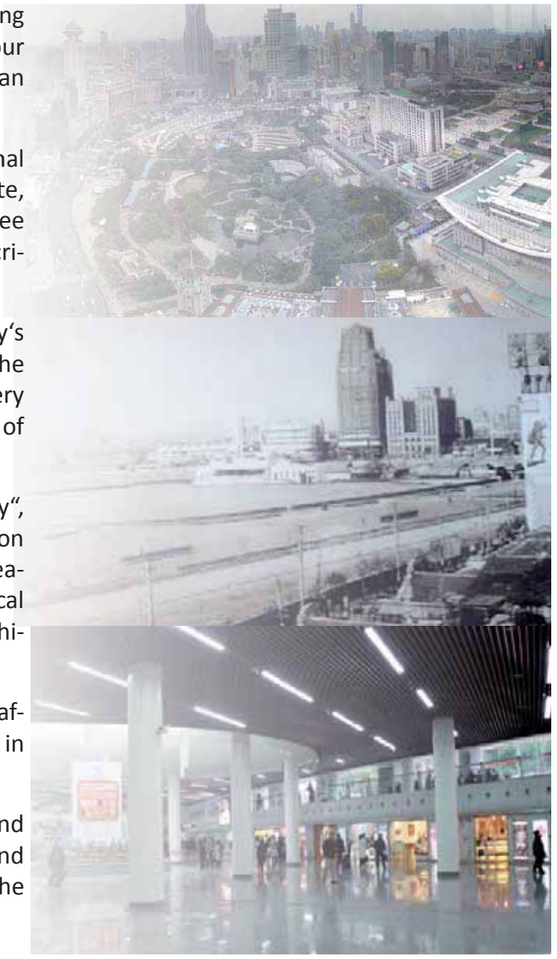


fig. 170_resume - chapter I

CHAPTER II - SPECIFIC SITE ANALYSIS

This chapter mainly deals with the accessibility and connectivity of the subway system to its surrounding environment. Based on the research on site we started to develop mind maps in order to approximate the various densities of the site‘s circulation paths.

A permeability diagram helped us to understand the linear connectivities between traffic system, park area and the urban environment in order to visualize the different types of connections within the urban network.

A special focus lies on the combination of two dimensional and three dimensional diagrams so as to visualize the collected data without any distortion on the one hand and in spatial relation to the city‘s context on the other hand.

Besides the acoustic measurement of important areas on and around Renmin Square, the pedestrian frequencies at the subway entrances/exits were one of our main focal points.

The additional analysis of the subway station “Karlsplatz“ in Vienna shows the huge differencies between Austria and China in terms of human density within a traffic system.

2.1 connectivity & accessibility in the urban network

general principle of the urban network

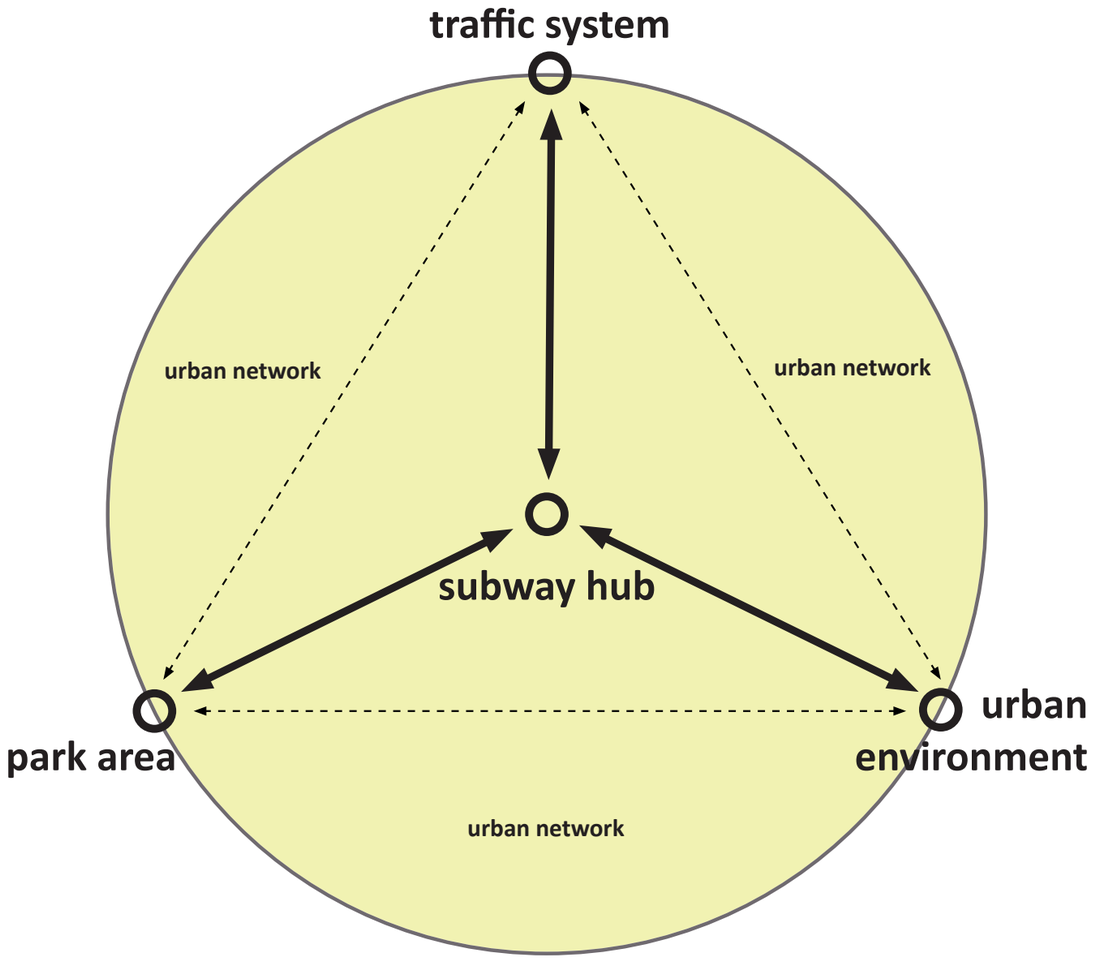


fig. 171_general priciple of the urban network

Discovering and anlysing the disadvantages of the current circulation system is a special focus of the specific site analysis.

Urban barriers and architectural mistakes cause a lack of connectivity and efficient accessibility of the subway hub on Renmin Square to its surrounding environmental systems. The diagram to the left shows our interpretation of a homogenous connection between important factors within the urban network.

In our opinion the subway hub is the central knot of the local urban network around Renmin Square, with hierarchically equal connections to the global traffic system, the surrounding urban environment and the leisure areas of Renmin Park.

2.1 connectivity & accessibility in the urban network

permeability diagram

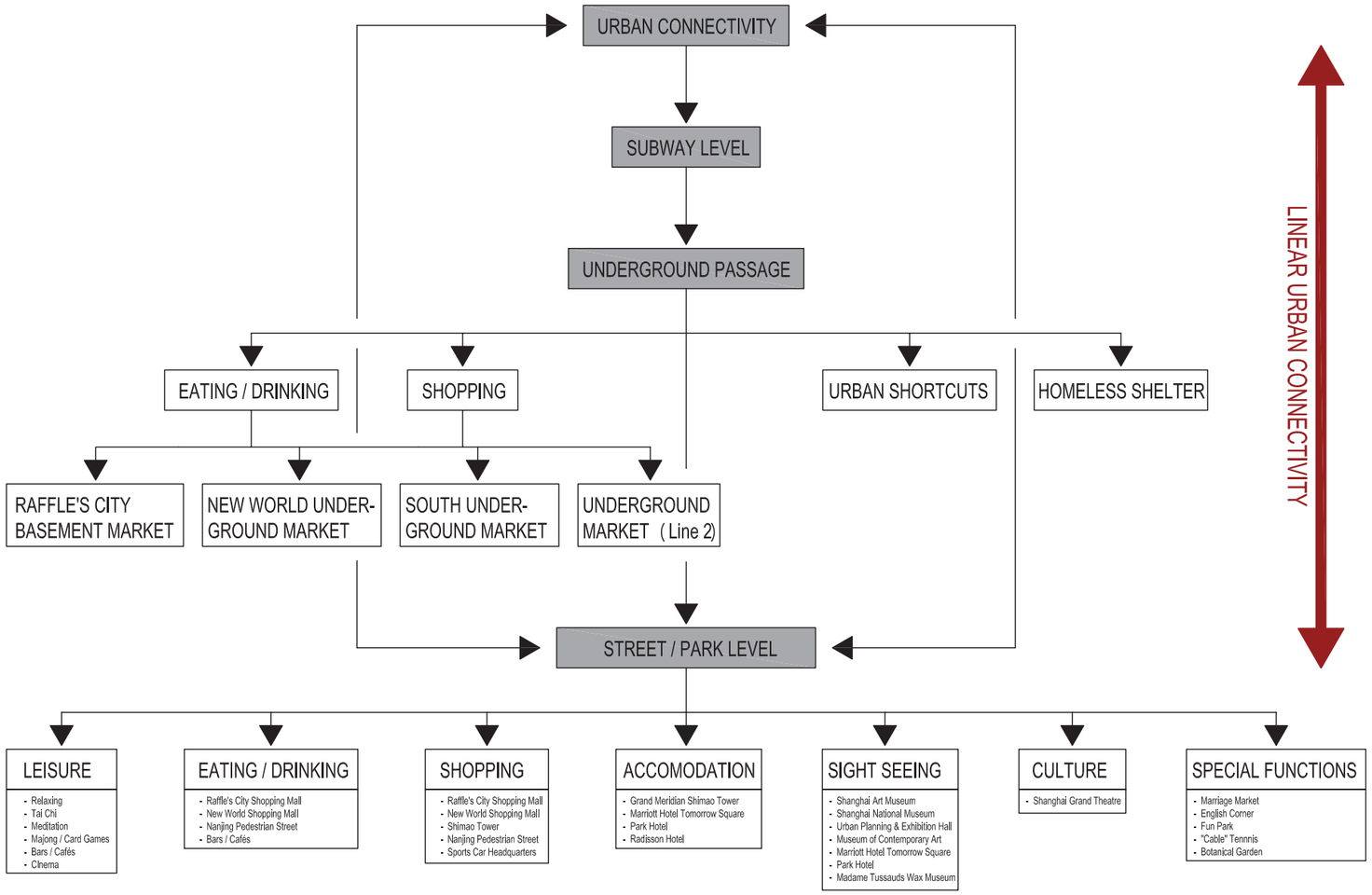


fig. 172_permeability diagram of the current situation

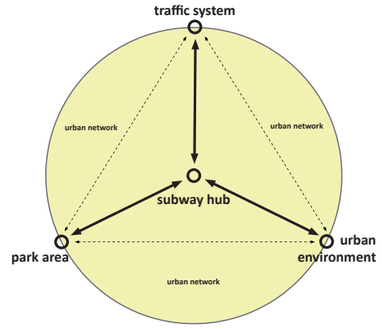


fig. 171_general priciple of the urban network

A permeability diagram is, in terms of architecture, a tool to analyze the grade of linear accessibility between different spaces within a closed system.

In this special case, the diagram visualizes the spatial sequence of a person who reaches Renmin Square by the subway and walks from the underground level up to the street/park level in order to get access to urban functions like sightseeing or shopping areas.

We speak of a linear urban connectivity because there are no interconnections between the urban functions above ground and the actual subway access areas.

2.1 connectivity & accessibility in the urban network

mind map - flow diagram of the pedestrian movement

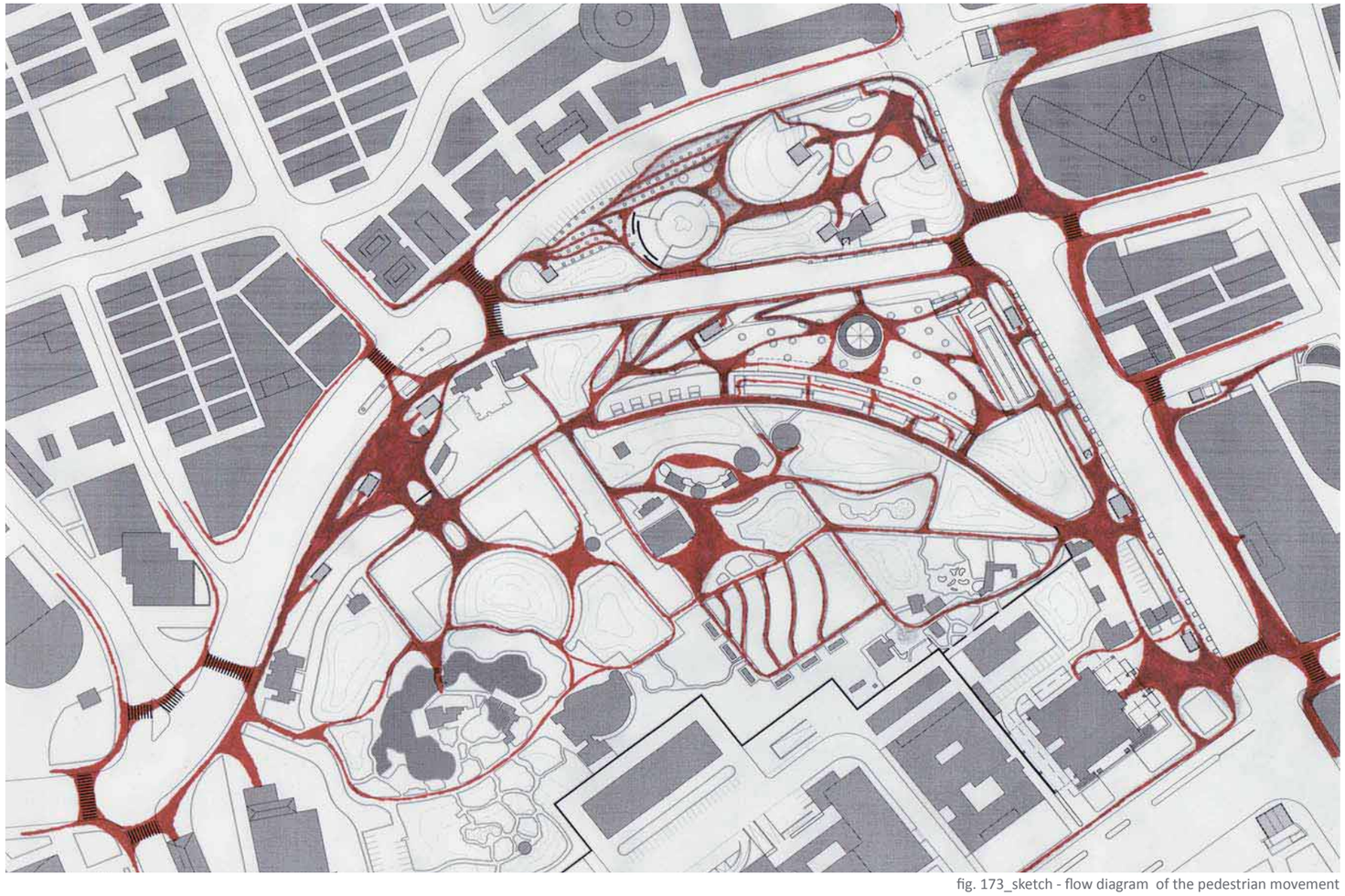


fig. 173_sketch - flow diagram of the pedestrian movement

fig. 174_sketch book - subway entrance frequencies

The mind map to the left was drawn on site to visualize our intuitive interpretation of the different densities within the pedestrian circulation system of Renmin Square area.

The diagram is based on local observations and reflects our first impression of the site's connectivity.

It is significant that the previously analyzed areas of urban influence strongly affect the grade of density at the crossways and underground passages which connect the surrounding environment with Renmin Square.

2.1 connectivity & accessibility in the urban network

urban barriers

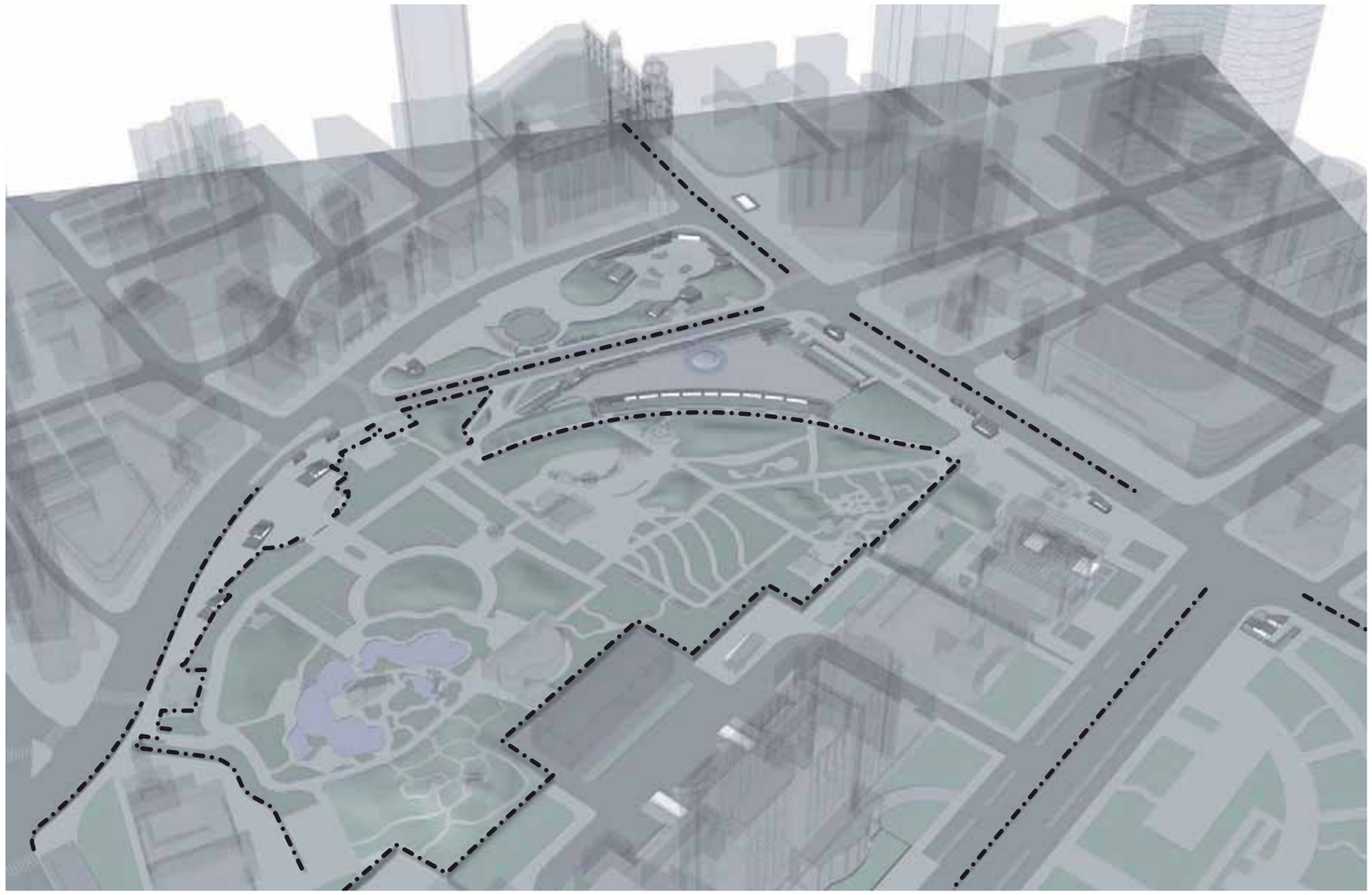


fig. 175_3D diagram - urban barriers

fig. 176_barrier West Nanjing Road

fig. 177_barrier Renmin Park

urban barriers

Although it is dangerous, it is very common in China that people cross even heavily frequented roads when and wherever they can.

In order to prevent people from doing this, main roads are separated with fences at their medial strip.

For safety reasons Renmin Park is also surrounded by fences and walls.

2.1 connectivity & accessibility in the urban network

main connections to the site

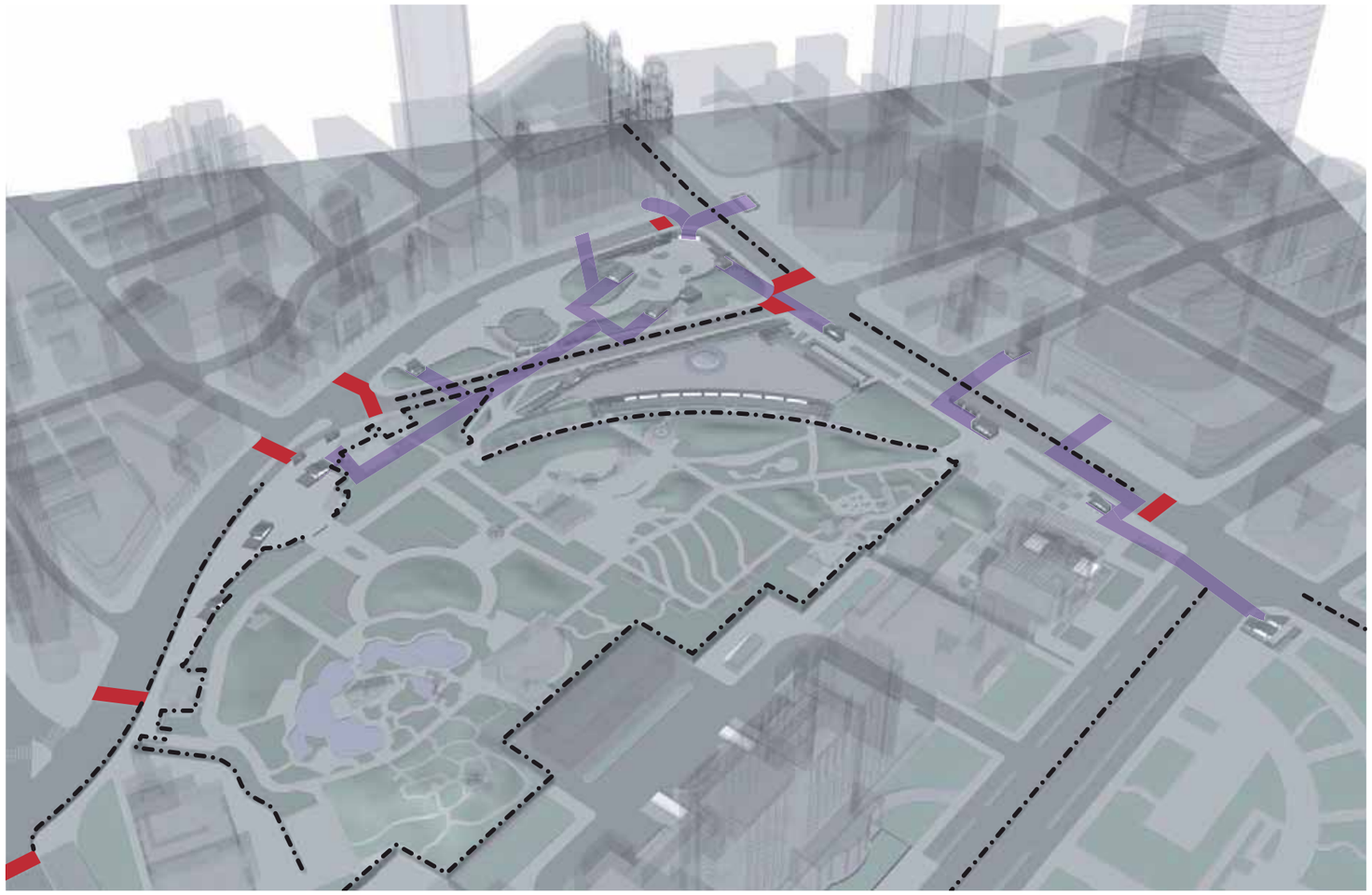


fig. 178_3D diagram - main connections to the site

fig. 179_crosswalks at Middle Xizang Raod

fig. 180_underground passage

connections above ground (crosswalks)

underground connections

urban barriers

The diagram to the left shows the crosswalks which connect Renmin Square with the urban environment above ground as well as the underground passages, which mostly lead to the basement levels of important shopping facilities.

2.1 connectivity & accessibility in the urban network

park entrances

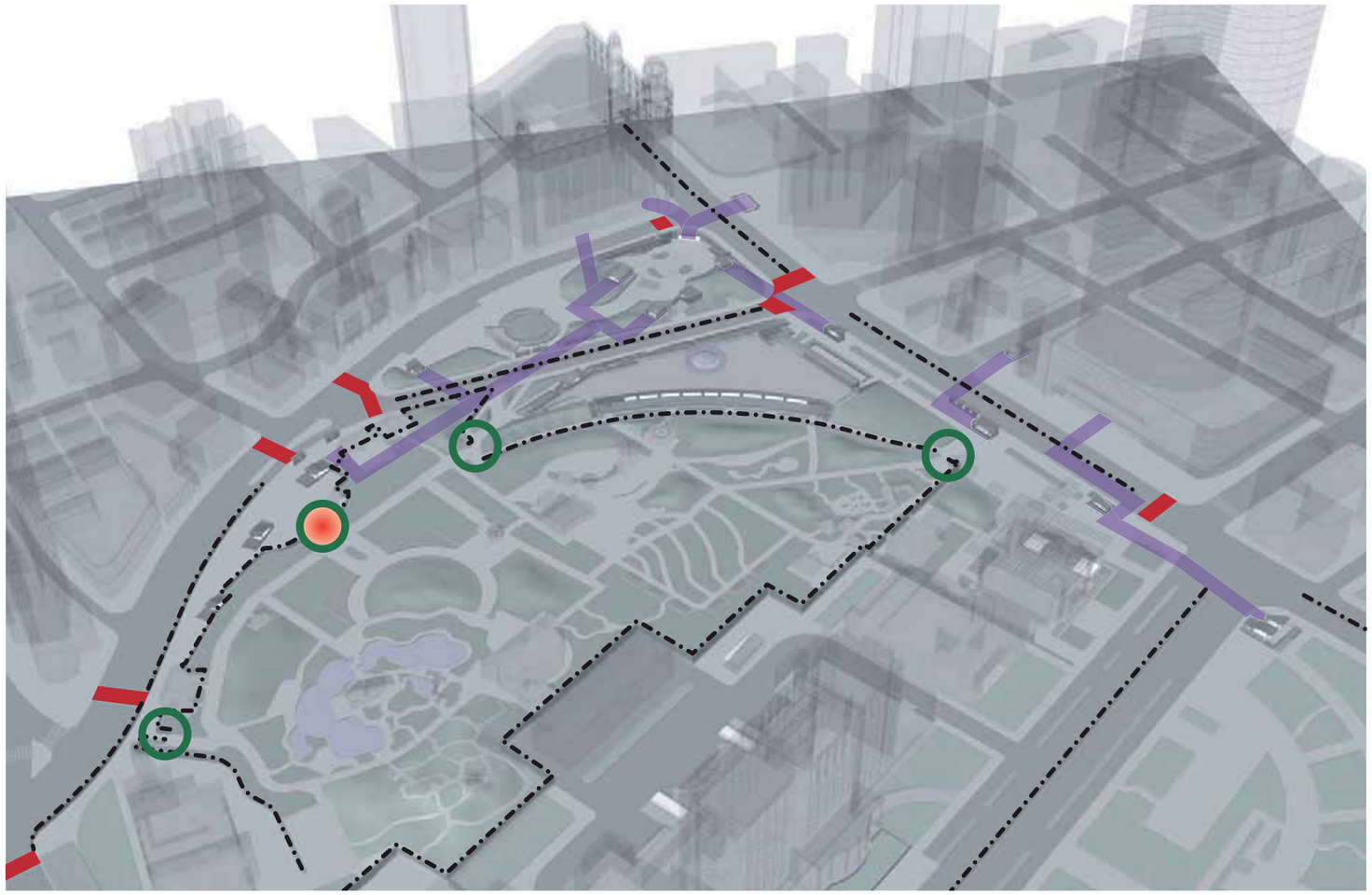


fig. 181_3D diagram - park entrances

fig. 182_park entrance at the Shanghai Art Museum

fig. 183_park entrance near the subway hub

entrances to the park / main entrance

connections above ground (crosswalks)

underground connections

urban barriers

Theoretically, Renmin Park is open to the public from 6 a.m. to 6 p.m. although the entrance next to the Shanghai Art Museum is never closed - not even at night - in order to guarantee access to the Barbarossa Bar inside the park at.

Until a few years ago, people had to pay an entrance fee to access the park's recreation areas.

2.1 connectivity & accessibility in the urban network

access points to the main subway hub

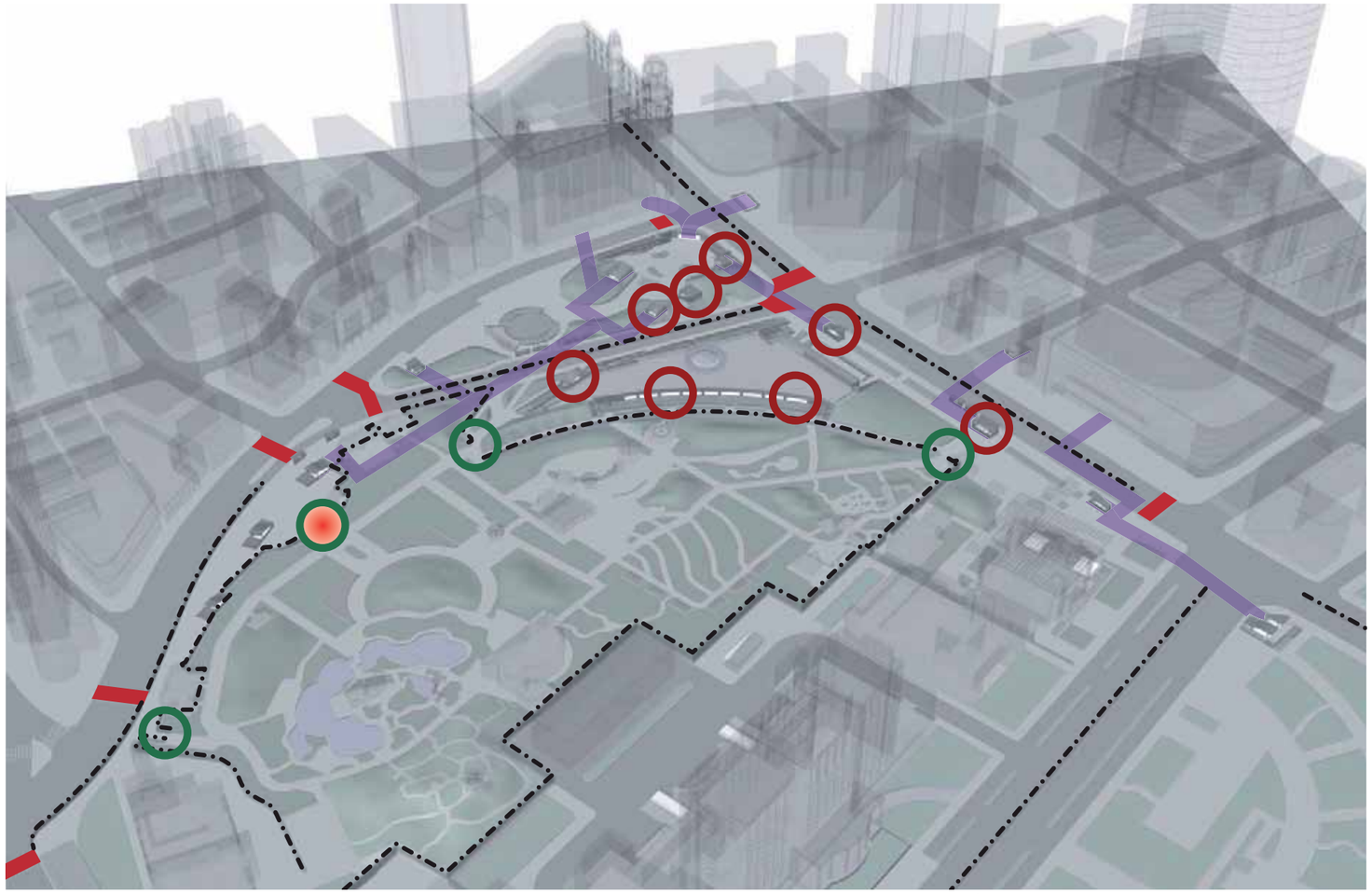


fig. 184_3D diagram - access points to the main subway hub

fig. 185_subway entrance No. 19

fig. 186_subway entrance No. 18

entrances to underground subway hub

entrances to the park / main entrance

connections above ground (crosswalks)

underground connections

urban barriers

The diagram to the left shows the entrances to the main subway hub area. Due to the hub's important role in the urban network, we consider the location of these access points very important for the further design process.

2.1 connectivity & accessibility in the urban network
access points to the public transportation system

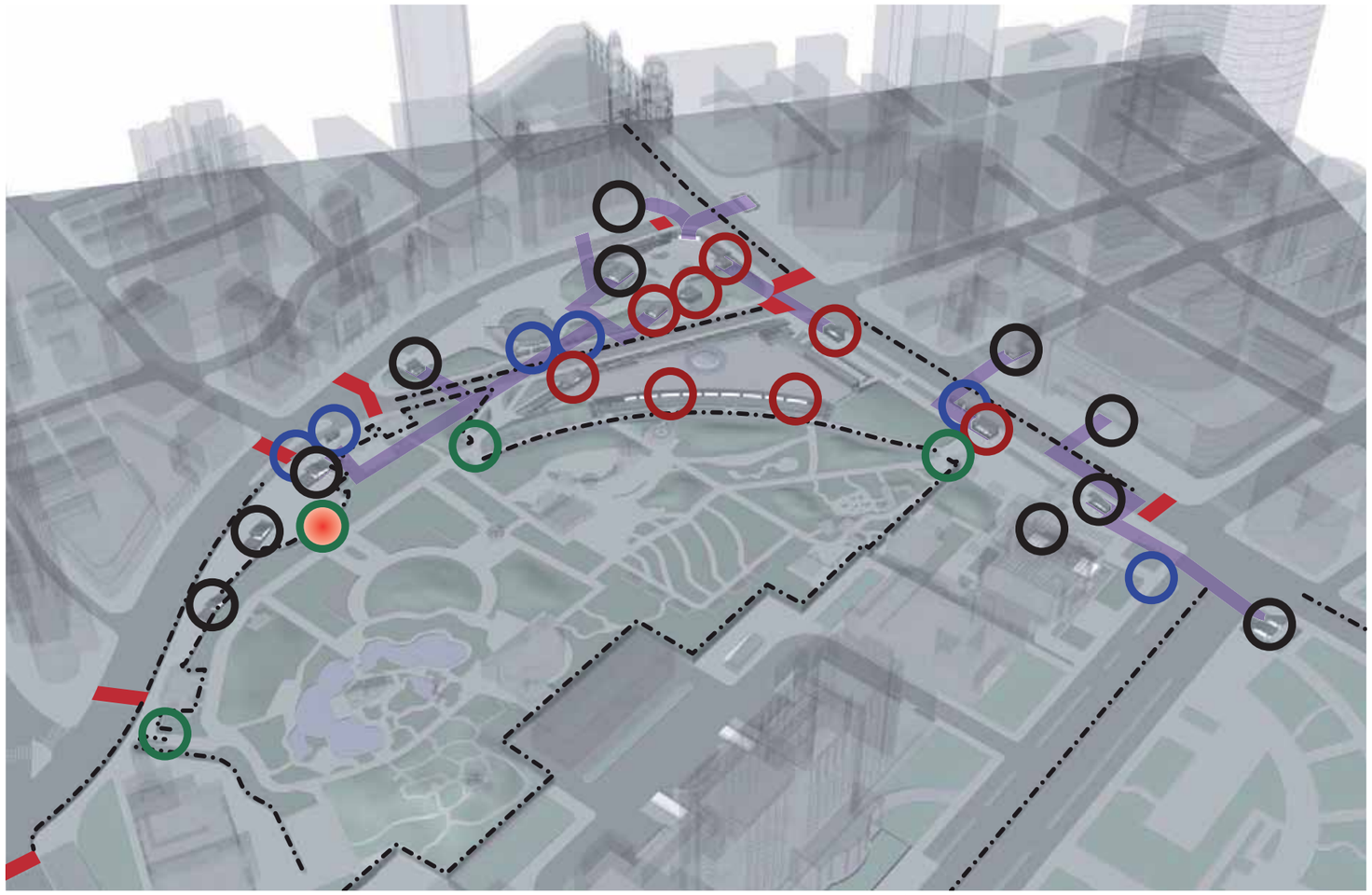


fig. 187_3D diagram - access points to the public transportation system

fig. 188_subway entrance No. 07

fig. 189_bus station West Nanjing Road

- entrances to underground subway hub
- entrances to underground level
- bus stations
- entrances to the park / main entrance
- connections above ground (crosswalks)
- underground connections
- urban barriers

2.2 subway entrance frequency

collected data

Frequency counting interval:
10 minutes

Counting period:
01:00 - 03:00 p.m. (working day)

The intensity value refers to the total amount of people.

SUBWAY STATION RENMIN SQUARE (SHANGHAI, CHINA)

Exit	Entrance Geometry		Frequency Inside		Frequency Outside		Persons	Persons / Minute	Intensity [%]
	Width [m]	Height [m]	Persons	Intensity [%]	Persons	Intensity [%]			
1 (Middle Xizang Lu)	11,60	3,80	302	11,85%	219	10,72%	521	52,1	11,35%
1b (Hong Kong Mall Street)	4,60	3,30	6	0,24%	7	0,34%	13	1,3	0,28%
2 (Urban Planning Museum)	2,60	7,30	85	3,33%	85	4,16%	170	17	3,70%
3 (Middle Xizang Lu)	3,90	3,60	189	7,41%	53	2,60%	242	24,2	5,27%
5 (West Nanjing Lu)	7,40	4,00	14	0,55%	6	0,29%	20	2	0,44%
6 (West Nanjing Lu)	5,10	4,10	166	6,51%	76	3,72%	242	24,2	5,27%
7 (West Nanjing Lu)	7,00	4,50	219	8,59%	98	4,80%	317	31,7	6,90%
7b (New World)	4,80	2,60	74	2,90%	92	4,51%	166	16,6	3,62%
8 (West Nanjing Lu)	5,10	3,70	48	1,88%	61	2,99%	109	10,9	2,37%
9 (West Nanjing Lu)	5,50	3,60	73	2,86%	108	5,29%	181	18,1	3,94%
10 (West Nanjing Lu)	5,00	3,50	5	0,20%	12	0,59%	17	1,7	0,37%
11 (West Nanjing Lu)	3,40	3,60	86	3,37%	83	4,06%	169	16,9	3,68%
12 (West Nanjing Lu)	5,20	3,50	7	0,27%	10	0,49%	17	1,7	0,37%
14 (Hankou Lu)	4,30	3,60	126	4,94%	137	6,71%	263	26,3	5,73%
15 (Fuzhou Lu)	4,20	4,00	173	6,79%	226	11,07%	399	39,9	8,69%
15b (Raffles City)	4,80	3,00	276	10,83%	312	15,28%	588	58,8	12,81%
16 (Middle Xizang Lu)	7,20	3,30	78	3,06%	60	2,94%	138	13,8	3,01%
17 (People's Park)	4,50	2,20	5	0,20%	54	2,64%	59	5,9	1,29%
18 (People's Park)	4,50	2,20	3	0,12%	32	1,57%	35	3,5	0,76%
19 (West Nanjing Lu)	4,70	3,60	574	22,52%	294	14,40%	868	86,8	18,91%
20 (Middle Xizang Lu)	5,20	3,30	40	1,57%	17	0,83%	57	5,7	1,24%
	Ø 5,27	**Ø 3,63**	**2549**	**100,00%**	**2042**	**100,00%**	**4591**	**459,1**	**100,00%**

fig. 190_spread sheet - human frequencies

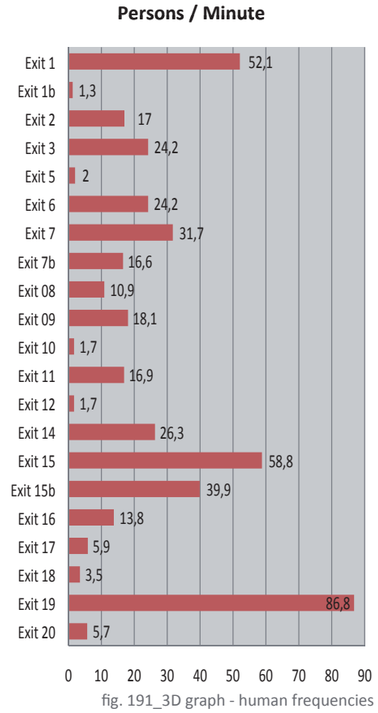


fig. 191_3D graph - human frequencies

2.2 subway entrance frequency

2D diagram - connectivity above ground (urban environment --> traffic system)

fig. 192_2D diagram - subway entrance frequency above ground

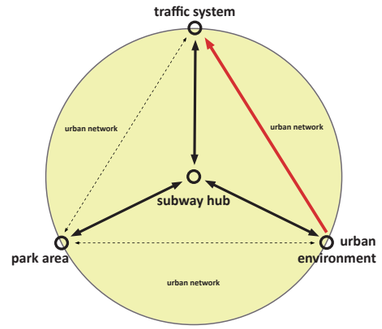


fig. 171_ general priciple of the urban network

- connection to underground subway hub
- entrances to underground subway hub
- connection to underground level
- entrances to underground level
- subway hub
- urban barriers

The diagram to the left analyzes the specific connection between the urban environment and the traffic system.

It indicates the shortest pathways to the subway hub entrances and to the other access points at underground level, considering crossways and urban barriers on Renmin Square.

The specific pedestrian frequencies at the entrances were not included in this illustration, but they can be retrieved from the diagram‘s 3D interpretation on-following page.

2.2 subway entrance frequency

3D diagram - connectivity above ground (urban environment --> traffic system)

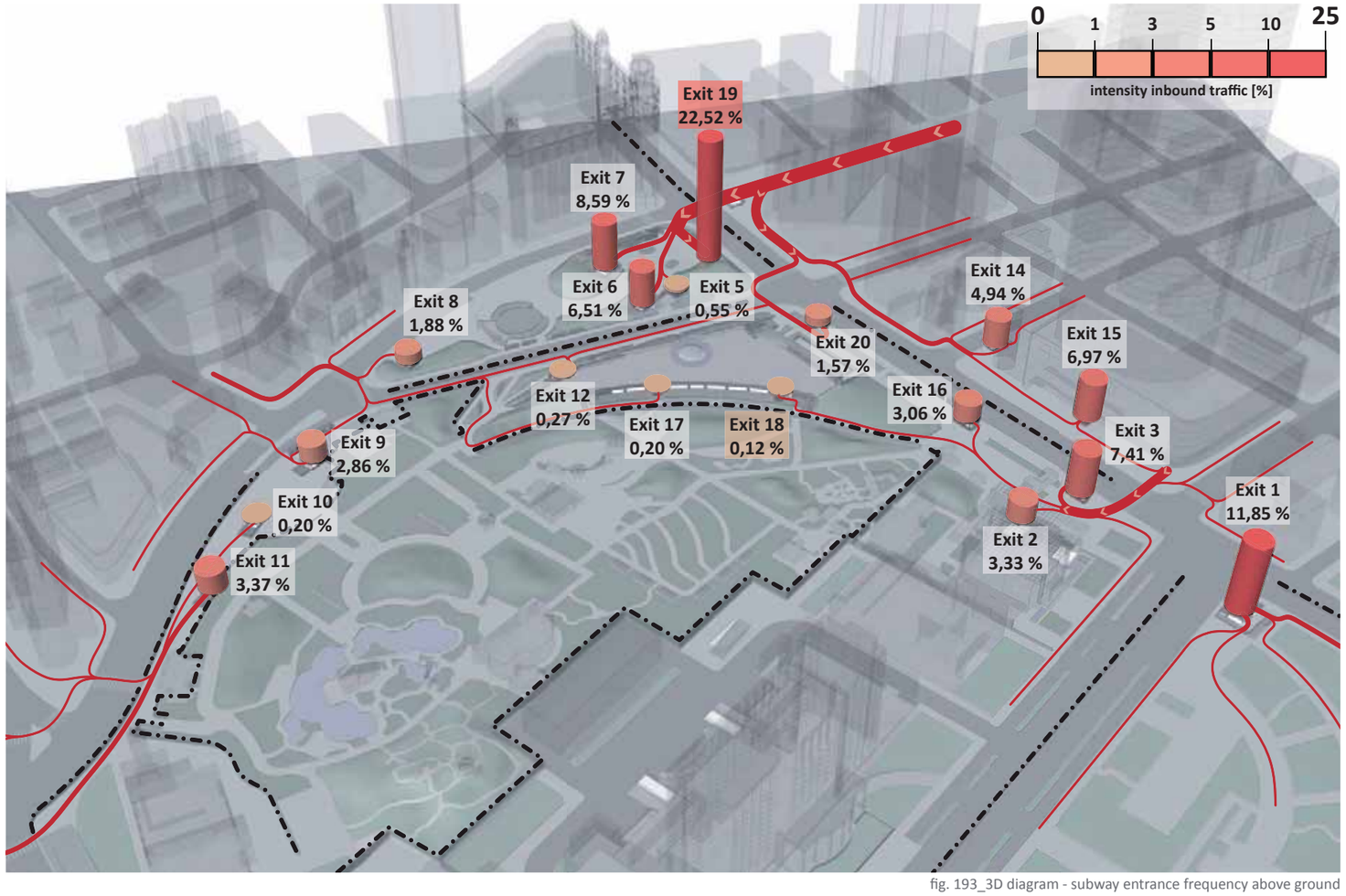


fig. 193_3D diagram - subway entrance frequency above ground

DIAGRAM DATA		
Exit	Frequency Inside	
	Inbound	Intensity %
1 (Middle Xizang Lu)	302	11,85%
2 (Urban Planning Museum)	85	3,33%
3 (Middle Xizang Lu)	189	7,41%
5 (West Nanjing Lu)	14	0,55%
6 (West Nanjing Lu)	166	6,51%
7 (West Nanjing Lu)	219	8,59%
8 (West Nanjing Lu)	48	1,88%
9 (West Nanjing Lu)	73	2,86%
10 (West Nanjing Lu)	5	0,20%
11 (West Nanjing Lu)	86	3,37%
12 (West Nanjing Lu)	7	0,27%
14 (Hankou Lu)	126	4,94%
15 (Fuzhou Lu)	173	6,79%
16 (Middle Xizang Lu)	78	3,06%
17 (People's Park)	5	0,20%
18 (People's Park)	3	0,12%
19 (West Nanjing Lu)	574	22,52%
20 (Middle Xizang Lu)	40	1,57%
	2193	86,03%

urban barriers

RANKED DATA		
Exit	Frequency Inside	
	Inbound	Intensity %
18 (People's Park)	35	0,12%
10 (West Nanjing Lu)	59	0,20%
17 (People's Park)	59	0,20%
12 (West Nanjing Lu)	83	0,27%
5 (West Nanjing Lu)	165	0,55%
20 (Middle Xizang Lu)	472	1,57%
8 (West Nanjing Lu)	566	1,88%
9 (West Nanjing Lu)	861	2,86%
16 (Middle Xizang Lu)	920	3,06%
2 (Urban Planning Museum)	1003	3,33%
11 (West Nanjing Lu)	1015	3,37%
14 (Hankou Lu)	1486	4,94%
6 (West Nanjing Lu)	1958	6,51%
15 (Fuzhou Lu)	2041	6,79%
3 (Middle Xizang Lu)	2230	7,41%
7 (West Nanjing Lu)	2584	8,59%
1 (Middle Xizang Lu)	3563	11,85%
19 (West Nanjing Lu)	6772	22,52%

fig. 194_spread sheets - entrance frequencies

2.2 subway entrance frequency

2D diagram - connectivity underground (urban environment --> traffic system)

fig. 195_2D diagram - subway entrance frequency underground

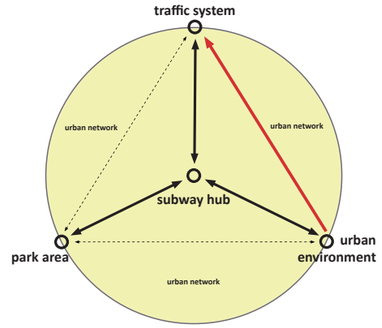


fig. 171_ general priciple of the urban network

connection to underground subway hub

connection to underground level

subway hub

The diagram to the left analyzes the specific connection between the urban environment and the traffic system with a special focus on the connectivity between the entrances and the subway access areas within the underground level.

It indicates the shortest distance between a subway entrance and the access points of semi-public areas which are only accessible with a valid subway ticket.

Constructional barriers and walls have been considered in this diagram; the specific pedestrian frequencies are visualized in the 3D interpretation on the following page.

2.2 subway entrance frequency

3D diagram - connectivity underground (urban environment --> traffic system)

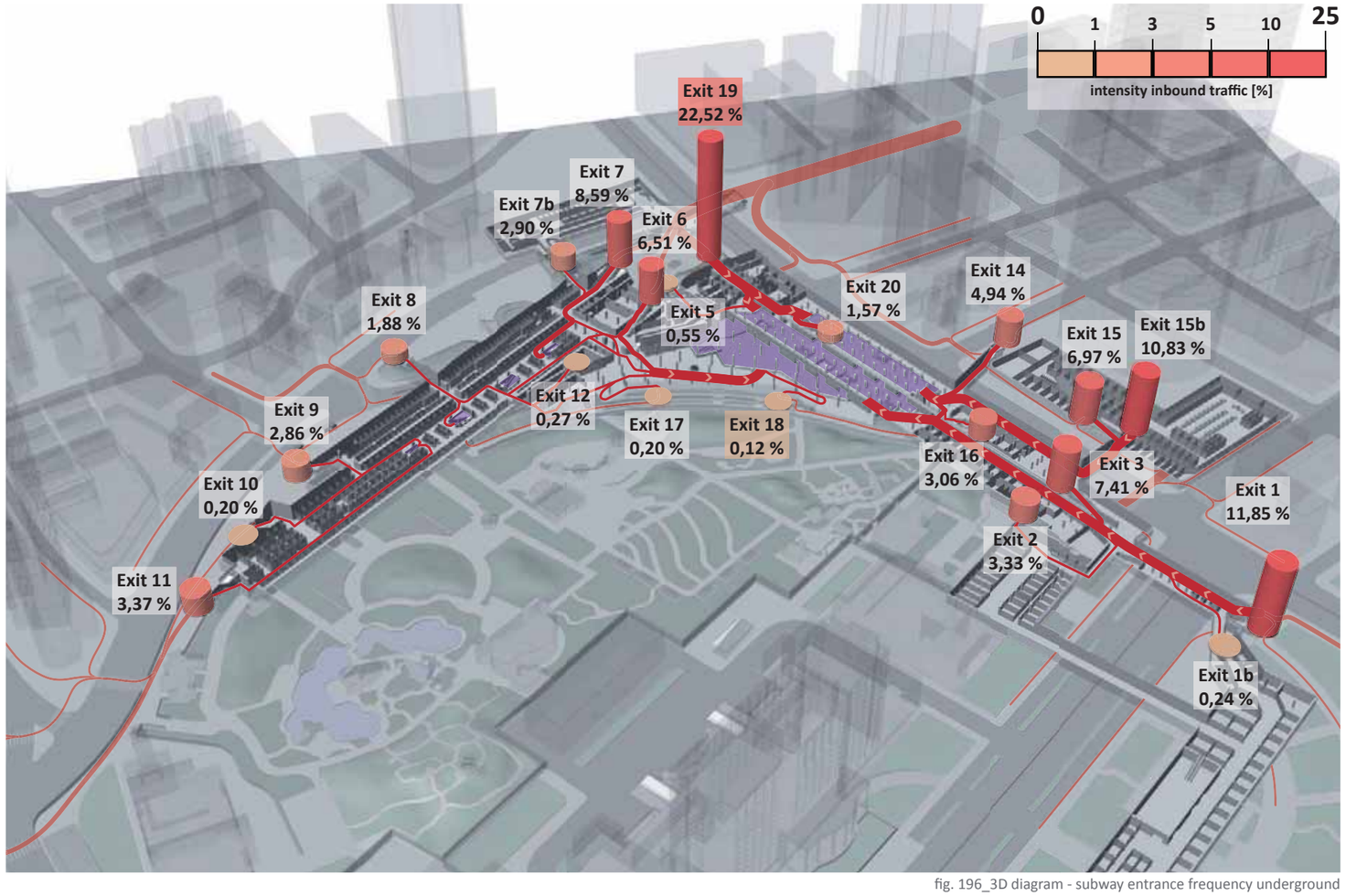


fig. 196_3D diagram - subway entrance frequency underground

DIAGRAM DATA		
Exit	Frequency Inside	
	Inbound	Intensity %
1 (Middle Xizang Lu)	302	11,85%
1b (Hong Kong Mall Street)	6	0,24%
2 (Urban Planning Museum)	85	3,33%
3 (Middle Xizang Lu)	189	7,41%
5 (West Nanjing Lu)	14	0,55%
6 (West Nanjing Lu)	166	6,51%
7 (West Nanjing Lu)	219	8,59%
7b (New World)	74	2,90%
8 (West Nanjing Lu)	48	1,88%
9 (West Nanjing Lu)	73	2,86%
10 (West Nanjing Lu)	5	0,20%
11 (West Nanjing Lu)	86	3,37%
12 (West Nanjing Lu)	7	0,27%
14 (Hankou Lu)	126	4,94%
15 (Fuzhou Lu)	173	6,79%
15b (Raffles City)	276	10,83%
16 (Middle Xizang Lu)	78	3,06%
17 (People's Park)	5	0,20%
18 (People's Park)	3	0,12%
19 (West Nanjing Lu)	574	22,52%
20 (Middle Xizang Lu)	40	1,57%
	2549	100,00%

subway entrance zone

RANKED DATA		
Exit	Frequency Inside	
	Inbound	Intensity %
18 (People's Park)	35	0,12%
10 (West Nanjing Lu)	59	0,20%
17 (People's Park)	59	0,20%
1b (Hong Kong Mall Street)	72	0,24%
12 (West Nanjing Lu)	83	0,27%
5 (West Nanjing Lu)	165	0,55%
20 (Middle Xizang Lu)	472	1,57%
8 (West Nanjing Lu)	566	1,88%
9 (West Nanjing Lu)	861	2,86%
7b (New World)	1117	2,90%
16 (Middle Xizang Lu)	920	3,06%
2 (Urban Planning Museum)	1003	3,33%
11 (West Nanjing Lu)	1015	3,37%
14 (Hankou Lu)	1486	4,94%
6 (West Nanjing Lu)	1958	6,51%
15 (Fuzhou Lu)	2041	6,79%
3 (Middle Xizang Lu)	2230	7,41%
7 (West Nanjing Lu)	2584	8,59%
15b (Raffles City)	3248	10,83%
1 (Middle Xizang Lu)	3563	11,85%
19 (West Nanjing Lu)	6772	22,52%

fig. 197_spread sheets - entrance frequencies

2.3 subway exit frequency

2D diagram - connectivity underground (traffic system --> urban environment)

fig. 198_2D diagram - subway exit frequency underground

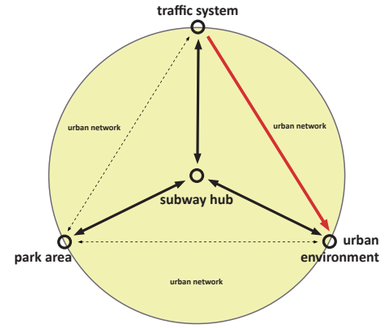


fig. 171_ general priciple of the urban network

connection to underground subway hub

connection to underground level

subway hub

The diagram to the left analyzes the specific connection between the traffic system and the urban environment. This means that the shortest pathways from the semi-public subway access areas to the exits and therefore to the urban environment above ground were visualized.

As in the previous 2D diagram constructional barriers and walls of the underground level were considered. The specific values of the subway exit frequencies are displayed in the 3D diagram on the following page.

2.3 subway exit frequency

3D diagram - connectivity underground (traffic system --> urban environment)

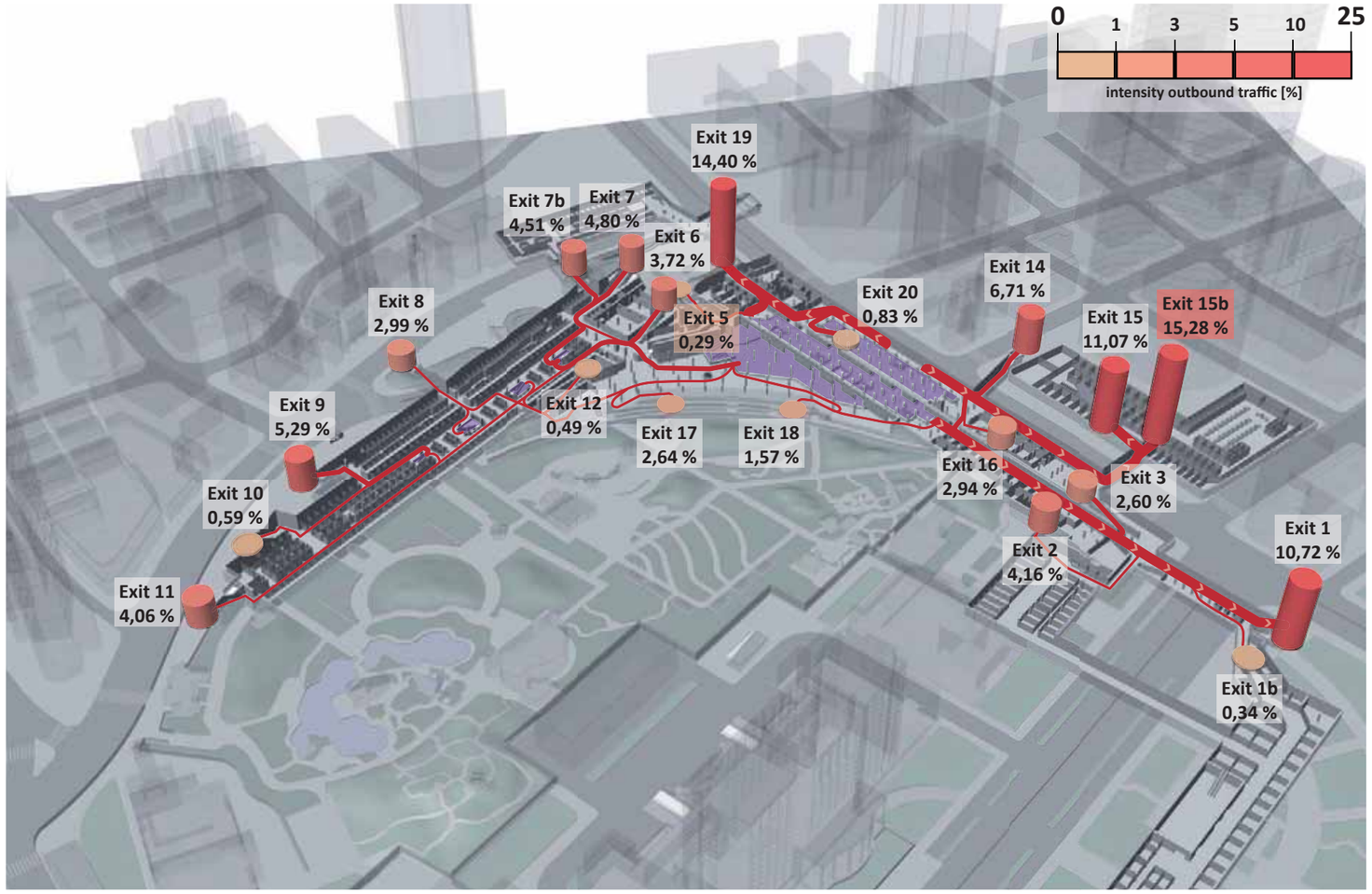


fig. 199_3D diagram - subway exit frequency underground

DIAGRAM DATA

Exit	Frequency Outside	
	Outbound	Intensity %
1 (Middle Xizang Lu)	219	10,72%
1b (Hong Kong Mall Street)	7	0,34%
2 (Urban Planning Museum)	85	4,16%
3 (Middle Xizang Lu)	53	2,60%
5 (West Nanjing Lu)	6	0,29%
6 (West Nanjing Lu)	76	3,72%
7 (West Nanjing Lu)	98	4,80%
7b (New World)	92	4,51%
8 (West Nanjing Lu)	61	2,99%
9 (West Nanjing Lu)	108	5,29%
10 (West Nanjing Lu)	12	0,59%
11 (West Nanjing Lu)	83	4,06%
12 (West Nanjing Lu)	10	0,49%
14 (Hankou Lu)	137	6,71%
15 (Fuzhou Lu)	226	11,07%
15b (Raffles City)	312	15,28%
16 (Middle Xizang Lu)	60	2,94%
17 (Peoples Park)	54	2,64%
18 (Peoples Park)	32	1,57%
19 (West Nanjing Lu)	294	14,40%
20 (Middle Xizang Lu)	17	0,83%
	2042	**100,00%**

subway exit zone

RANKED DATA

Exit	Frequency Outside	
	Outbound	Intensity %
5 (West Nanjing Lu)	88	0,29%
1b (Hong Kong Mall Street)	102	0,34%
12 (West Nanjing Lu)	147	0,49%
10 (West Nanjing Lu)	177	0,59%
20 (Middle Xizang Lu)	251	0,83%
18 (People's Park)	472	1,57%
3 (Middle Xizang Lu)	781	2,60%
17 (People's Park)	796	2,64%
16 (Middle Xizang Lu)	885	2,94%
8 (West Nanjing Lu)	899	2,99%
6 (West Nanjing Lu)	1120	3,72%
11 (West Nanjing Lu)	1224	4,06%
2 (Urban Planning Museum)	1253	4,16%
7b (New World)	1352	4,51%
7 (West Nanjing Lu)	1445	4,80%
9 (West Nanjing Lu)	1592	5,29%
14 (Hankou Lu)	2020	6,71%
1 (Middle Xizang Lu)	3229	10,72%
15 (Fuzhou Lu)	3332	11,07%
19 (West Nanjing Lu)	4334	14,40%
15b (Raffles City)	4584	15,28%

fig. 200_spread sheets - exit frequencies

2.3 subway exit frequency

comparison of the pedestrian frequencies (Karlsplatz <--> Renmin Square)

SUBWAY STATION RENMIN SQUARE (SHANGHAI, CHINA)

Exit	Entrance Geometry		Frequency of Persons				Intensity [%]
	Width [m]	Height [m]	Inbound	Outbound	# of Persons	Persons / Minute	
1 (Middle Xizang Lu)	11,60	3,80	302	219	521	52,1	11,35%
1b (Hong Kong Mall Street)	4,60	3,30	6	7	13	1,3	0,28%
2 (Urban Planning Museum)	2,60	7,30	85	85	170	17	3,70%
3 (Middle Xizang Lu)	3,90	3,60	189	53	242	24,2	5,27%
5 (West Nanjing Lu)	7,40	4,00	14	6	20	2	0,44%
6 (West Nanjing Lu)	5,10	4,10	166	76	242	24,2	5,27%
7 (West Nanjing Lu)	7,00	4,50	219	98	317	31,7	6,90%
7b (New World)	4,80	2,60	74	92	166	16,6	3,62%
8 (West Nanjing Lu)	5,10	3,70	48	61	109	10,9	2,37%
9 (West Nanjing Lu)	5,50	3,60	73	108	181	18,1	3,94%
10 (West Nanjing Lu)	5,00	3,50	5	12	17	1,7	0,37%
11 (West Nanjing Lu)	3,40	3,60	86	83	169	16,9	3,68%
12 (West Nanjing Lu)	5,20	3,50	7	10	17	1,7	0,37%
14 (Hankou Lu)	4,30	3,60	126	137	263	26,3	5,73%
15 (Fuzhou Lu)	4,20	4,00	173	226	399	39,9	8,69%
15b (Raffles City)	4,80	3,00	276	312	588	58,8	12,81%
16 (Middle Xizang Lu)	7,20	3,30	78	60	138	13,8	3,01%
17 (People's Park)	4,50	2,20	5	54	59	5,9	1,29%
18 (People's Park)	4,50	2,20	3	32	35	3,5	0,76%
19 (West Nanjing Lu)	4,70	3,60	574	294	868	86,8	18,91%
20 (Middle Xizang Lu)	5,20	3,30	40	17	57	5,7	1,24%
			2549	**2042**	**4591**	**459,1**	

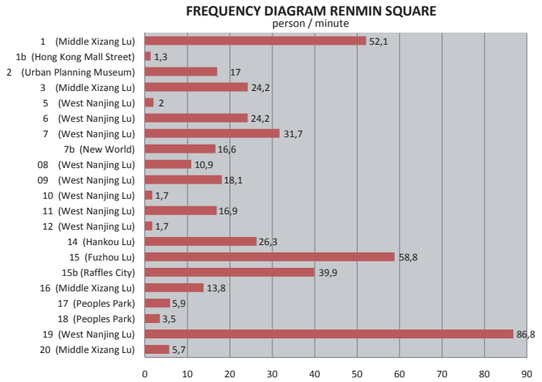


fig. 202_area viewport navigator - Shanghai

The collected data from the subway station "Karlsplatz" in Vienna demonstrates the huge difference between Austria and China in terms of human frequencies within the subway system.

Just on give you an idea Renmin Square is allegedly the busiest subway station in entire China, handling a daily traffic of 400,000 people.

SUBWAY STATION KARLSPLATZ (VIENNA, AUSTRIA)

Exit	Entrance Geometry		Frequency of Persons				Intensity [%]
	Width [m]	Height [m]	Inbound	Outbound	# of Persons	Persons / Minute	
1 (Karlsplatz 1)	14,70	4,60	80	124	204	20,4	13,45%
2 (Wiedner Hauptstr.)	4,70	2,70	65	86	151	15,1	9,95%
3 (Giradi-Park)	4,90	2,50	2	3	5	0,5	0,33%
4 (Operngasse)	5,40	2,50	14	15	29	2,9	1,91%
5 (Secession)	3,40	2,50	32	24	56	5,6	3,69%
6 (Akademiehof)	3,20	2,50	6	7	13	1,3	0,86%
7 (Elisabethstraße)	5,50	2,60	29	31	60	6	3,96%
8 (Heinrichhof)	5,00	2,70	4	4	8	0,8	0,53%
9 (Opernring)	5,60	2,60	75	114	189	18,9	12,46%
10 (Oper)	5,60	2,60	39	122	161	16,1	10,61%
11 (Kärntner Straße)	3,40	2,70	24	101	125	12,5	8,24%
12 (Kärntner Ring 1)	5,60	2,70	41	75	116	11,6	7,65%
13 (Kärntner Ring 2)	5,60	2,70	20	61	81	8,1	5,34%
14 (Bösendorfer Str. 1)	4,60	2,50	25	20	45	4,5	2,97%
15 (Bösendorfer Str. 2)	4,60	2,50	46	54	100	10	6,59%
16 (Handelsakademie)	4,30	2,50	0	6	6	0,6	0,40%
17 (Akademiestraße)	5,00	2,60	2	4	6	0,6	0,40%
18 (Künstlerhaus)	3,00	2,50	9	11	20	2	1,32%
19 (Karlsplatz 2)	2,50	2,70	7	10	17	1,7	1,12%
20 (Resselpark)	9,50	2,80	30	95	125	12,5	8,24%
			550	**967**	**1517**	**151,7**	

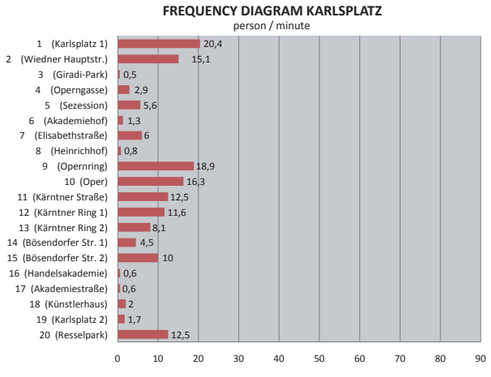


fig. 201_spread sheets - frequencies Vienna / Shanghai

fig. 203_ area viewport navigator - Vienna

2.4 accessibility of Renmin Park area

2D diagram - connectivity above ground (urban environment --> park area)

fig. 204_2D diagram - Renmin Park accessibility above ground

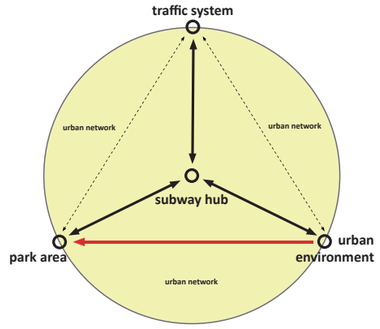


fig. 171_ general priciple of the urban network

- connection to underground subway hub
- entrances to underground subway hub
- entrances to the park / main entrance
- subway hub
- urban barriers

The diagram to the left analyzes the specific connection between the urban environment and the entrances of the park area.

Similar to the diagram on page 60 the shortest pathways above ground are visualized, considering crosswalks and urban barriers of Renmin Square.

Especially the insufficient connection between roof garden and park area is striking detail. Generally speaking, the pathways between the heavily crowded East Nanjing Road pedestrian area and Renmin Park are failures in terms of an efficient connectivity system.

2.4 accessibility of Renmin Park area

2D diagram - connectivity above ground (park area --> traffic system)

fig. 205_2D diagram - accessibility of the traffic system from the park

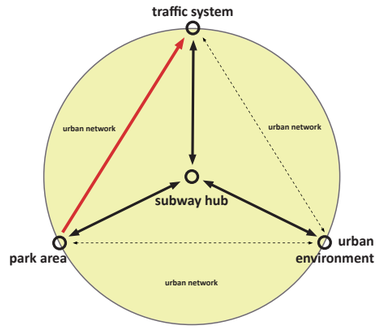


fig. 171_ general priciple of the urban network

connection to underground subway hub

entrances to underground subway hub

connection to underground level

entrances to underground level

subway hub

urban barriers

connection to underground subway hub

entrances to the park / main entrance

The diagram to the left analyzes the specific connection between important locations of Renmin Park and the park entrances as well as their further connection to the subway entrances and bus stops.

The park geometries and the urban barriers throughout Renmin Square are considered in this diagram.

2.5 acoustic measurement

three dimensional acoustic diagram

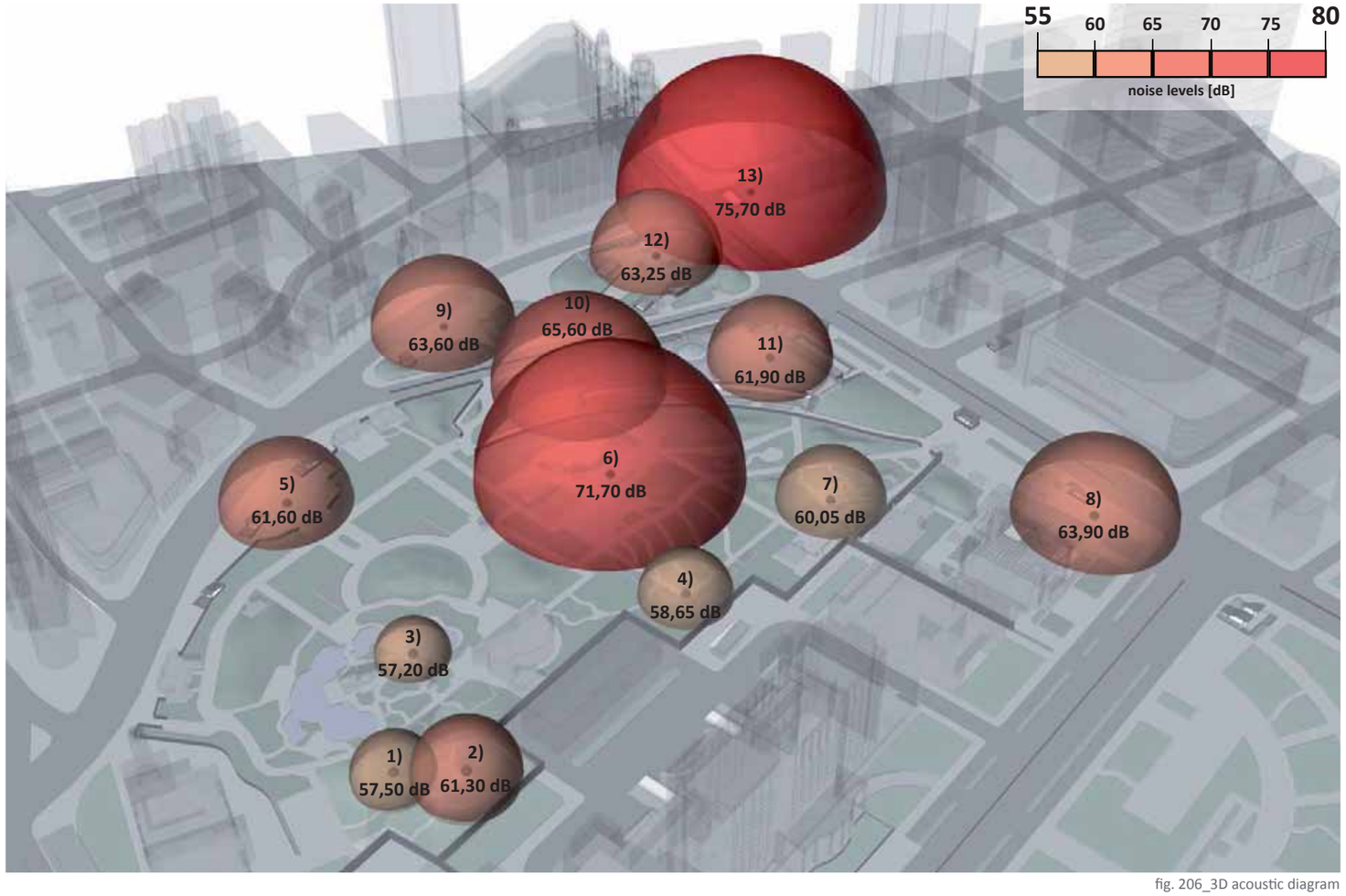


fig. 206_3D acoustic diagram

COLLECTED DATA			
Position	Minimum [dB]	Maximum [dB]	Uniform Value [dB]
1)	54,9	60,1	57,50
2)	59,8	62,8	61,30
3)	55,3	59,1	57,20
4)	56,4	60,9	58,65
5)	55,9	67,3	61,60
6)	67,3	76,1	71,70
7)	56,8	63,3	60,05
8)	60,5	67,3	63,90
9)	57,6	69,6	63,60
10)	62,7	68,5	65,60
11)	59,3	64,5	61,90
12)	59,5	67,0	63,25
13)	64,2	87,2	75,70

DIAGRAM DATA	
Position	Uniform Value [dB]
1) Rock Formation (People's Park)	57,50
2) Pagoda (People's Park)	61,30
3) Chinese Garden (Barbarossa)	57,20
4) Botanic Garden (People's Park)	58,65
5) Main Entrance People's Park	61,60
6) Amusement-Park	71,70
7) "English-Corner" (People's Park)	60,05
8) Square Urban Planning Hall	63,90
9) Artifical Island (Park)	63,60
10) Rooftop Entrance Hall (Fun Park)	65,60
11) Rooftop Entrance Hall (Starbucks)	61,90
12) Artifical Island (Entrances)	63,25
13) Entrance Nanjing Lu	75,70

fig. 207_spread sheets - acoustic data

Examples of sound pressure levels[14]

Pain threshold	**130 dB**
Vuvuzela at 1 m	120 dB
Jet engine at 100 m	110 - 140 dB
Jack hammer at 1 m	100 dB
Hearing damage (long-term exposure, need not be contineous exposure)	**85 dB**
Passenger car at 10 m	60 - 80 dB
Very quiet room	**20 - 30 dB**

2.6 résumé

After having collect the site‘s specific data it was quite a challenge to combine the various information in different types of schemata. Especially in the case of the connectivity diagrams we decided to visualize the data in two different ways.

The two-dimensional drawings illustrate the circulation paths in an undistorted way, the three-dimensional drawings show the spatial context of the urban environment and the measured subway entrance/exit frequences in relation to each other.

The general site analysis, documented in chapter I, helped us to understand the different layers of the site and provided the essential basics to prepare the background information for the specific diagrams.

The specific site analysis which mainly focused on the terms “accessibility“ and “connectivity“ gave us specific knowledge about all the hidden urban and architectural problems present on Renmin Square. Delicate issues like the critical noise pollution of top of the roof garden, the subway entrances‘ non-uniform frequencies in relation to their diameter or the insufficient connection between park and subway hub are highlighted by these diagrams.

The geometries of Renmin Park, including efficiently used space like the Chinese Garden areas and problematic zones like the lovelessly designed botanical garden or the noisy but highly frequented amusement park, are considered an important additional issue in the following design process.

After having split up the specifically analyzed data in several diagrams, the design process does not focus on finding independent local solutions, but rather seeks one global system which emphasizes the advantages of Renmin Square and minimizes the existing problems.

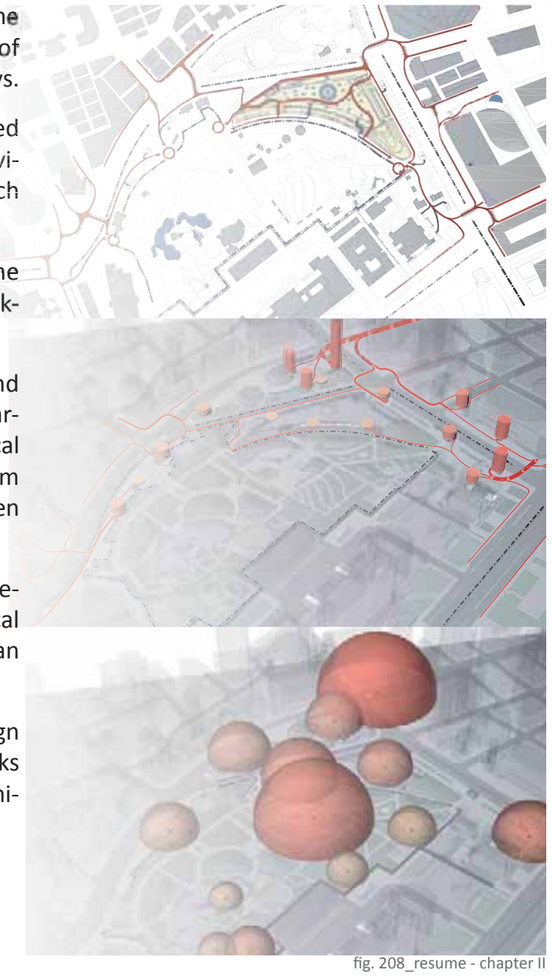


fig. 208_resume - chapter II

CHAPTER III - MAIN PROBLEMS OF THE CURRENT SITUATION

The following chapter illustrates the six main problems of Renmin Square with a special focus on the connectivity and accessibility of the subway hub and its proximate environment.

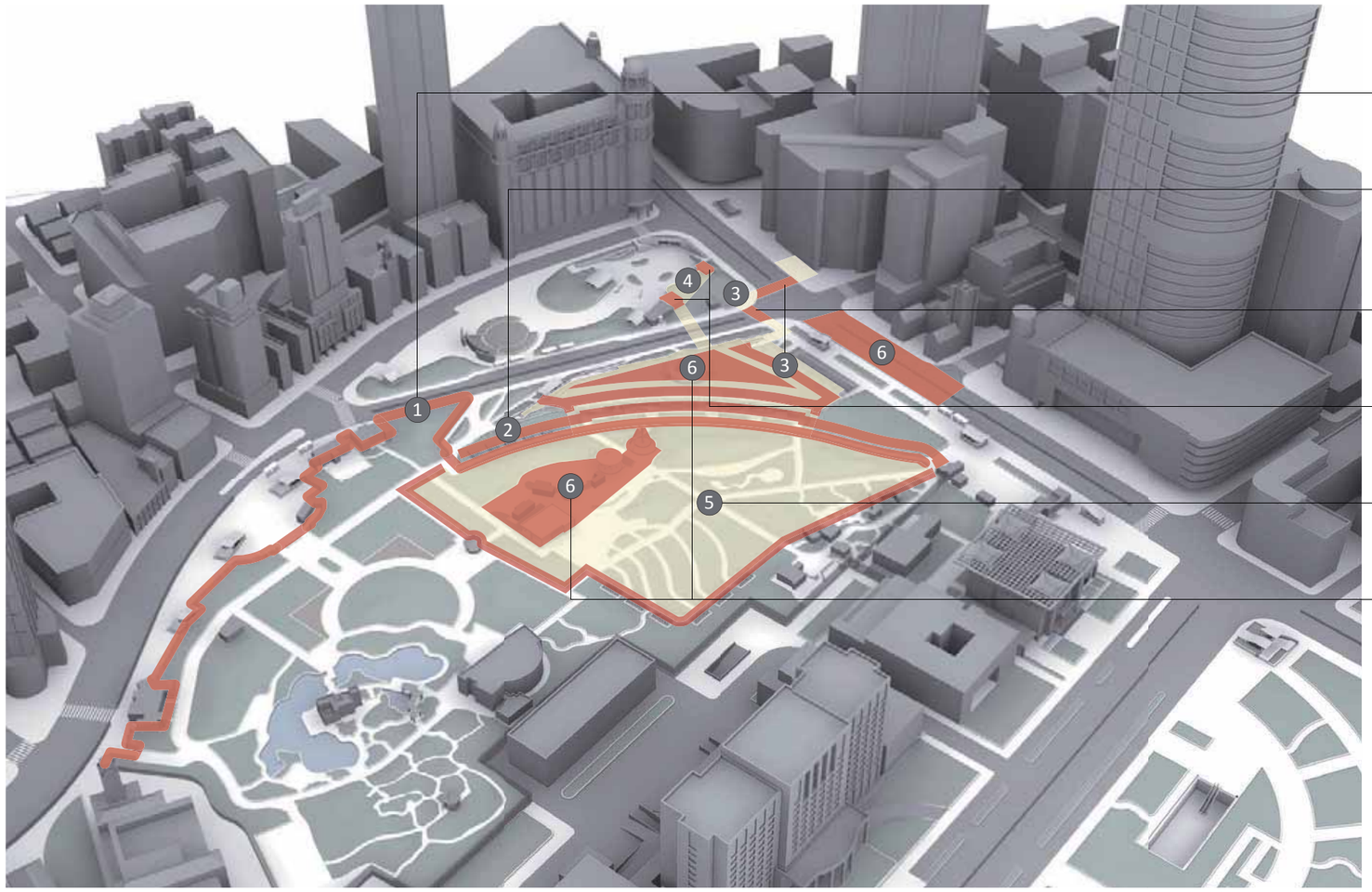
Noise pollution, urban barriers, missing links between the subway system and the roof garden and other structural mistakes show the wide range of different problems on site.

In order to asses the magnitude of a certain problem we compared its positive and negative characteristics and visualized them in a three dimensional diagram.

The specific analysis of these problems is the basis for developing the design method and also influences the form-finding process. Creating a new global system which is able to optimize those critical spaces is the main goal of the following design process.

3.1 overview - main problems of the current situation

three-dimensional overview



PROBLEM I
urban barriers

PROBLEM II
connectivity between subway hub and Renmin Park

PROBLEM III
roof garden accessibility

PROBLEM IV
entrance dimensions

PROBLEM V
useability of the park areas

PROBLEM VI
noise pollution

specific problem

problematic area

The diagram to the left shows a complete overview of the detected critical areas with their specific problems.

They are mainly located around the subway hub and in the park areas which do not follow the design principles of the traditional Chinese Garden.

fig. 209_3D diagram - main problems of the current situation

3.2 problem I - urban barriers

three-dimensional overview

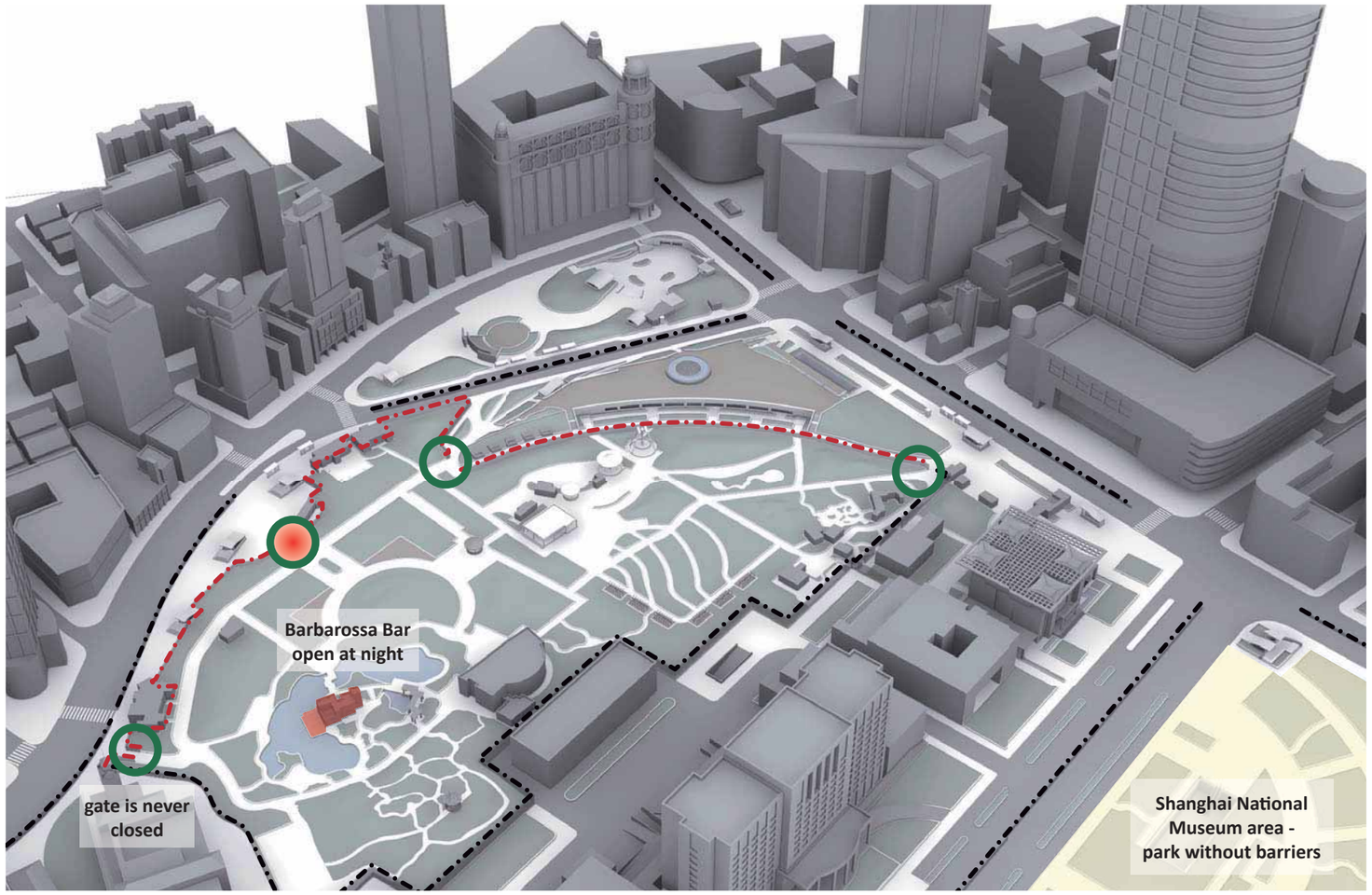


fig. 210_3D overview - barriers of Renmin Square

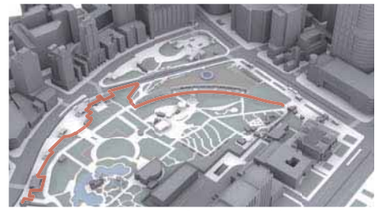


fig. 211_problem navigator

fig. 212_Shanghai National Museum area

- useless blocking barriers (fences)
- urban barriers worth to be kept
- entrances to the park / main entrance

- \+ regulating the motor vehicle traffic
- \+ protection of non-public areas
- \+ fences do not limit the view
- − free access to park is constrained
- − fences do not have a real safety function
- − roof garden is sealed off from Renmin Park
- − gates were originally constructed to facilitate the collection of an entrance fee for accessing the park

3.2 problem I - urban barriers

urban barriers around the subway hub

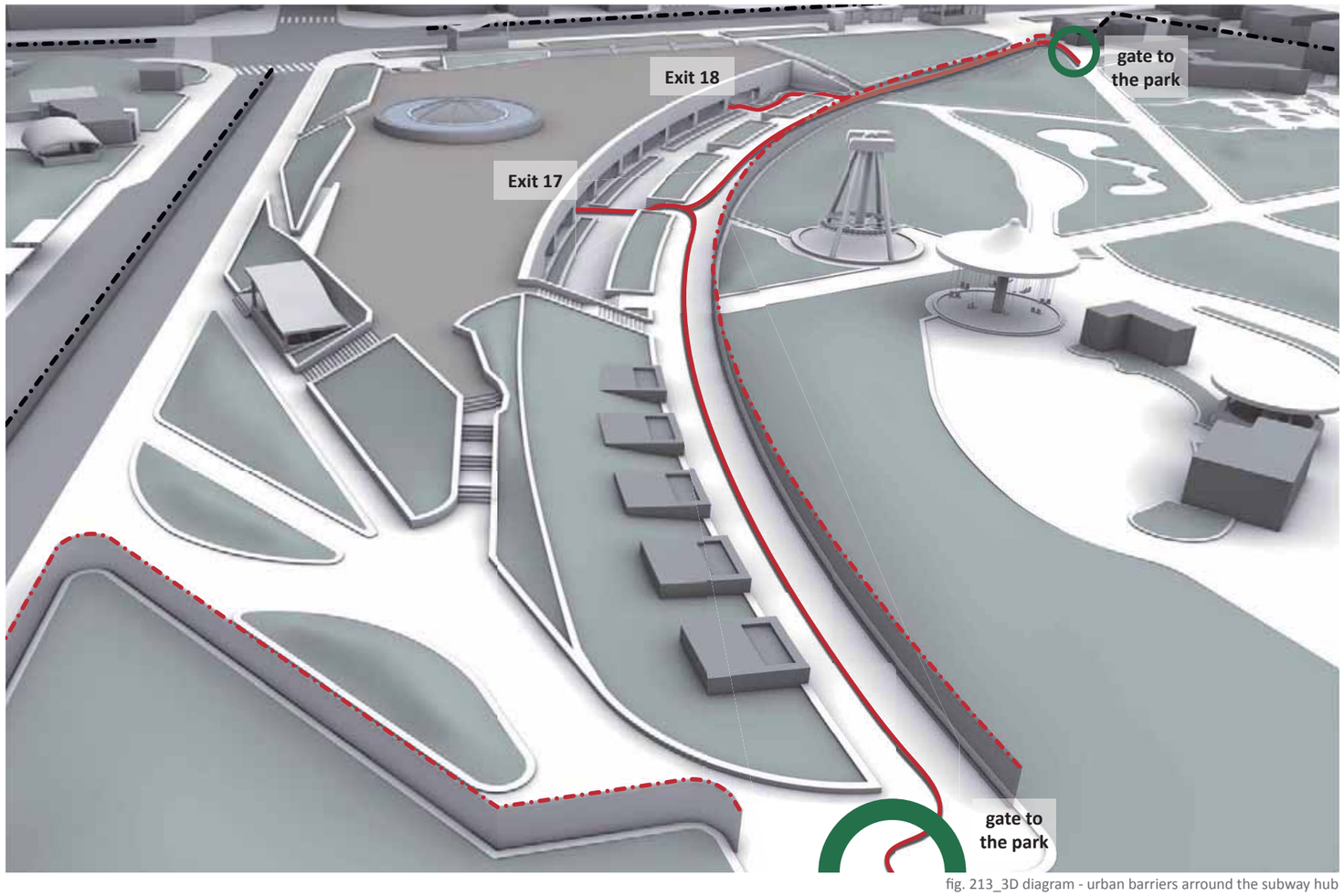


fig. 213_3D diagram - urban barriers arround the subway hub

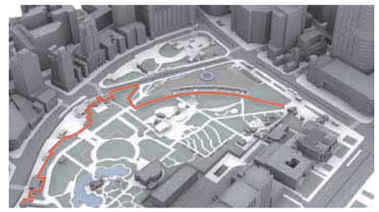


fig. 214_problem navigator

fig. 215_park area in front of the subway hub

useless blocking barriers (fences)

urban barriers worth to be kept

connection between subway hub & park

The fences along Renmin Park strongly constrain the connectivity between the subway hub and the amusement park. The park's pathways leading to the exit 17 and 18 are actually dead ends which are blocked by the fences.

The accessible park entrances are far away and the pathways coming from the subway hub are circuitous.

Although the fences are not solid and allow at least a visual connection, they represent a strong and problematic urban barrier.

3.3 problem II - connectivity between subway hub & park

three dimensional section of the subway hub

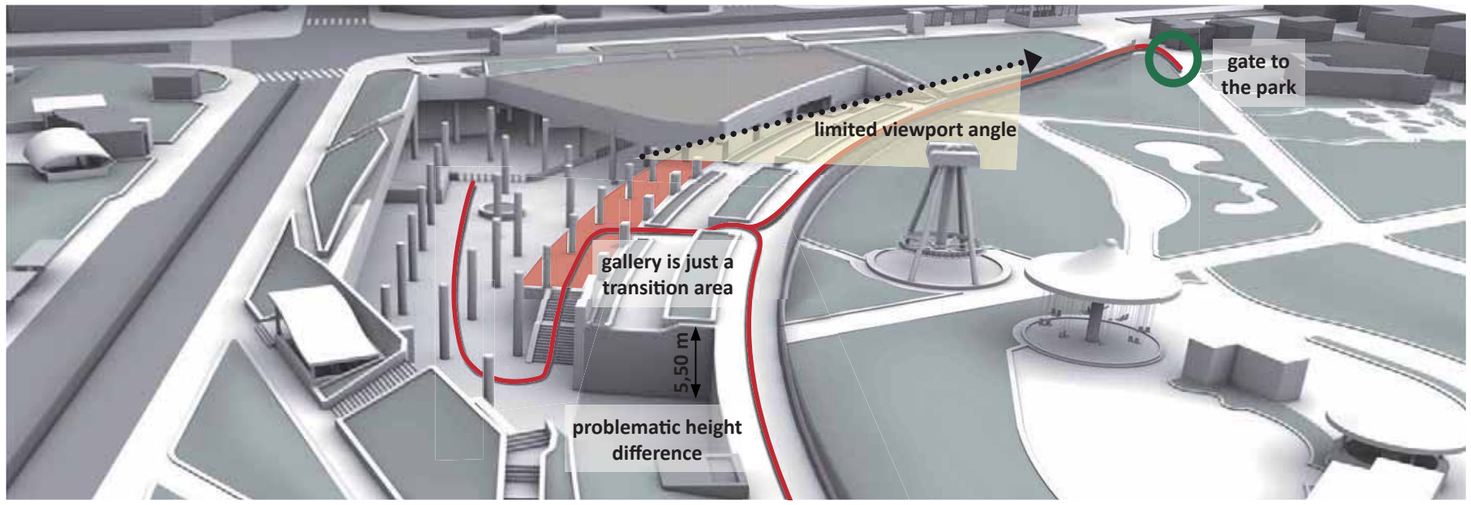


fig. 216_3D overview - connectivity between hub & park

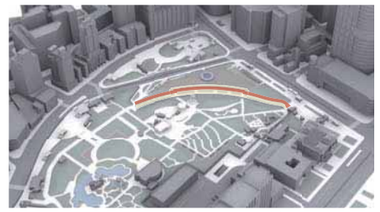


fig. 218_problem navigator

- \+ intervisibility between subway hub and park
- − park remains unnoticed
- − circuitous pathways between subway hub and park
- − food shops below gallery do not get any sunlight and need artificial illumination
- − gallery is just a transition area without any special functions and is missused as a homleless shelter in the cold periods of the year

fig. 217_panorama photo of the hub gallery

3.4 problem III - roof garden accessibility

accessibility from the underground subway hub

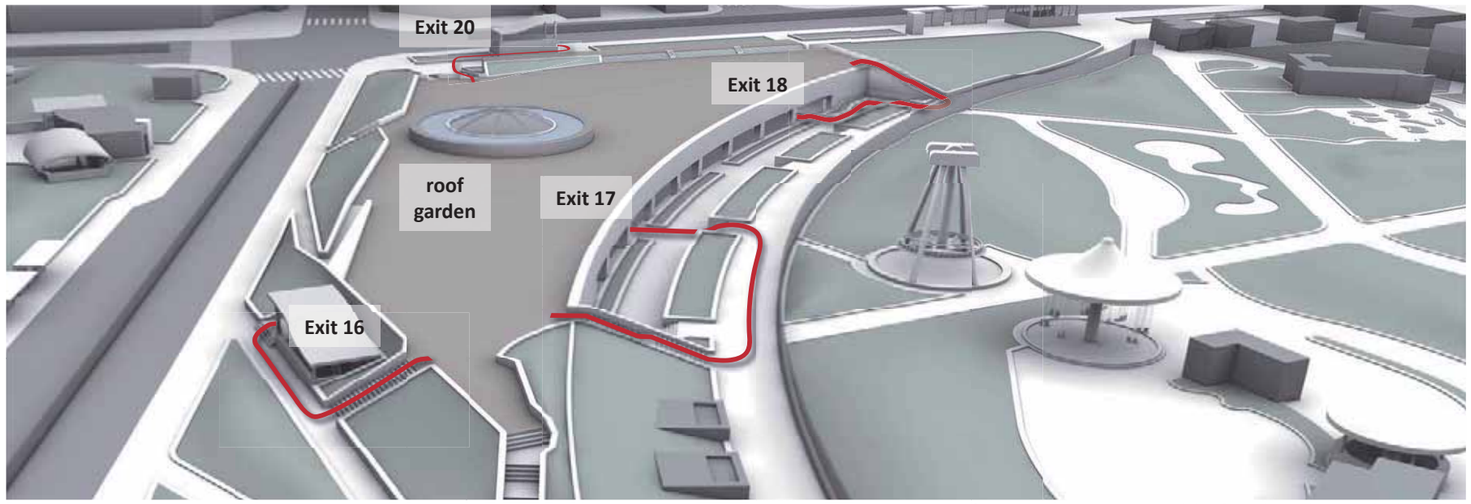


fig. 219_3D overview - accessibility from the underground subway hub

fig. 221_problem navigator

connections between subway hub and roof garden

- \+ roof garden is an extension of the park
- − direct connection to subway hub is missing
- − existing connections are not obvious
- − monotonous design of the roof garden
- − the area is not utilized to its full potential

fig. 220_panorama photo of the roof garden

3.4 problem III - roof garden accessibility

accessibility from the Island & East Nanjing pedestrian area

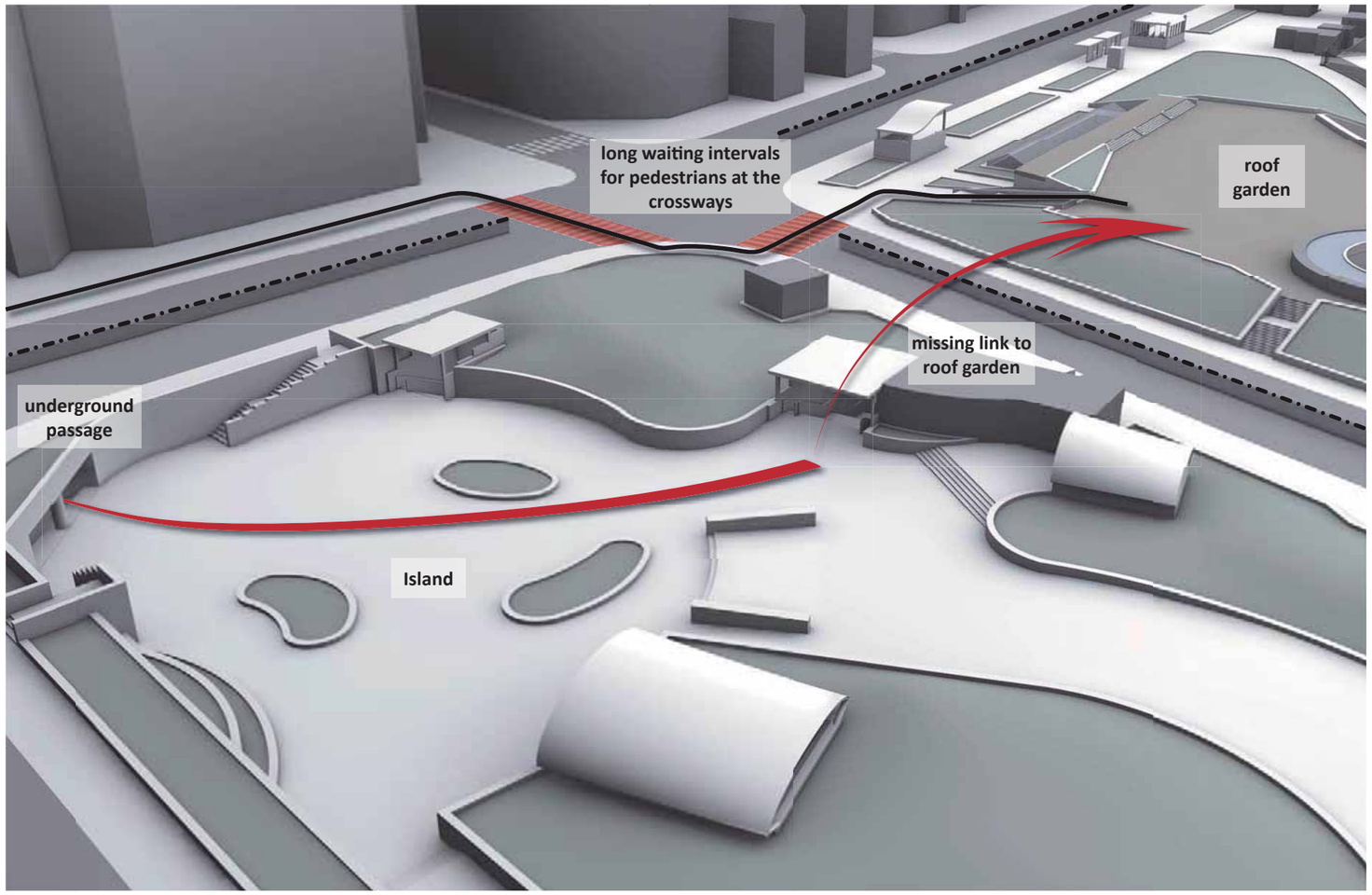


fig. 222_3D overview - accessibility from the island & East Nanjing Pedestrian Road

fig. 223_problem navigator

fig. 224_crosswalks at Middle Xizang Road

circuitous & overcrowded route

alternate route

urban barriers worth to be kept

The weak link between the crowed pedestrian area of East Nanjing Road and the roof garden is currently one of Renmin Square's main problems: The only way of reaching the roof garden coming from that direction is by entering the subway system through one of the Island's entrances. Currently, all of those underground passages lead directly to the main entrance hall, which paradoxically lacks a vertical connection to the roof garden above.

An important direct shortcut between Island and roof garden across Jiujiang Road is missing.

3.5 problem IV - entrance proportions

insufficient proportions of entrance No. 19 & 5

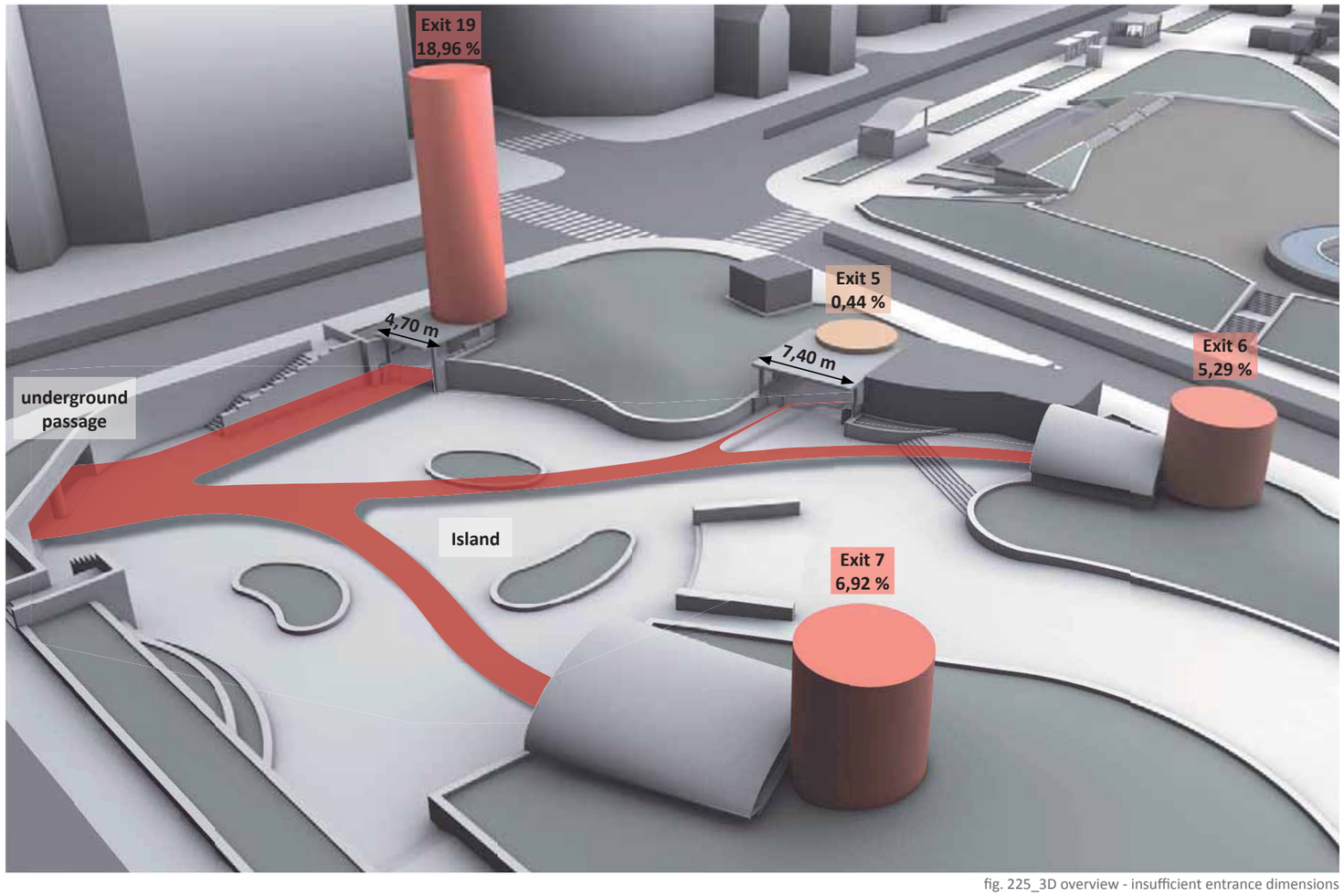


fig. 225_3D overview - insufficient entrance dimensions

fig. 226_problem navigator

DIAGRAM DATA		
Exit	Width [m]	Intensity %
1 (Middle Xizang Lu)	11,60	11,35%
1b (Hong Kong Mall Street)	4,60	0,28%
2 (Urban Planning Museum)	2,60	3,70%
3 (Middle Xizang Lu)	3,90	5,27%
5 (West Nanjing Lu)	7,40	0,44%
6 (West Nanjing Lu)	5,10	5,27%
7 (West Nanjing Lu)	7,00	6,90%
7b (New World)	4,80	3,62%
8 (West Nanjing Lu)	5,10	2,37%
9 (West Nanjing Lu)	5,50	3,94%
10 (West Nanjing Lu)	5,00	0,37%
11 (West Nanjing Lu)	3,40	3,68%
12 (West Nanjing Lu)	5,20	0,37%
14 (Hankou Lu)	4,30	5,73%
15 (Fuzhou Lu)	4,20	8,69%
15b (Raffles City)	4,80	12,81%
16 (Middle Xizang Lu)	7,20	3,01%
17 (Peoples Park)	4,50	1,29%
18 (Peoples Park)	4,50	0,76%
19 (West Nanjing Lu)	4,70	18,91%
20 (Middle Xizang Lu)	5,20	1,24%
	Ø 5,27	Ø 4,76%

fig. 227_spread sheet - frequencies

pedestrian traffic

\+ short distances between the crowded underground passage and the subway entrances

\- diameters of exit 19 and exit 5 have no relation to the amount of people who are passing through

\- exit 5 is redundant due to its very low frequency

3.6 problem V - useability of park areas

insufficient pathway system and randomly applied green areas

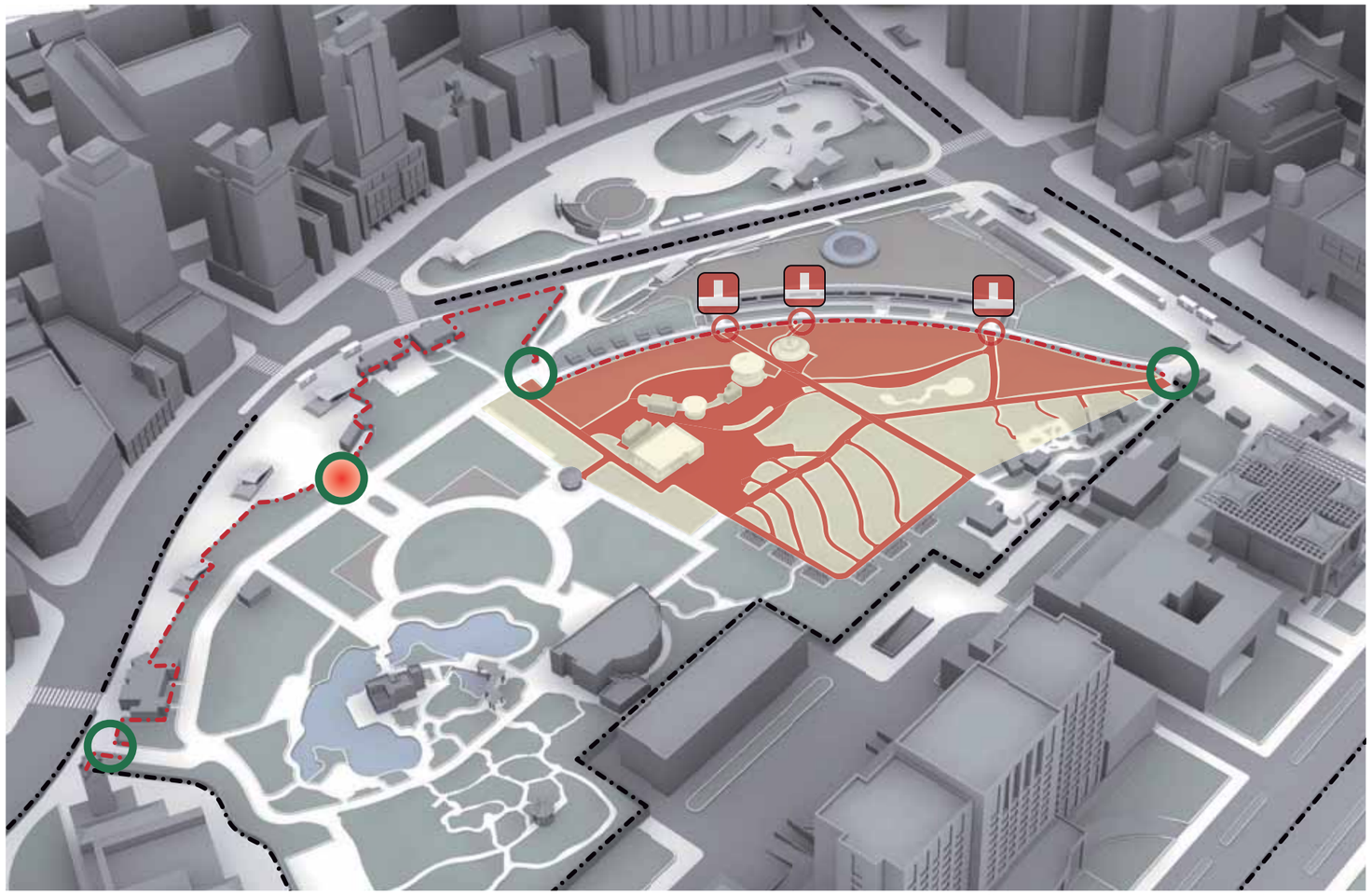


fig. 228_3D overview - insufficient pathway system and randomly applied green areas

fig. 229_problem navigator

limited boarder areas of the park

randomly applied pathway system

problematic area

useless blocking barriers (fences)

urban barriers worth to be kept

entrances to the park / main entrance

\+ various functions within the park areas

\+ entertainment factor of the amusement park

\- accessibility of the problematic park area is limited (just two entrances)

\- pathways which lead to the hub are dead ends, obstructed by the fences.

\- the pathway system and the green areas of the park appear to be randomly arranged

\- the park‘s periphery is limited by the walkway in front of the subway hub.

3.7 problem VI - acoustics

noise problem on the roof garden

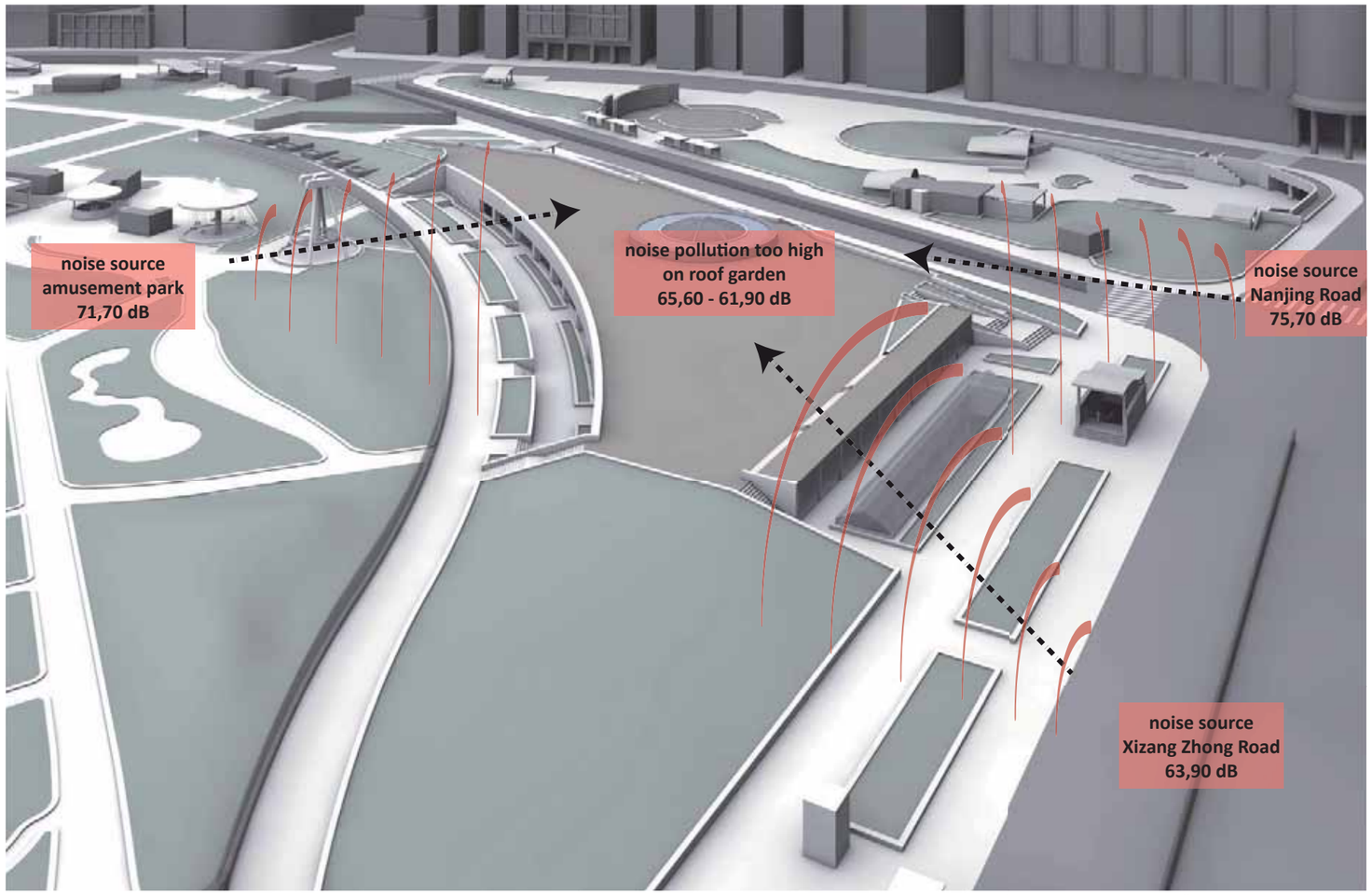


fig. 230_3D overview - insufficient entrance dimensions

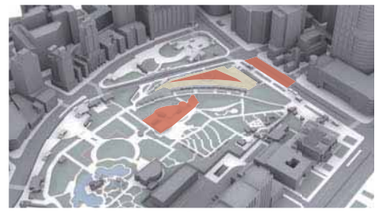


fig. 231_problem navigator

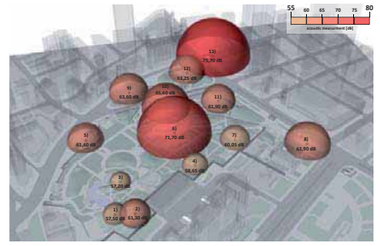


fig. 232_problem navigator

Examples of sound pressure levels

Hearing damage (over long-term exposure, need not be contineous exposure)	85 dB
Passenger car at 10 m	60 - 80 dB
Very quiet room	20 - 30 dB

- \+ great area overview from elevated roof garden
- − position of the amusement park
- − no protection against traffic noise
- − monotonous area design of the roof garden
- − the high potential of the area is just partially performed

3.8 résumé

Identifying the positive and negative characteristics of the main problems gave us specific information about the site‘s weak points.

CONSTRUCTIONAL PROBLEMS

The measured pedestrian frequencies at the entrances/exits of the subway system revealed a very high importance of exit 19 and a rather low frequency of exit 5. We furthermore discovered, that there is no direct connection between the entrances‘ diameters and the amout of people passing through them.

The majority of the people who are entering the subway system from the Island use exit 19 which is located very close to the important underground passage to East Nanjing Road. Exit 6 and exit 7 are important links to the northern underground market whereas exit 5, with its low frequency percentage of 0,44 %, is redundant.

In addition we registered a high amount of traffic pollution on the roof garden caused by the surrounding streets and the highly frequented amusement park. There are no constructional means that prevent or help to reduce this acoustical problem.

CONNECTIVITY/ACCESSIBILITY PROBLEMS

The urban barriers strongly influence the connectivity between the main areas of the site. The main entrance hall, the roof garden above it and the Island in the north as well as various park areas are separated from each other and form a conglomerat of completely autonomous areas throughout the site.

The geometries of the park‘s green areas near the subway hub - including the pathways inbetween - appear to be random. They represent a grown system, which ignores any relation to its surrounding environment. Especially the urban barriers between Renmin Park and the main subway hub divide the site into two separate areas and impede a homogenous and interrelated arrangement of different functions on site.

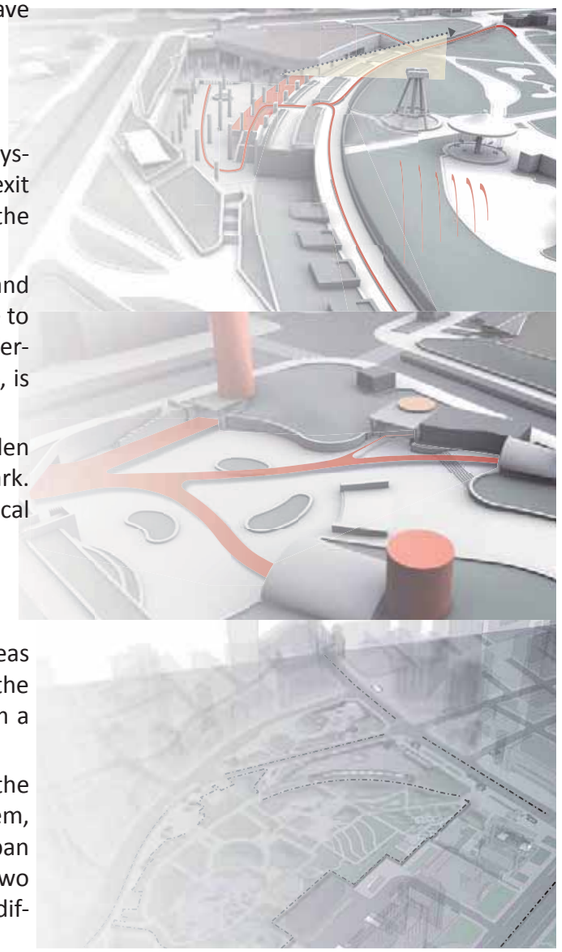


fig. 233_resume - chapter III

CHAPTER IV - MAIN DESIGN PROPOSAL

The combination of the enormous traffic on the subway system, the recreation zones of Renmin Park and the surrounding urban environment with its high density areas makes the site very special in terms of finding new architectural solutions which don‘t neglect any of these parameters.

Based on the extracted data of the specific site analysis this chapter mainly focuses on finding answers for the previously determined structural and urban problems of Renmin Square area.

The design process comprises two phases. In the first phase we concentrated on finding a specific design method based on logic mathematical rules in order to generate a new and efficient urban system. In the second phase cetain design methapors and intuitive architectural decisions based on our research experience on site will be adjusted to the global system so as to further develop certain areas in a more detailed scale.

The concept of preserving Renmin Square as “Shanghai‘s green lung“, plays a key role in the design process and takes center stage in the form-finding process. Traditinal Chinese activities as well as the main elements of the Chinese garden are considered essential in developing new types of space and special functions.

4.1 site classification
critical space

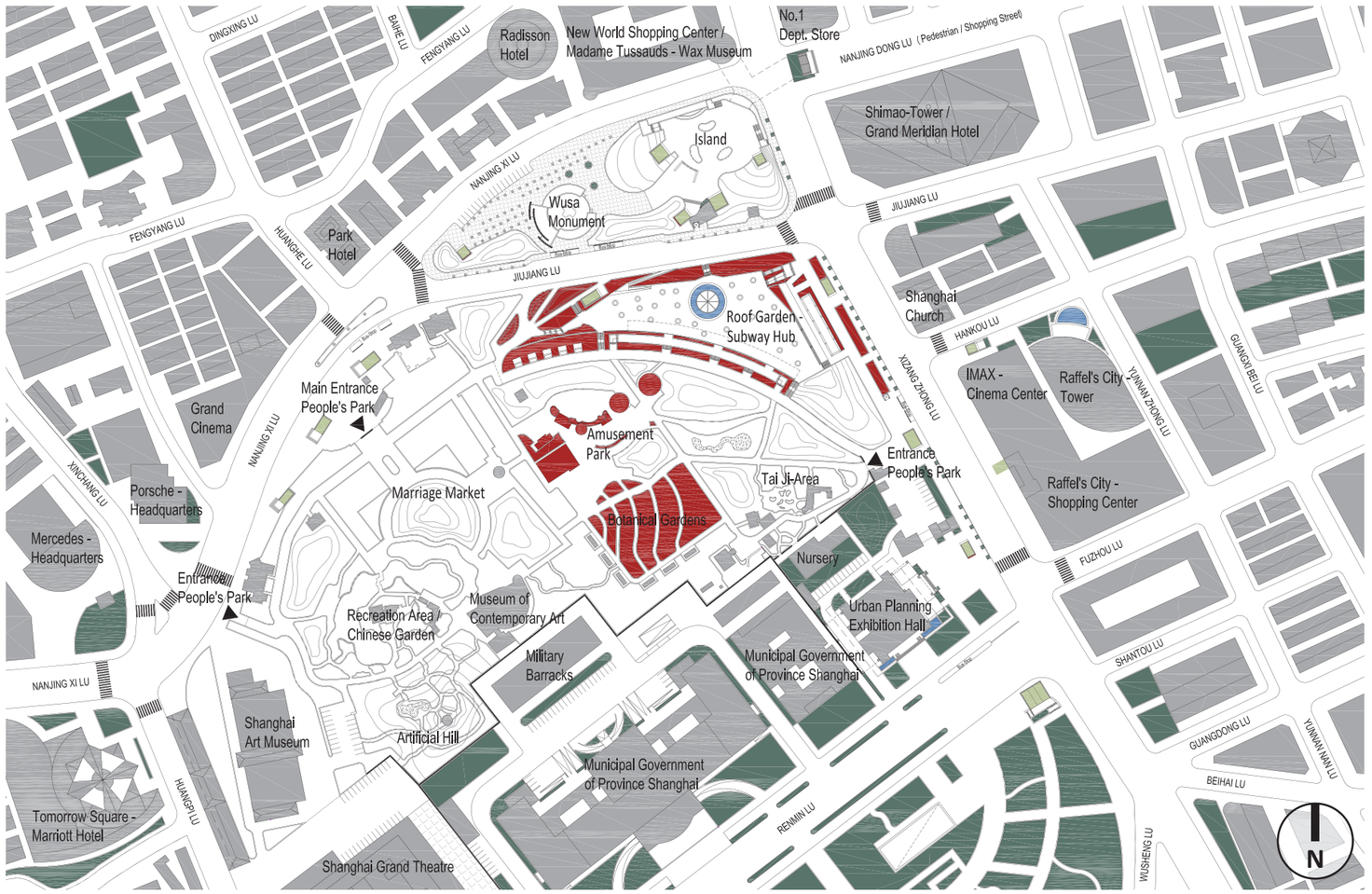


fig. 234_critical space of Renmin Park m = 1:3000

fig. 235_3D overview - critical space

- non-relevant green areas
- existing buildings
- critical areas

In order to establish a more efficient connection between the subway hub and the park area, the different zones of the site are divided into three groups.

In the diagram to the left, critical and problematic areas are highlighted in red. This group contains green areas which are in direct relation to the existing geometry of the hub, including the rarely frequented botanical garden and the acoustically alarming amusement park.

These areas constrain the connectivity and social quality of the subway hub and Renmin park. Therefore, they will be erased or, in case of the amusement park, repositioned.

4.1 site classification
influenced space

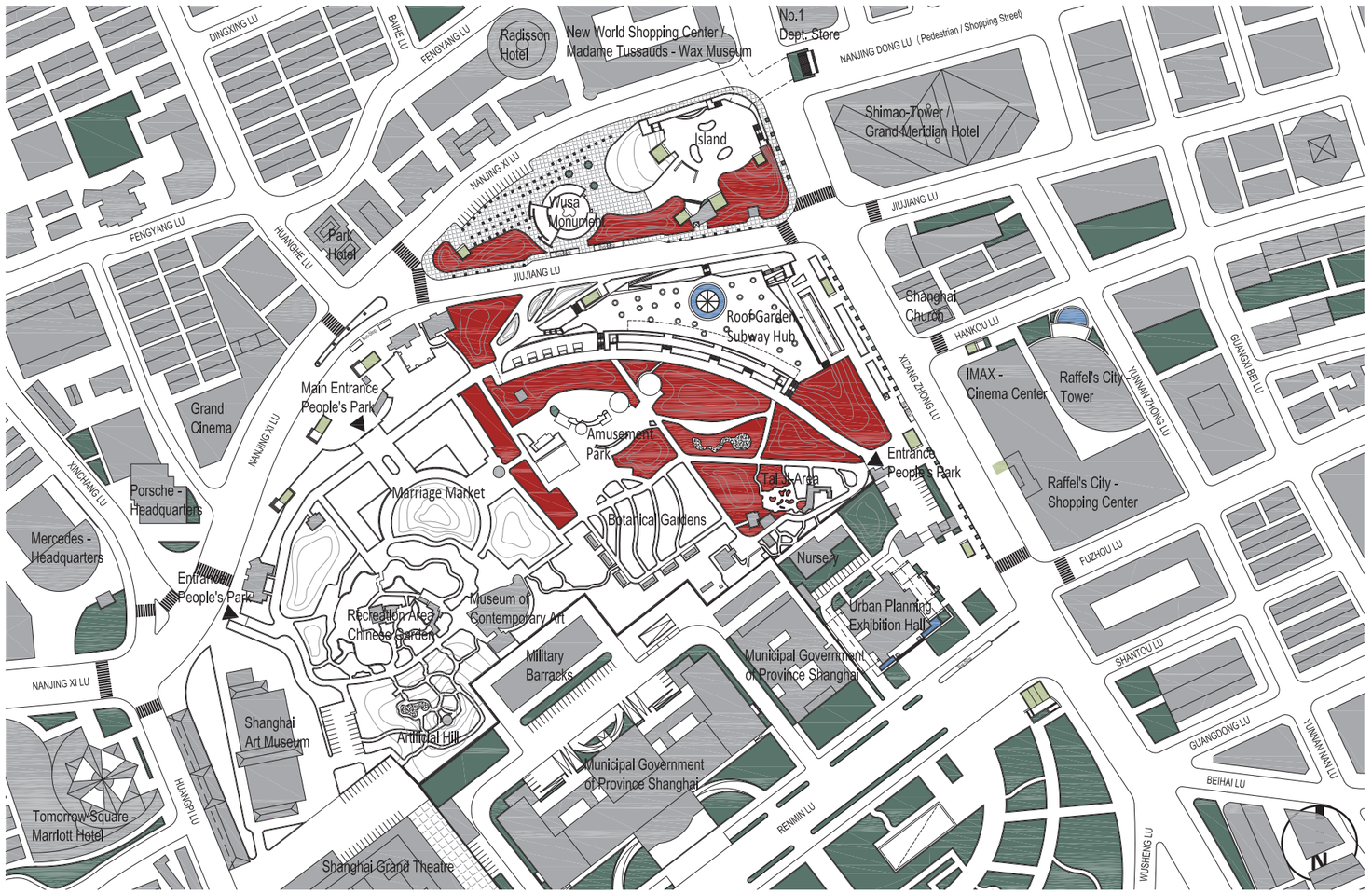


fig. 236_influenced space of Renmin Park m = 1:3000

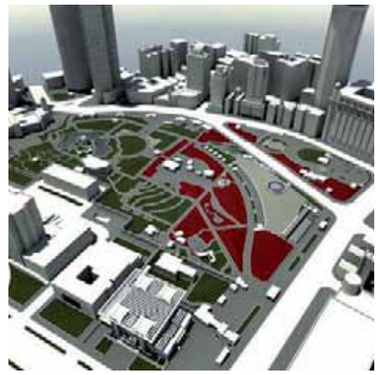


fig. 237_3D overview - influenced space

non-relevant green areas

existing buildings

influenced areas

In the diagram to the left, areas which are influenced by the subway hub are highlighted in red.

These zones are considered very important as to function as a transition space between the subway area and Renmin Park and will be integrated in the further design process.

4.1 site classification

efficient space

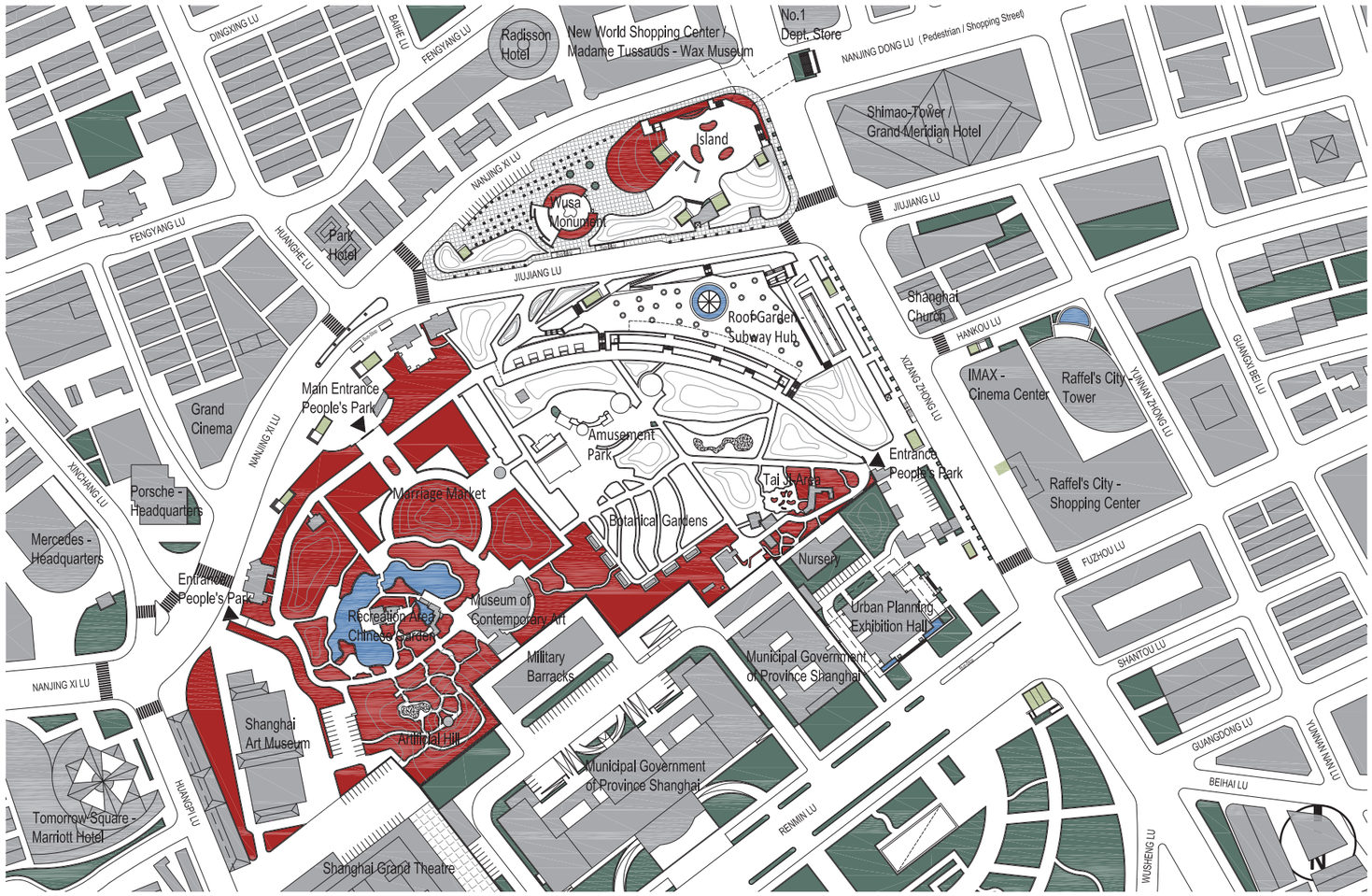


fig. 238_efficient space of Renmin Park m = 1:3000

fig. 239_3D overview - efficient space

non-relevant green areas

existing buildings

efficient areas

In the diagram to the left, efficiently used areas of Renmin Park are highlighted in red.

Especially the western part of the park which follows the principles of the traditional Chinese garden functions well as recreational area and underlines the methaphor of the “green lung of Shanghai“.

Areas with special functions like the marriage market at the main entrance gates, the Tai Ji area in the south-east or the Wusa-Monument on the Island enhance the sociological status of Renmin Square and are to be considered in the new design.

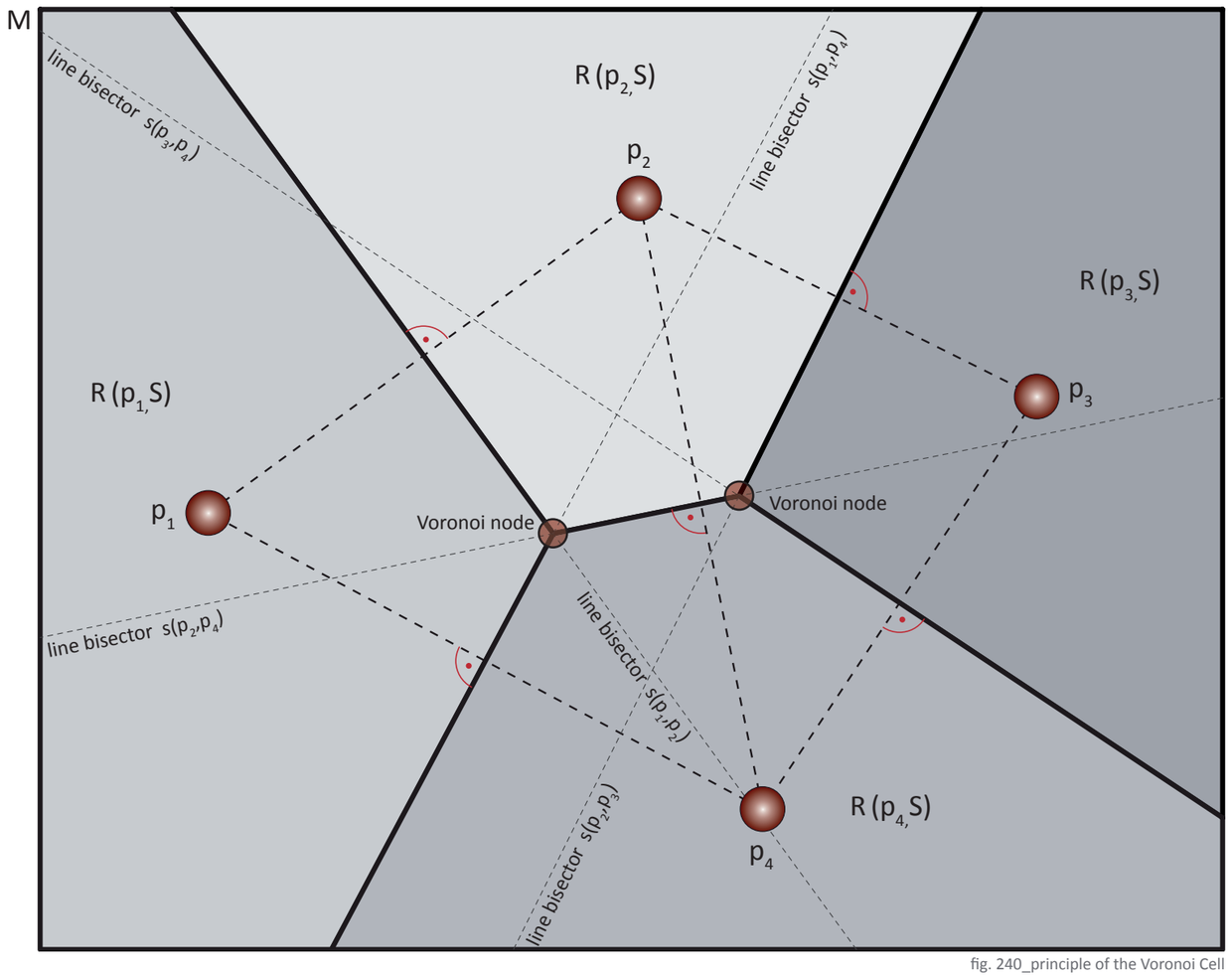


fig. 240_principle of the Voronoi Cell

„In general, if a finite set S of objects p_i is given in a space M, computing the Voronoi diagram of S means to partition the space into regions, R(p_i, S), in such a way that R(p_i, S) contains all points of M that are closer to pi than to any other object p_j in S.“ [15]

The segments of the Voronoi diagram are all the points in the plane that are equidistant to the two nearest sites. The Voronoi nodes are the points equidistant to three (or more) sites.

In the further design process the mathematical principle of the Voronoi Cell is used to generate a new green space configuration which will be able to interact with the influence of the subway hub and the heavy traffic areas of the urban environment.

4.2 subdivided environment

extracting the parameters from the site

fig. 241_extracted parameters of the site

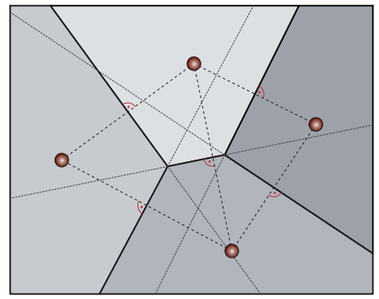


fig. 240_principle of the Voronoi cell

Voronoi boundary /field of interest

influenced areas

area center point / Voronoi points

erased critical areas

For generating a Voronoi digram, specific parameters have to be extracted from the site's geometry.

The diagram to the left shows the areas which are influenced by the subway hub. In the future design these areas will function as a transition space between the hub and Renmin Park.

In order to arrange these zones more efficiently and in a certain relation to each other, we calculated their area center points. These points represent the input points for the Voronoi calculation. The yellow area limits space M of the Voronoi diagram and forms as outer boundary for the Voronoi cells.

4.2 subdivided environment

generating a Voronoi diagram

fig. 241_extracted parameters of the site

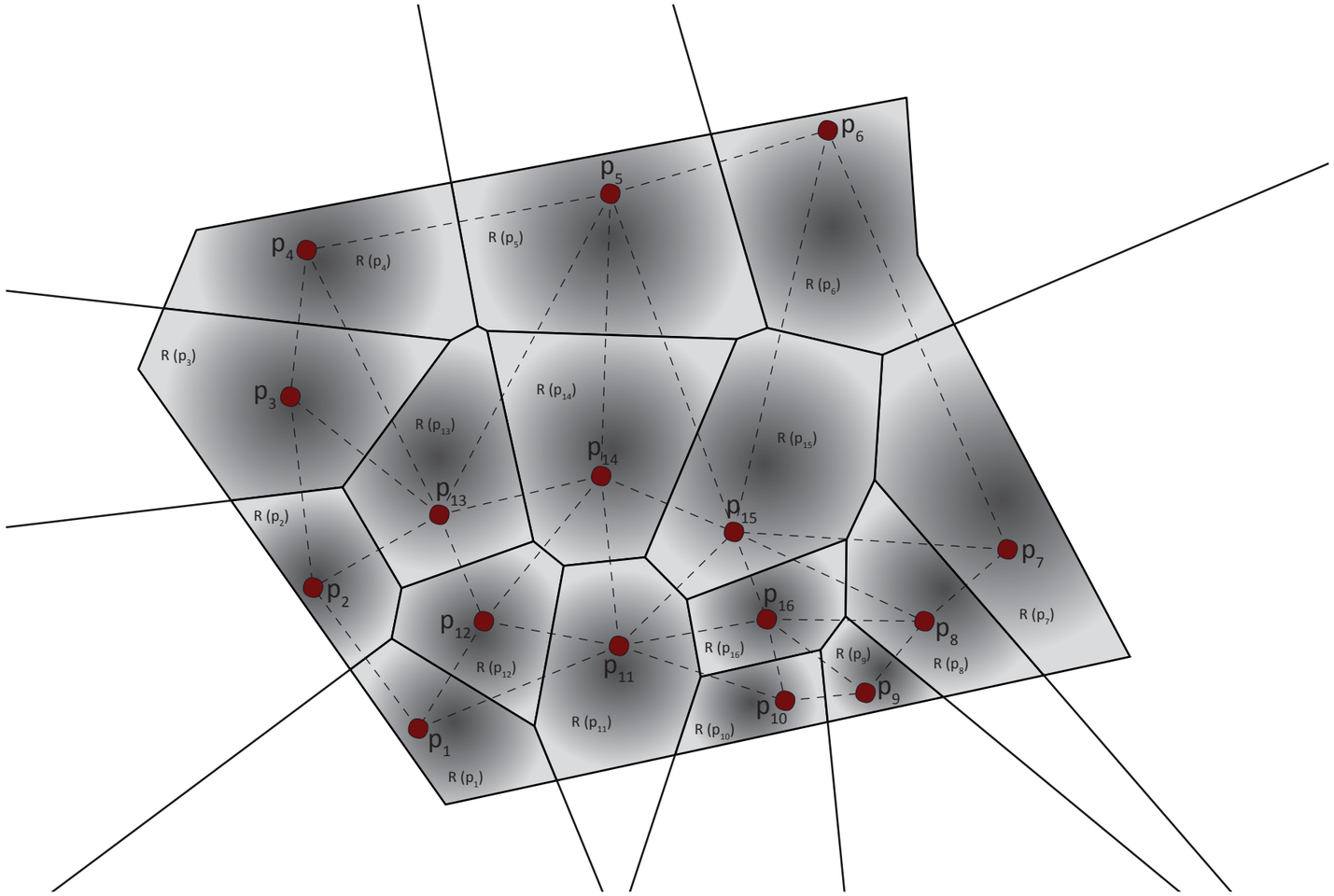


fig. 242_Voronoi diagram of the extracted site points

The diagram to the left shows a Voronoi algorithm applied to the extracted center points.

According to the number of points the diagram contains 16 cells. The size and boundary lines of each cell are directly related to the distance and location of the neighbouring points.

The shorter the distance between the input points, the smaller the circumfluent Voronoi cells and viceversa.

The dashed connection lines between the points are based on the mathematical system of the Delauny triangulation, which implies that a connection line between two points is always perpendicular to their line bisector.

Generally, the Delauny triangulation and the Voronoi diagram maintain a complex mathematical relationship with each other.

4.2 subdivided environment
smoothing the voronoi cells

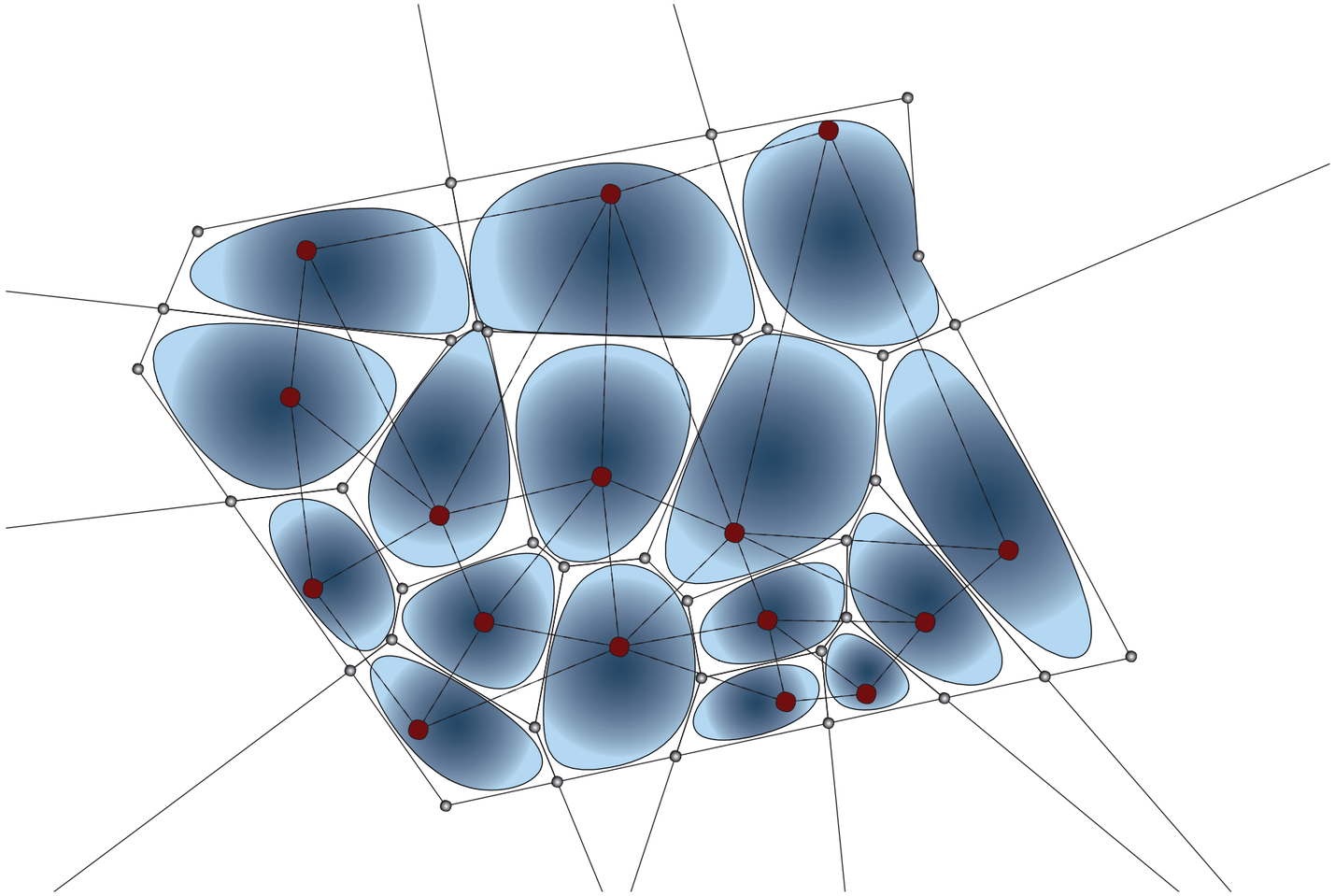


fig. 243_smoothed Voronoi diagram

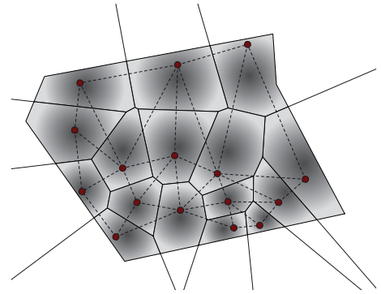


fig. 242_Voronoi diagram of the extracted site points

influenced areas

area center points / Voronoi points

control points for the smoothed cells

Delauny triangulation

In order to create an offset the cell boundaries are smoothed with cubic Bezier spline curves, related to the control points of the Voronoi polygons.

The new, smoothed boundaries are all situated within the orginal cell. The more linear segments a Voronoi cell has, the more exact is the smoothed curve aproximation to its original geometry.

The shape of the new, smoothed cells is determined by the geometry of the original Voronoi diagram with its respective control points.

4.2 subdivided environment

building an abstract pathway system

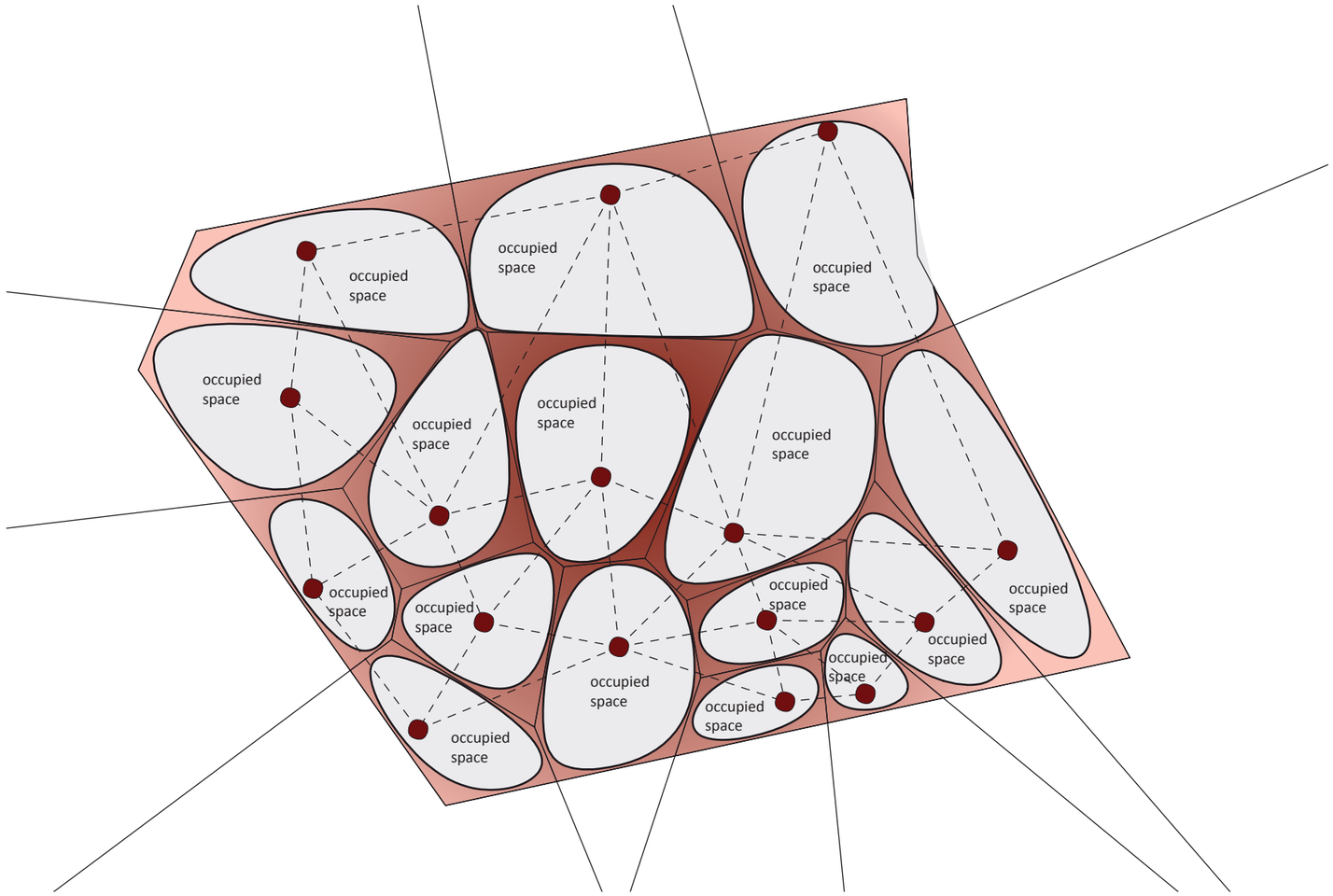


fig. 244_occupied space and circulation space

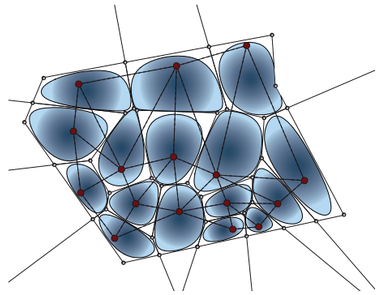


fig. 243_smoothed Voronoi diagram

occupied space

circulation space between the cells

area center points / Voronoi points

Delauny triangulation

In the next step we declare the smoothed Voronoi cells in the diagram to the left as occupied space, the areas highlighted in red as the circulation space inbetween.

The nodes symbolize crossways in this circulation system which have an equal distance to three or more center points of the original site areas.

The occupied spaces, on the other hand, are defined by the number of surrounding nodes.

Therefore, the diagram could be interpreted as an abstract solution to readjust the current site areas by keeping their direct relation to the origial geometrical center points.

4.3 attracted environment

locating the global attractor point

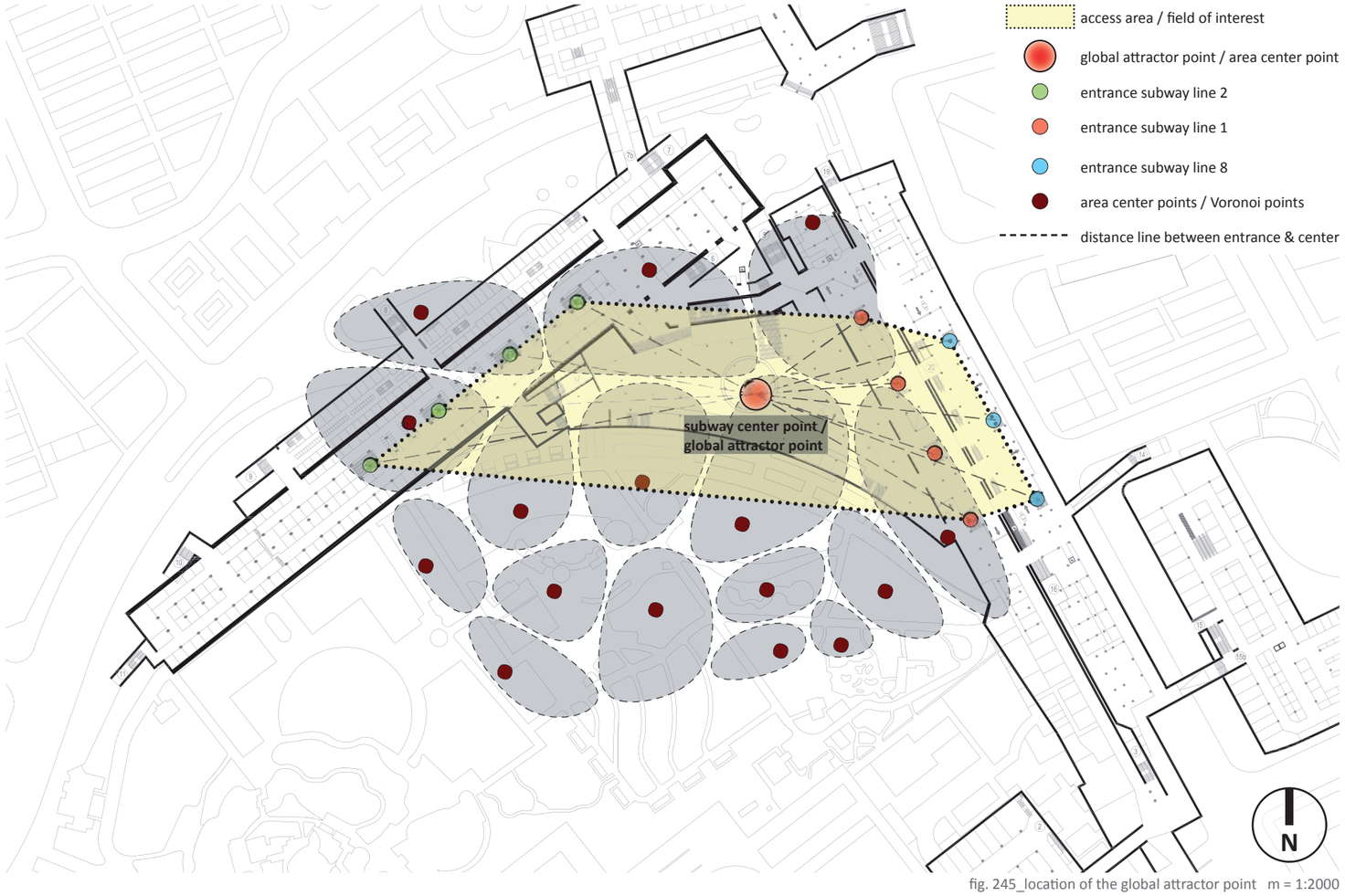


fig. 245_location of the global attractor point m = 1:2000

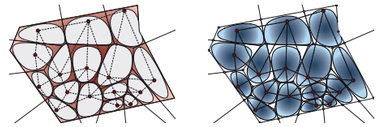


fig. 243/244_spaces of the Voronoi algorithm

The previous steps focused on developing a new subdividing system for the green areas which is related to the original geometry of the park.

This system is completly autarkic. The Voronoi algorithm is calculated with just one specific parameter - the area center points. External factors like the influence of the subway hub were ignored.

The following diagrams show the transformation from the subdivided system into an attracted system. Therefore, we need a global attractor point which influences the occupied space of the generated Voronoi cells.

We consider the main entrance hall in the subway area a very important transition space, as people make connections between the three different subway lines. The gravity point which attracts the subdivided system should be lie within this area, occupying a neutral position which ensures relatively uniform distances to the different subway entrances.

In order to locate this point, a minimal area containing all the 11 accesses to the subway lines (highlighted in yellow) is generated. By extracting the area's center point we obtain the location of the neutrally positioned global attractor point.

4.3 attracted environment

integrating the global attractor point into the voronoi diagram

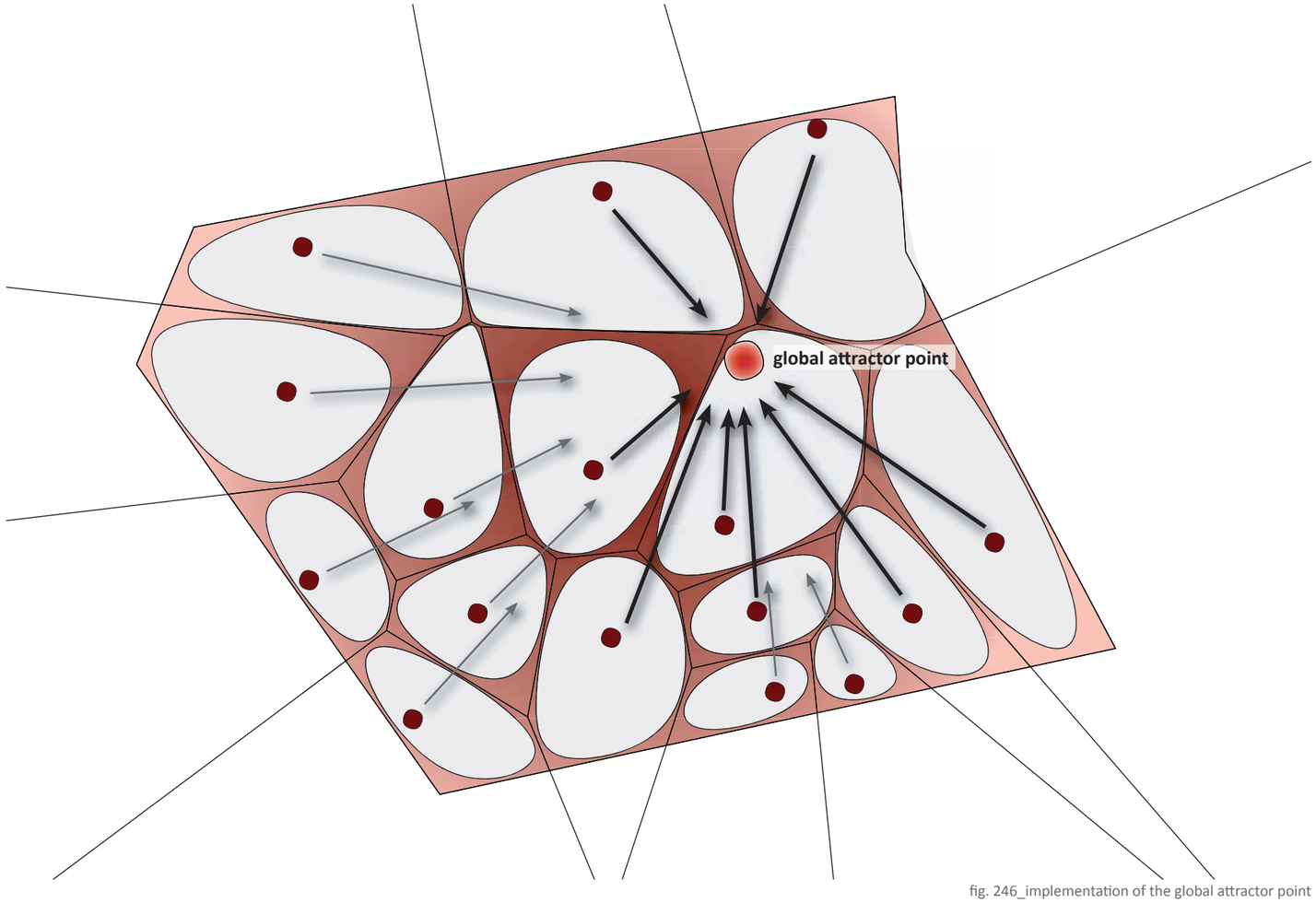


fig. 246_implementation of the global attractor point

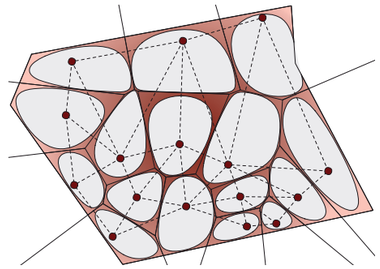
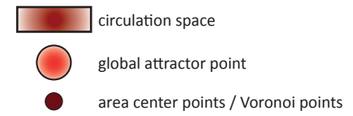


fig. 244_circulation space

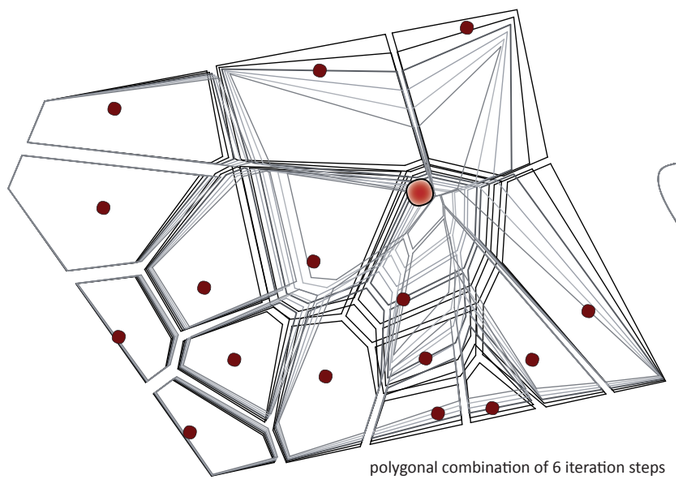


The global attractor point is integrated into the abstract Voronoi diagram, where it attracts circulation space and occupied space in like manner. The intensity of deformation is linked relative to the distance between the Voronoi cell and the attractor point.

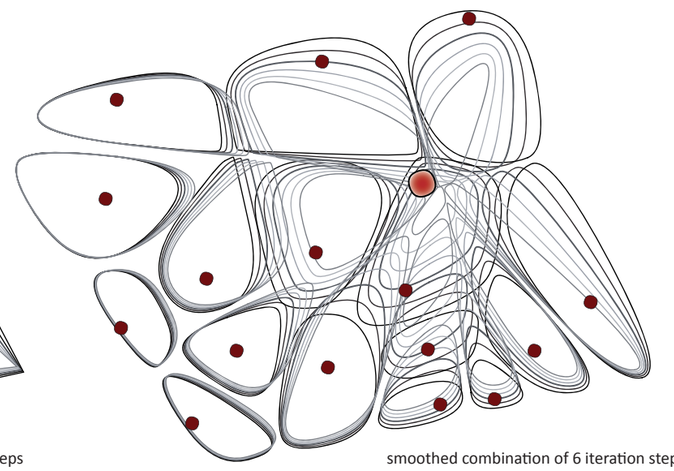
Hence, the geometries of cells closer to the point are more distorted than the geometries of cells farther away.

4.3 attracted environment

attractor iterations of the Voronoi Cells



polygonal combination of 6 iteration steps



smoothed combination of 6 iteration steps

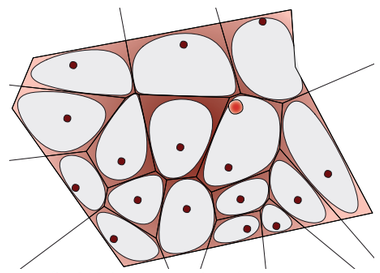


fig. 246_implementation of the attractor point

global attractor point

area center points / Voronoi points

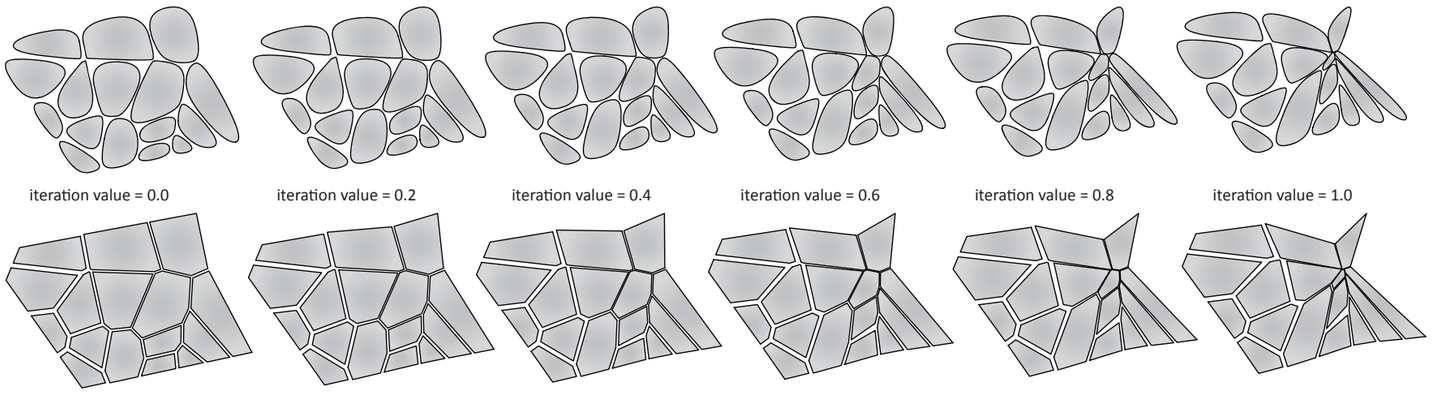


fig. 247_attractor point iteration process

The diagrams to the left show 6 iterations of a mathematical script which deforms the Voronoi cells.

The higher the gravity value in this script, the more the geometries are deformed towards the global attractor point. A gravity value of 0.0 simulates the initial state whereas, a value of 1.0 is the maximum of gravitation before the cells start to intersect. A value below 0.0 results in a distractor instead of an attractor.

Additionally, the script calculates an offset between the cells which is directly related to the position of the global attractor. The farther two cells are away from the gravity center, the bigger is the offset between them.

4.3 attracted environment

the scripted code behind the process

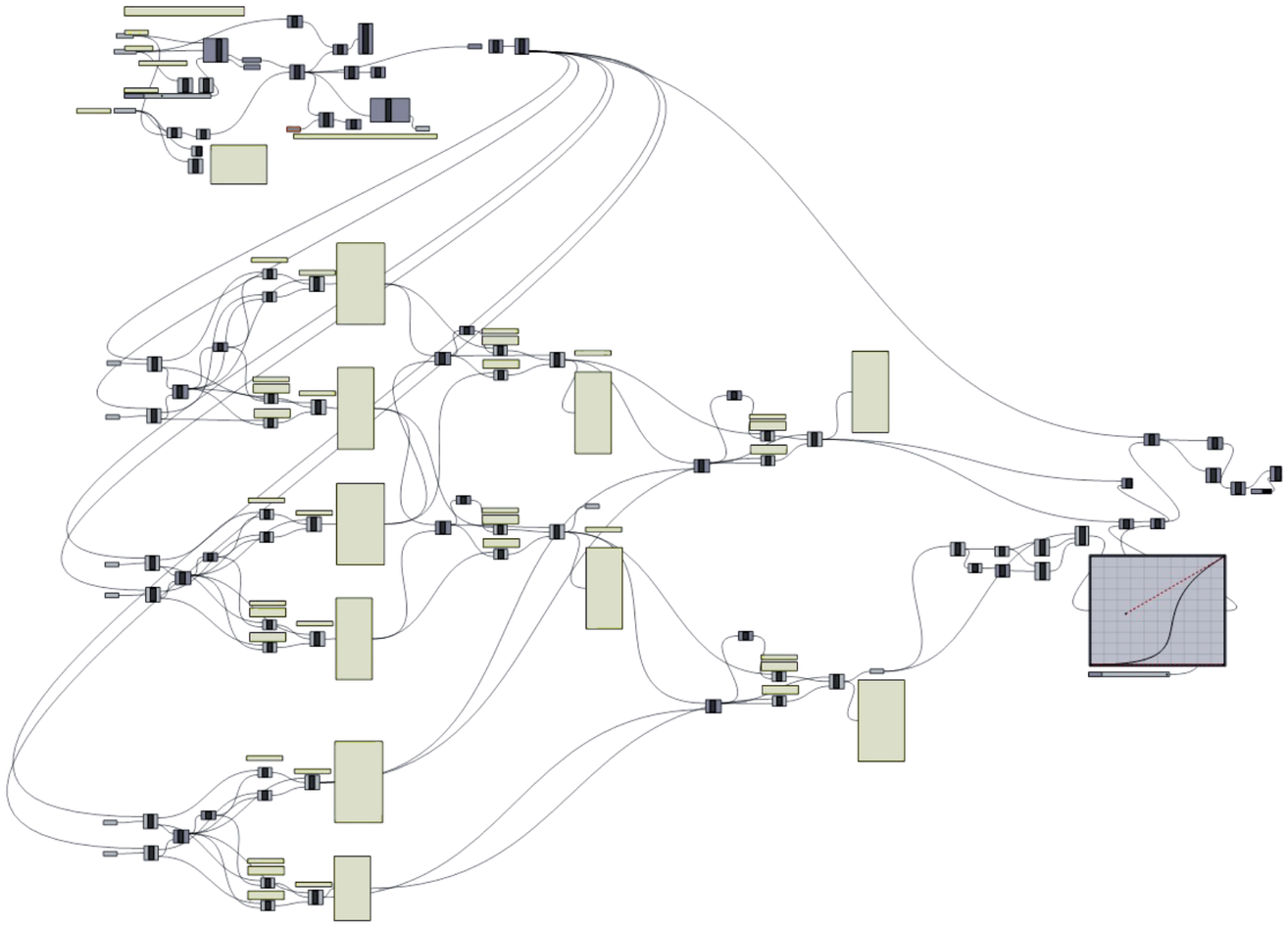


fig. 248_scripted code (grasshopper)

For simulating the different iteration steps the parametric tool „grasshopper“ was used.

The first code block (on top of the graphic to the left) is responsible for calculating the Voronoi cells with a VB script component by using input points, boundary points and the global attractor point. The offset between the cells is calculated with the following formula:

distance between attractor and input point/50

In the main procedure below the first code block calculates the vectors and their vector lengths between the global attractor point and every single Voronoi node of the diagram.

The resulting maximum and minimum values are then sorted and used for the formula:

1-((x-y) / (z-y))

x ..... all the calculated vector lengths

y ..... minimum value on the list

z ..... maximum value on the list

This formula creates certain values below 1.0 which are then processed in a graph mapper, which has a numeric mapping function based on a Bézier curve.

Multiplying the original vectors by the scalar output from the graph mapper generates the final translation vector for each point of the Voronoi cells.

4.3 attracted environment

extracting the best result of the iterations

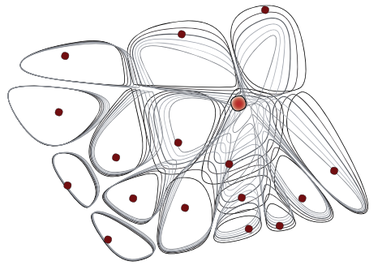
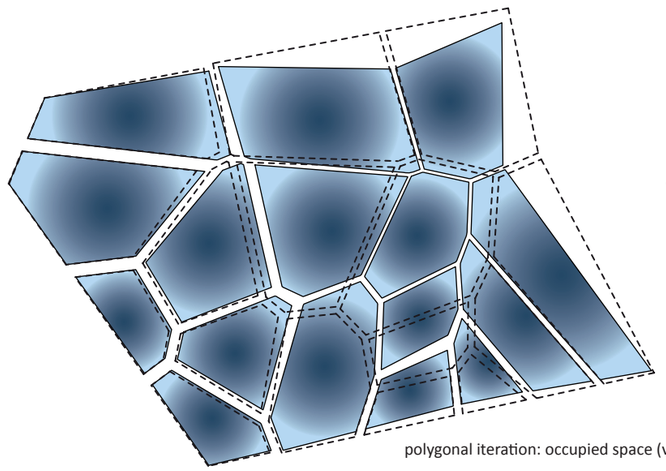
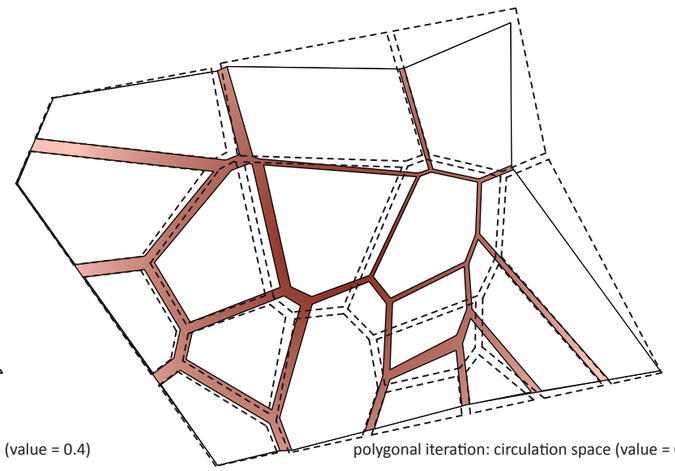


fig. 247_attractor point iteration process



polygonal iteration: occupied space (value = 0.4)

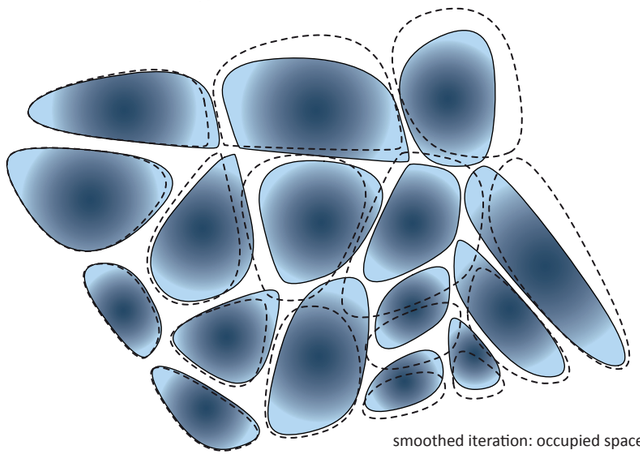


polygonal iteration: circulation space (value = 0.4)

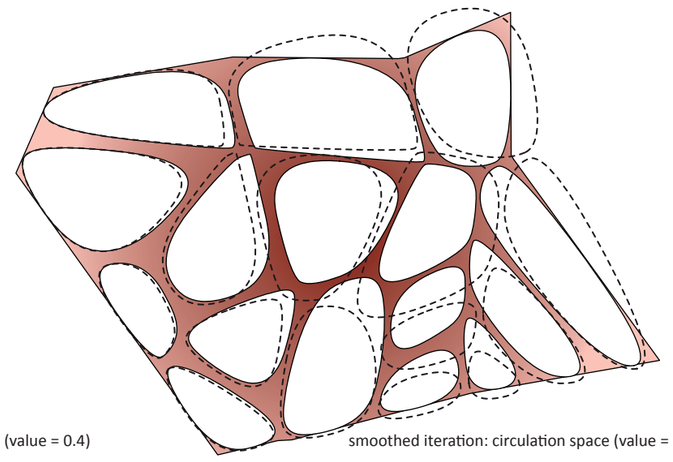
circulation space (iteration 0.4)

occupied space (iteration 0.4)

original Voronoi cells (iteration 0.0)



smoothed iteration: occupied space (value = 0.4)



smoothed iteration: circulation space (value = 0.4)

fig. 249_diagram of iteration value 0,4

The influence value of 0.4 generates the best offset result in relation to the general dimensions of the site and represents an average between the two extrema of 0.0 and 1.0.

The diagrams to the left show the polygonal iteration as well as the smoothed iteration and the interpretation of occupied and circulation space.

The dashed lines denote the orginal Voronoi cells and visualize the deformation caused by the global attractor point.

4.3 attracted environment

connectivity of the pattern to the main urban influences

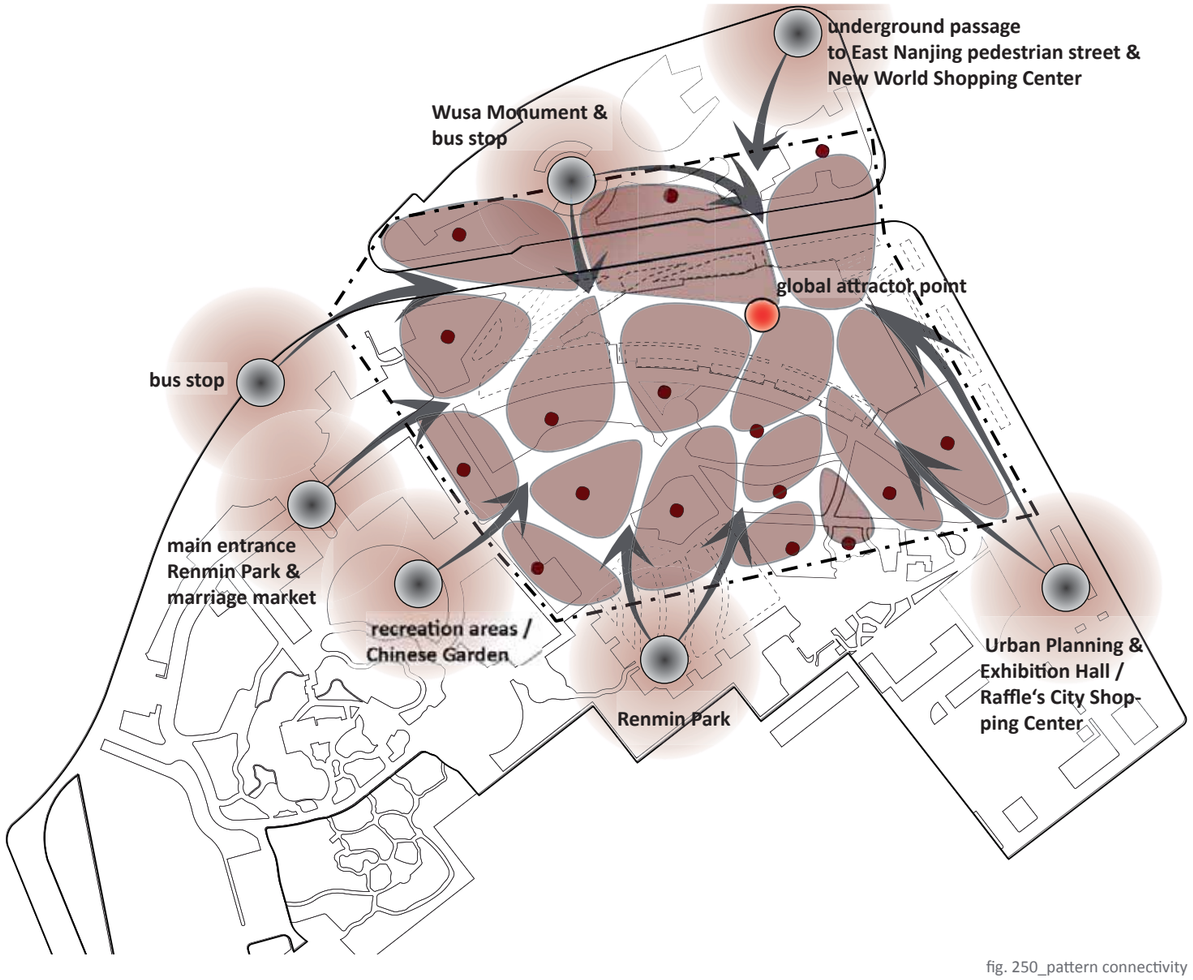


fig. 250_pattern connectivity

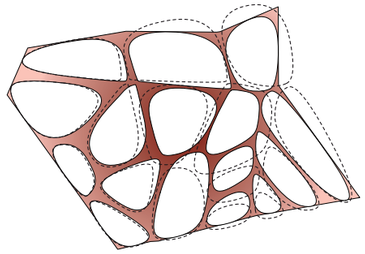


fig. 249_attractor point iteration step 0,4

Voronoi pattern

global attractor point

main urban influences

area center points / Voronoi points

The pattern resulting from the iteration is applied to the site in order to check its geometrical connectivity to the surrounding urban influences.

Because of the original green zones' relation to the area center points, the new pathways between the cells (circulation space) are still connected to the existing paths, especially at the area's periphery.

Furthermore, urban barriers and limitations such as fences or roads were not taken into consideration for this diagram. The application of the pattern with regard to these important factors will be subject of the following steps.

4.3 attracted environment

application of the pattern on the site

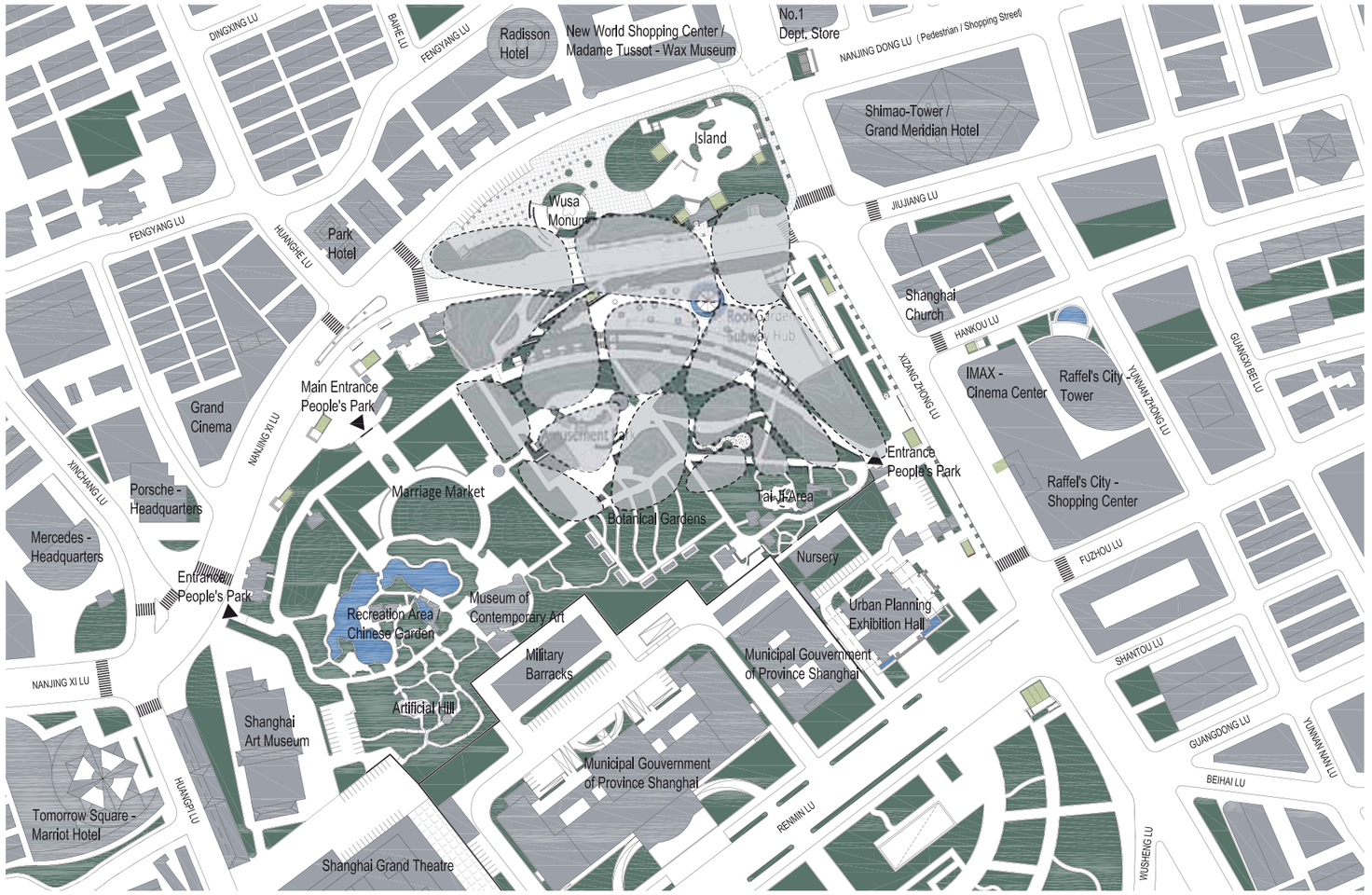


fig. 251_pattern implementation on site - step I m = 1:3000

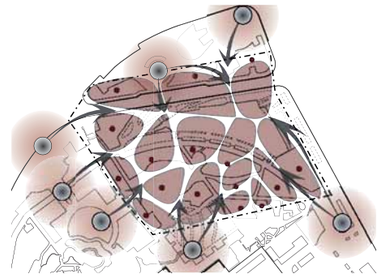


fig. 250_pattern connectivity

green areas

Voronoi pattern

After having verified the connectivity of the attracted pattern with its surrounding environment, the new system can be applied to the site.

The original green areas which were redefined by means of the new system, will be replaced by the occupied space of the generated Voronoi pattern.

At this stage, the pattern stills serves as an overlay to the current system. Margins and urban barriers are still not taken into account. After a detailed analysis of the pattern in relation to the site's geometry, specific parts which are overlapping problematic areas like roads will be adjusted in the next step.

4.3 attracted environment

application of the pattern on the site

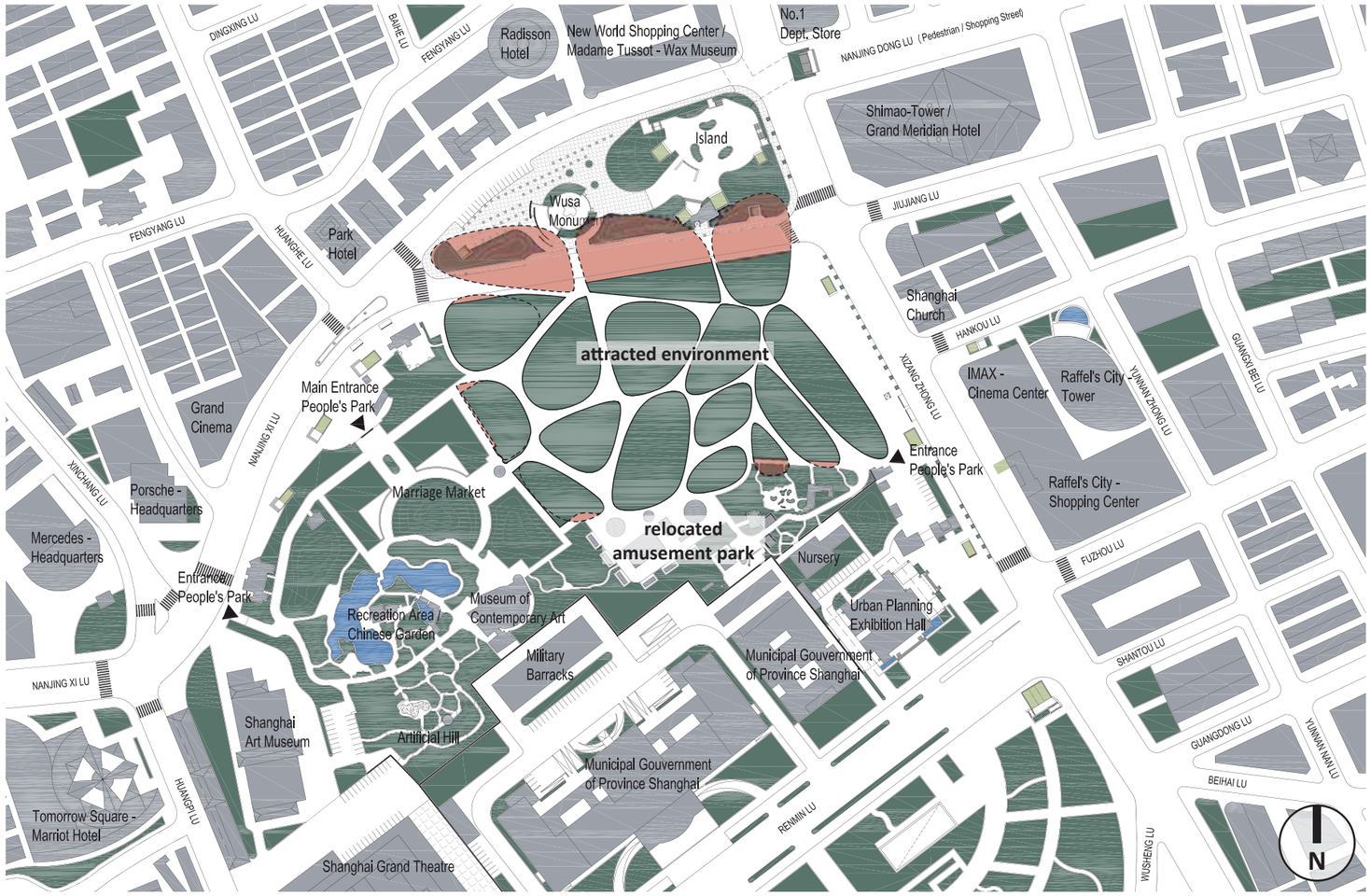


fig. 252_pattern implementation on site - step II m = 1:3000

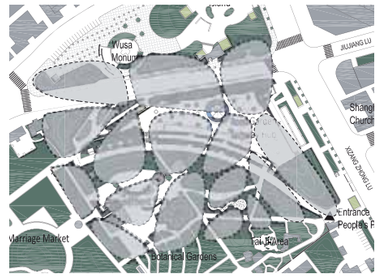


fig. 251_pattern implementation - step I

green areas

deleted parts of the Voronoi pattern

The section of West Nanjing Road between the Island and Renmin Park represents a strong urban barrier. Therefore, the Voronoi cells which are intersecting with this road had to be erased.

By deleting the botanical gardens in the southern park area, the amusement park can be re-located to that very same spot. The greater distance between subway hub and amusement park solves the problem of the noise pollution and prevents people from suffering permanent hearing damage.

Some of the Voronoi cells located at the outer periphery - next to the existing environment - were partly adjusted to optically link them to the urban geometry. The dashed lines in the diagram illustrate their orginal outlines.

4.4 three-dimensional development

height differentiation of the pattern

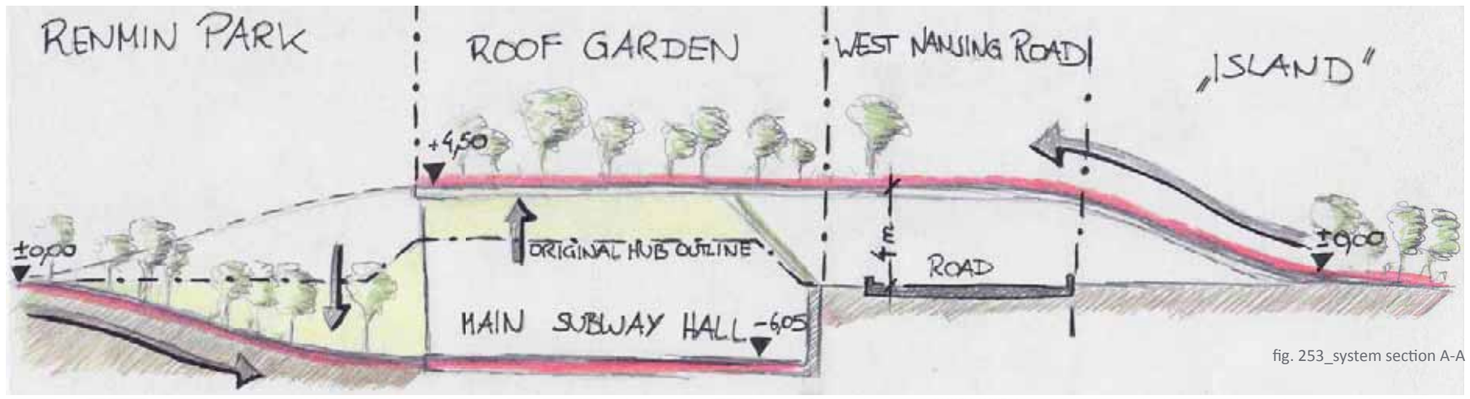


fig. 253_system section A-A

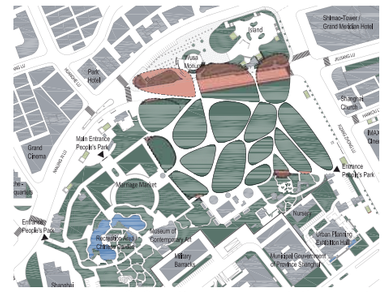


fig. 252_pattern implementation on site

elevated circulation space

lowered green areas (-4.50 m)

transition green areas (height gradiant)

elevated green areas (+4.25 m)

normal green areas (+0.00 m)

original height outline of Renmin Park and subway hub (sketch section)

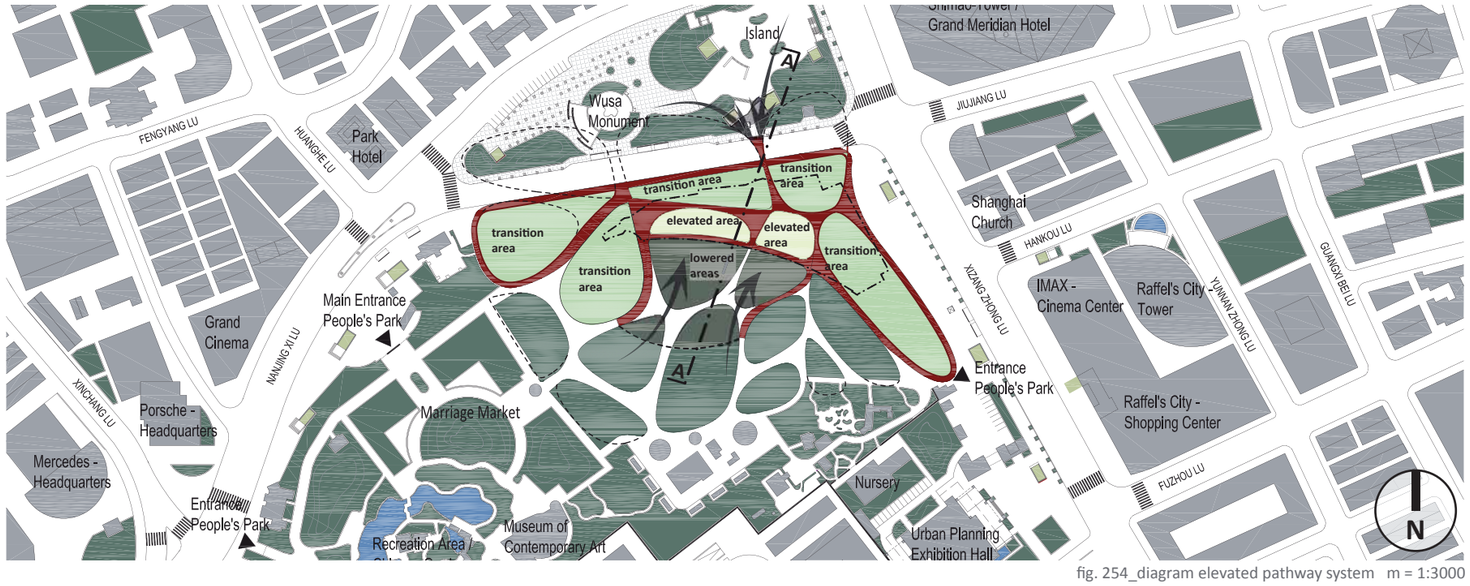


fig. 254_diagram elevated pathway system m = 1:3000

The sketch on top of the page illustrates two main design ideas: of lowering certain areas of Renmin Park to the main subway hall level as well as realizing a height adjustment of the roof garden in order to guarantee access to the Island.

Roof garden and park should interact with each other by overlapping their geometries on different height levels.

In this vein, the urban barrier of West Nanjing Road and the barrier between hub and Renmin Park are overcome by a bridge, which establishes the connectivity between the Island and the park areas.

4.4 three-dimensional development

height differentiation of the pattern - 3D model

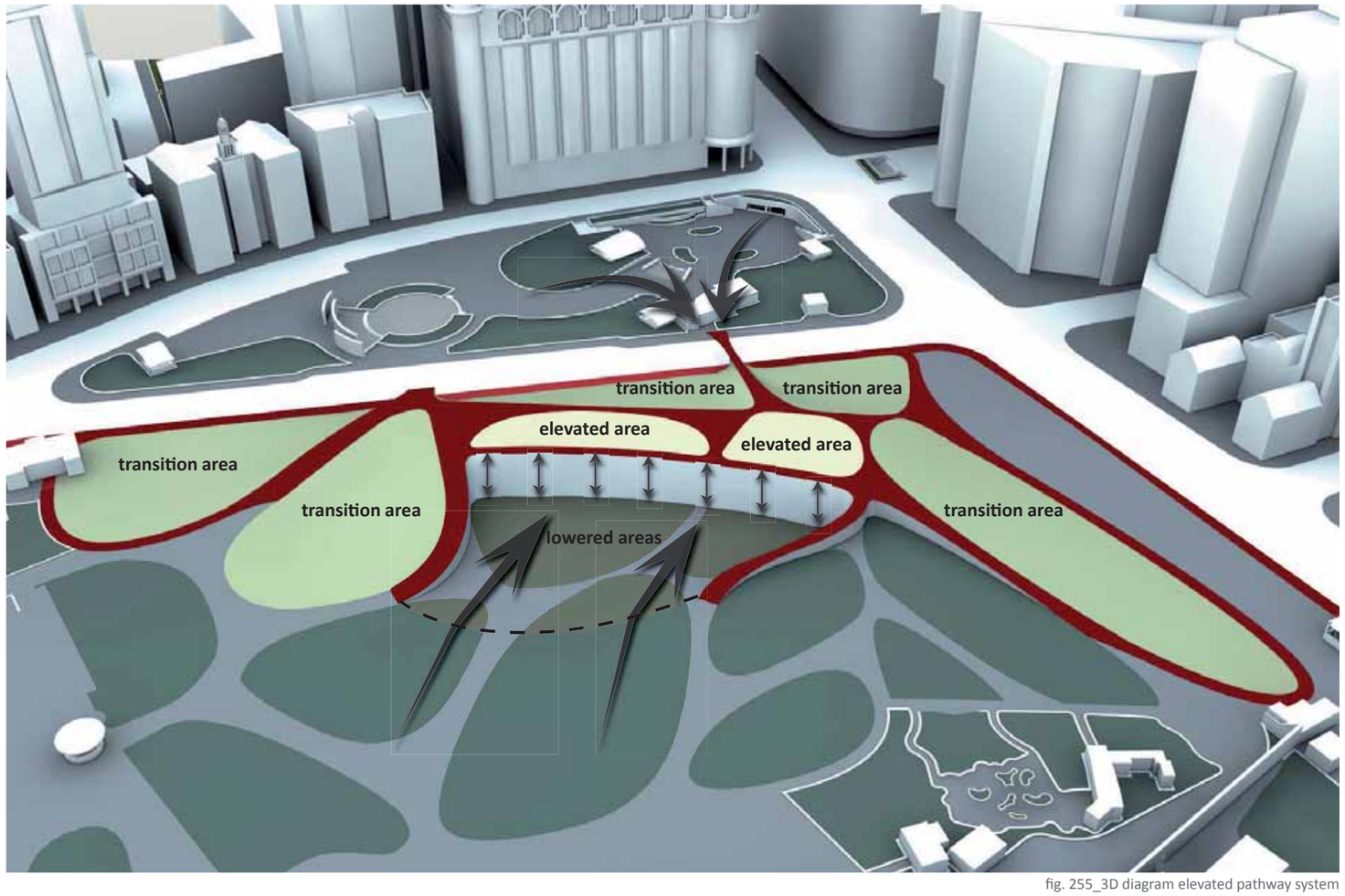


fig. 255_3D diagram elevated pathway system

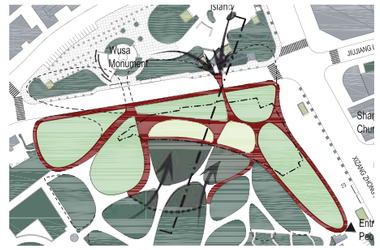


fig. 254_elevated pathway system

elevated circulation space

lowered green areas (-4.50 m)

transition green areas (height gradiant)

elevated green areas (+4.25 m)

normal green areas (+0.00 m)

boarder line between lowered and normal green areas

The diagram to the left explains the height displacement in a three-dimensional way. The areas above the main subway hall are shifted by 4.25 m along the z-axis to guarantee the necessary height for bridging West Nanjing Road and getting access to the Island.

Additionally, the green areas giving access to Renmin Park just outside the main subway hall are lowered (-4.50 m) in order to establish a direct connection between park and subway system.

The transition areas hold a gentle slope to generate a landscape gradiant between the elevated areas and Renmin Park.

4.4 three-dimensional development

3D park extension - sketches

fig. 256_smooth transition between Island, hub and Renmin Park

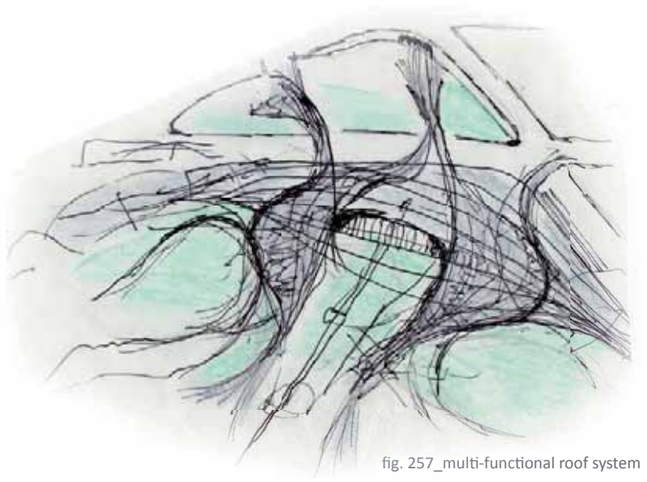


fig. 257_multi-functional roof system

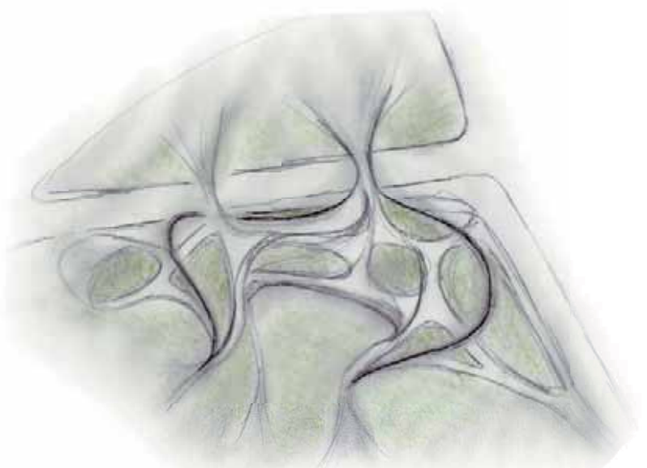


fig. 258_structural extension of Renmin Park

fig. 259_leaf metaphor

fig. 260_bud metaphor

The three sketches to the left show different ideas of how to create a three-dimensional connection between Renmin Park and the Island.

In all the diagrams, the metaphor of the leaf plays and important role: the park should be extended to the Island in an organic and smooth way, similar to the shape of two green leafs which are covering the heavy traffic in and around the subway hub and bluring the limits of Renmin Park in like manner.

The sketch to the very left also includes the idea of additional buds. They suppose a structural connection to the urban traffic system, like for example to bus stops or widened subway entrances.

4.4 three-dimensional development

3D park extension - “the two leafs“

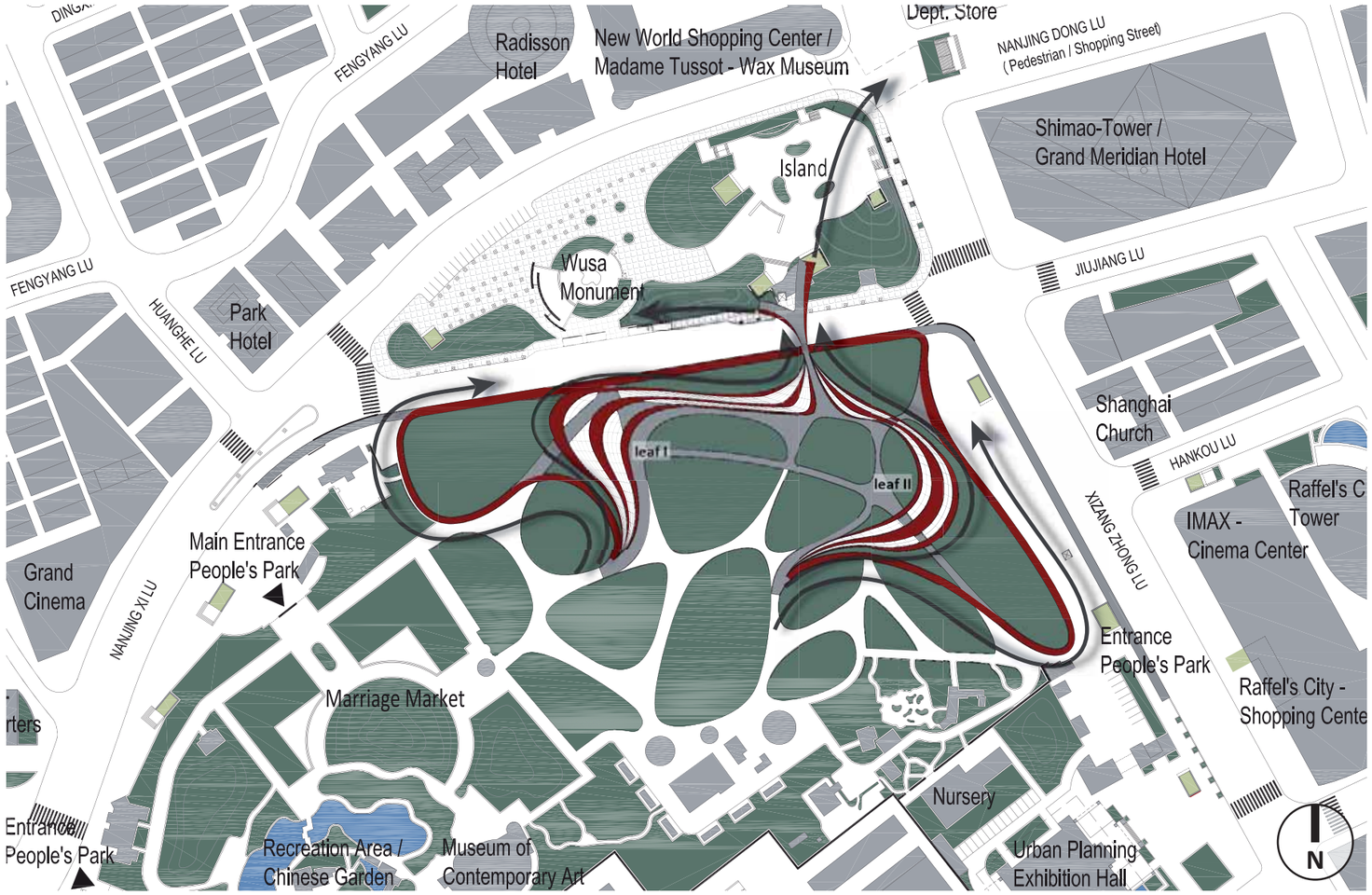


fig. 261_smooth transition m = 1:2000

fig. 256_sketch - smooth transition

primary leaf iso-curves

green areas

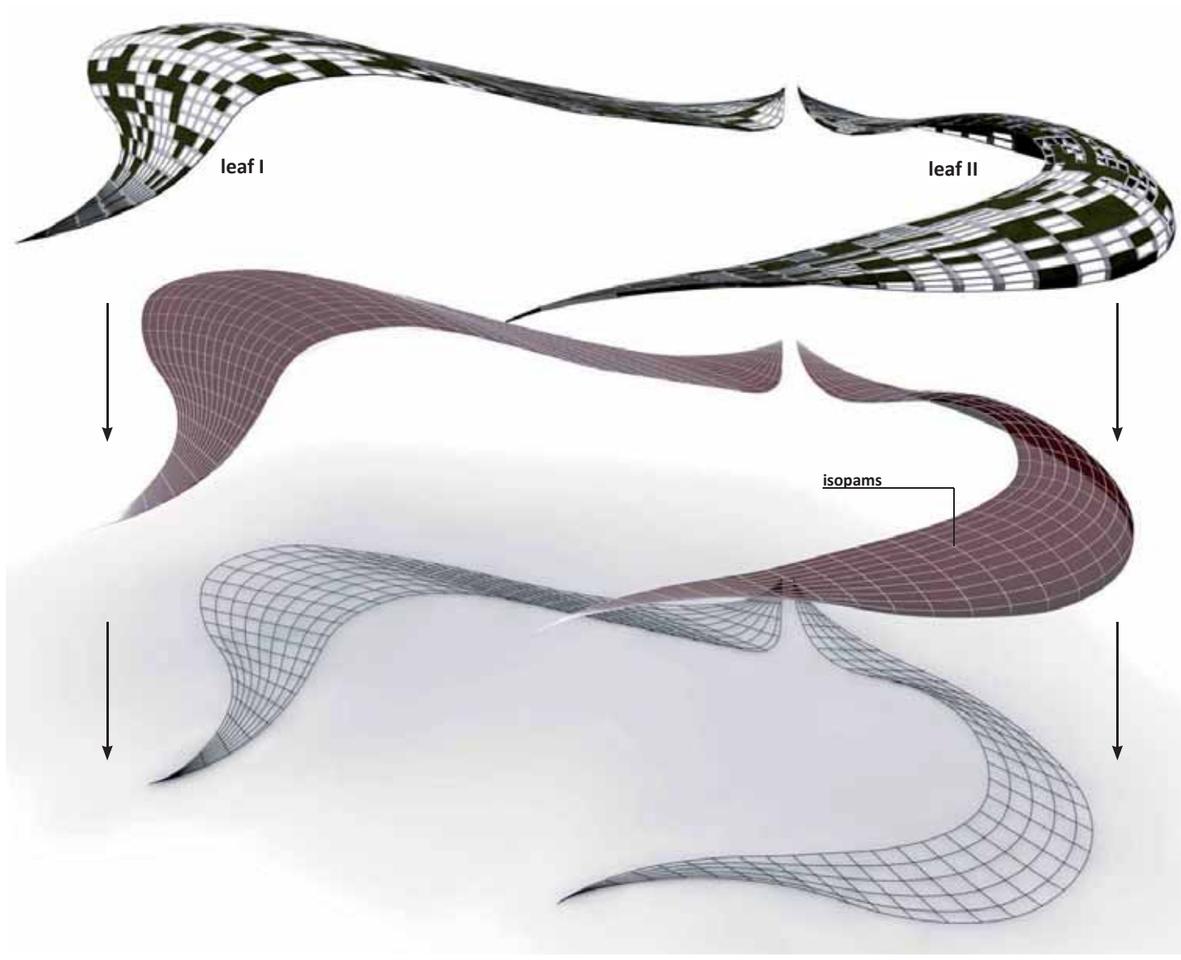
In the diagram on page 101, a new link in the elevated path system is integrated to overcome the barrier of Jiujiang Road.

This link, four meters above ground, functions as an attractor for the leaf structures. Their iso-curves emerge from the attracted park areas, describing the geometrical form of a leaf in order to finally transform themselves into a bridge over the road.

The “leaf structures” surround and enclose the center of the roof garden above the hub, enforcing its representative function and (acoustically) protecting it from the surrounding traffic noise.

4.4 three-dimensional development

3D park extension - “leaf“ geometries



step III
paneled surface

step II
three-dimensional structural deformation into a NURBS surface

step I
two-dimensional wireframe pattern

fig. 262_explosion graphic of the “leaf“ geometry

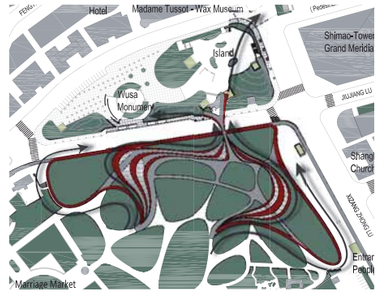


fig. 261_smooth transition

continous NURBS surfaces

grass panels

The 2D wireframe pattern (step I in diagram to the left) is based on the two-dimensional iso-curves from the site’s geometry. Step II shows the transformation from this two-dimensional pattern into a 3D NURBS surface before it finally converts into a paneled system in step III.

The second step describes two different transformations: the left leaf represents a slightly elevated roof while the right leaf creates a half-open, half-closed space.

The third step addresses the issue of the visual park extension. The applied grass panels on the surfaces underline the metaphor of “the green lung of Shanghai“.

4.4 three-dimensional development

3D park extension - “leaf“ geometries

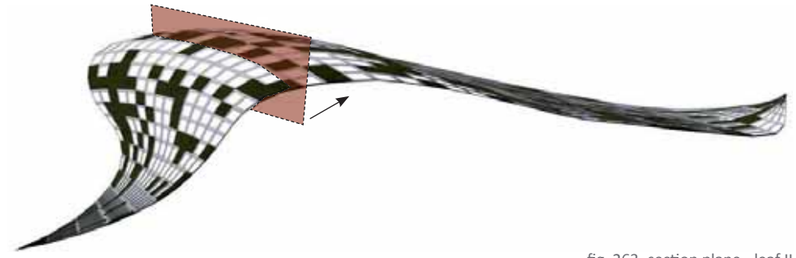


fig. 263_section plane - leaf II

fig. 264_section - leaf I m = 1:100

fig. 265_example hanging plants - ivy

“Leaf I“ is a multifunctional roof which partly covers the main subway hall, the roof garden and one of the green transition areas of Renmin Park.

The detail to the left shows how to use plants that are suspended from the gaps in the roof not covered by green panels, in order to convey a feeling of being totally surrounded by nature.

Using ivy, which is one of the traditional plants of Chinese gardens, creates a natural cover for the park’s green recreation area. It provides shade, is quite adaptable and can also endure a lack of sunlight over a longer period of time.

4.4 three-dimensional development

3D park extension - “leaf“ geometries

fig. 266_section plane - leaf II

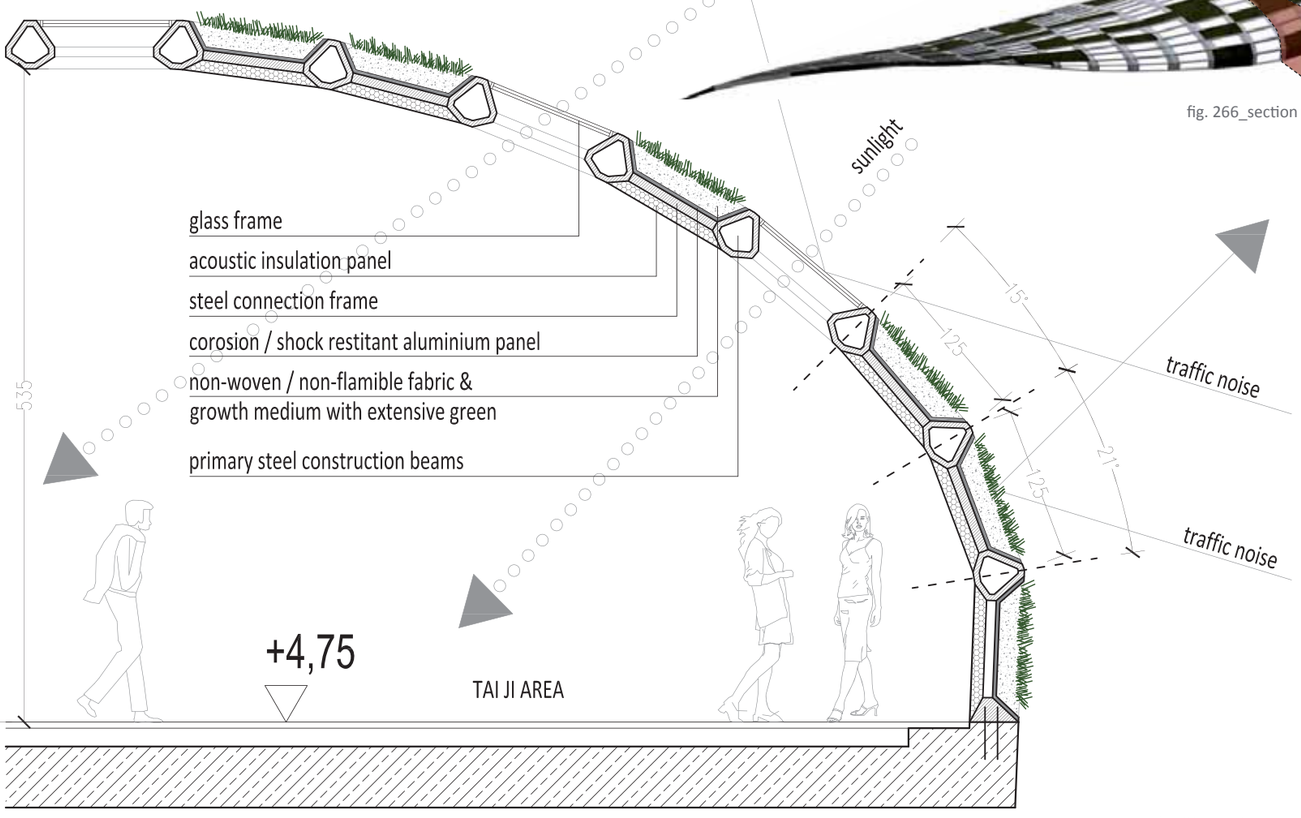


fig. 267_section - leaf II m = 1:50

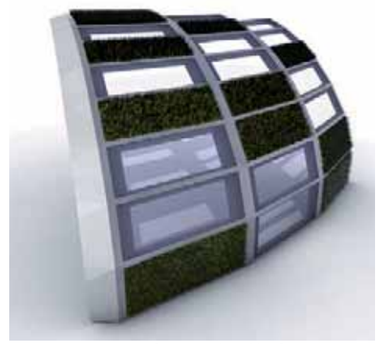


fig. 268_detail leaf construction

fig. 269_example green wall paneling

The second leaf’s green panels not only establish a visual connection between structural architecture and natural landscape, they also serve as acoustic insulation, protecting the roof garden from the traffic noise of Middle Xizang Road.

Glass frames for the gaps wich are neither covered by green panels guarantee natural illumination.

The primary construction material of the areas between the panels is stainless steel.

4.4 three-dimensional development

3D park extension - “the four additional leaf buds“

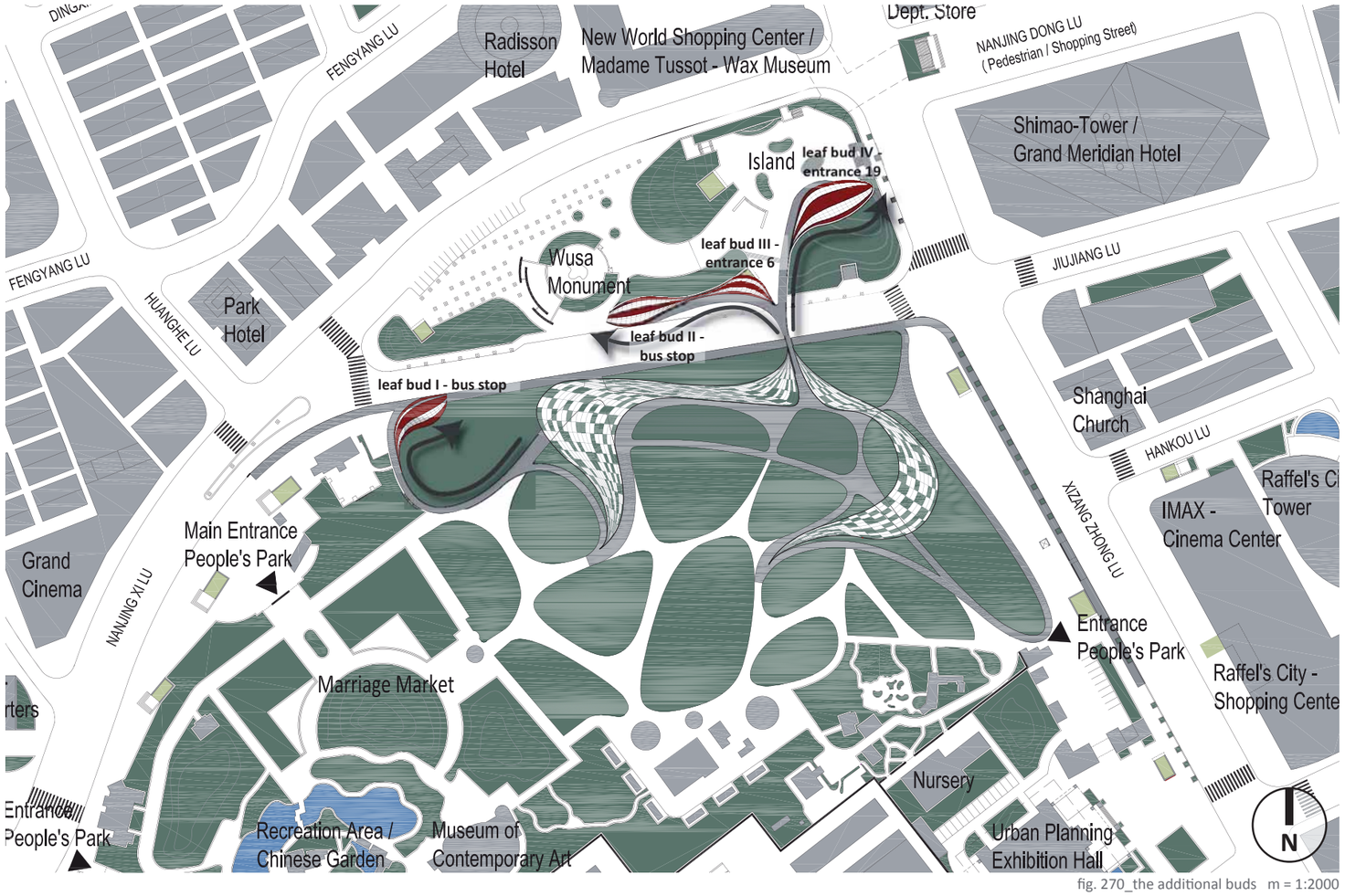


fig. 270_the additional buds m = 1:2000

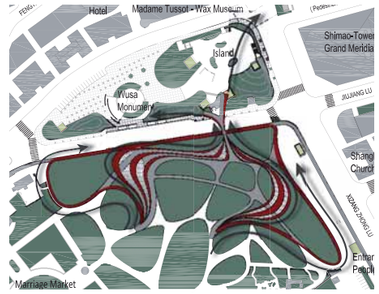


fig. 261_smooth transition

primary bud iso-curves

green areas

The two leafs mainly focus on enhancing the social status of the main subway hall and its roof garden as well as on bridging the barriers to the Island and Renmin Park.

In order to connect the new structure to the public transportation network and to deal with major architectural problems of the existing situation, four additional „leaf buds“ were added to the system.

Leaf bud I & II serve as additional roofs which cover the two bus stops at Jiujiang Road.

Leaf bud III & IV serve as new roof geometries of two very important entrances to the subway system.

The additional leaf buds strictly follow the design principles of the two leafs and therefore generate a coherent and homogenous roof system on the site.

4.4 three-dimensional development

3D park extension - “bud“ geometries

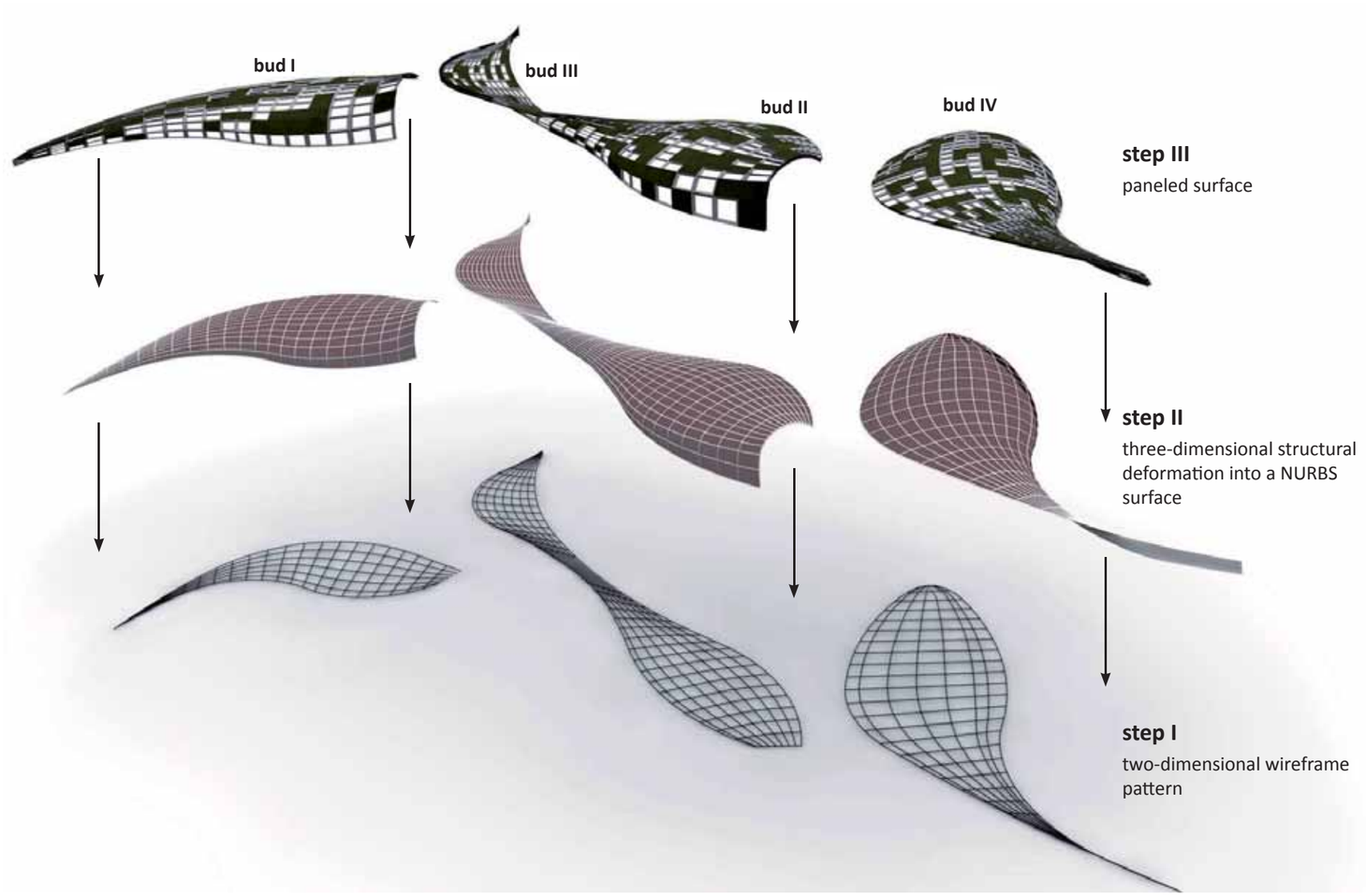


fig. 271_explosion graphic of the “bud“ geometry

fig. 270_the additional buds

continous NURBS surfaces

grass panels

The basic iso-curves of the buds are extracted from the site‘s geometry the same way the two main leafs were created, namely by transforming the 2D wireframe pattern into a 3D NURBS surface.

By paneling the surfaces in step III, the visual connection to the main leafs is established. The buds in combination with the leafs underline the idea of extending Renmin Park to the roof garden and therfore reinforce the metaphor of “the green lung of Shanghai“.

4.4 three-dimensional development

roof garden specification

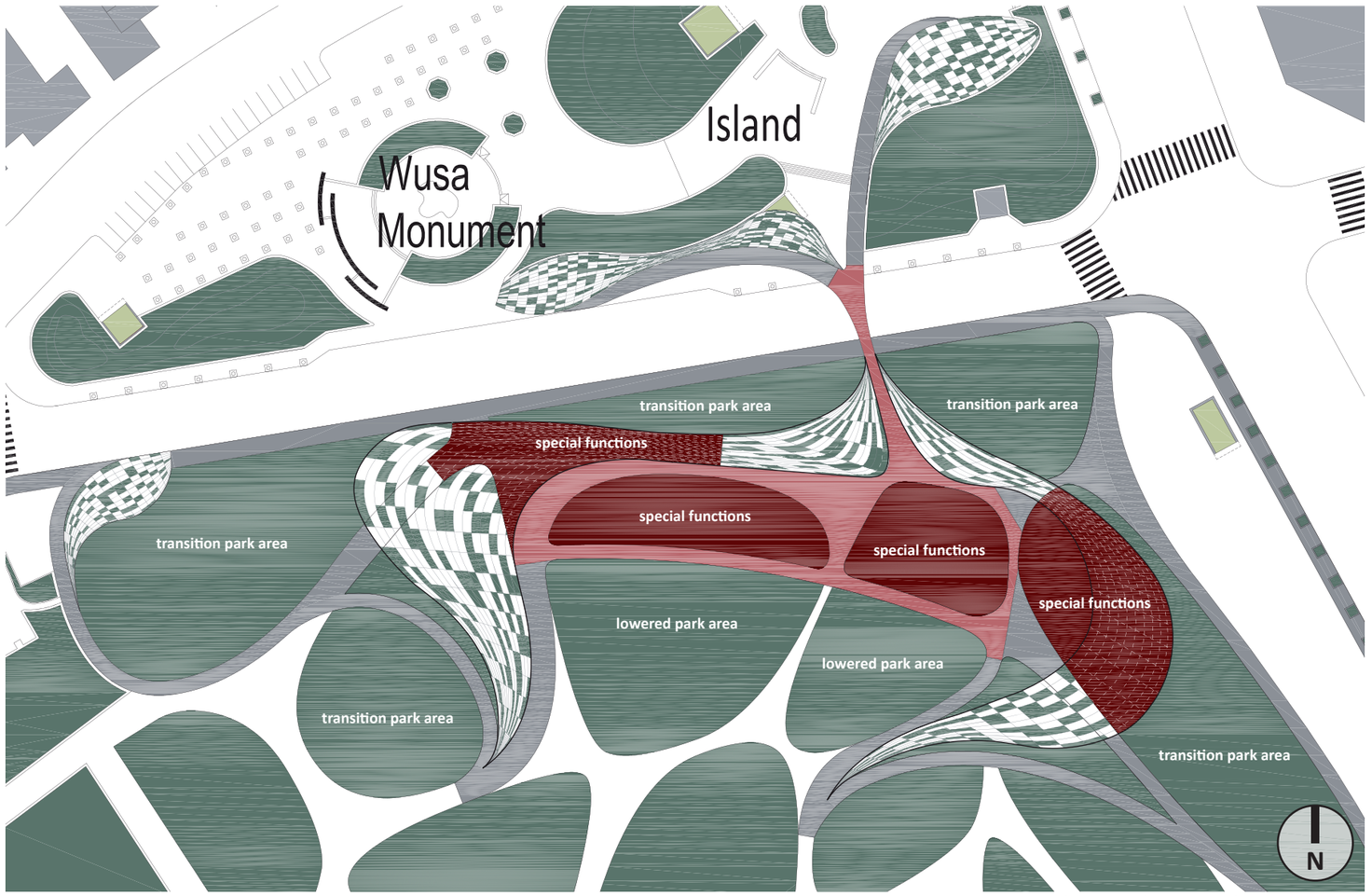


fig. 272_roof garden specification m = 1:1000

fig. 273_topview - leaf & bud geometries

special function areas

circulation paths (roof garden)

park areas

The elevated areas enclosed and protected by the two leafs are divided into roof garden circulation paths and special function areas.

Contrary to the current site's roof garden which does not offer any special functions at all, the newly designed space includes various areas focusing on different traditional Chinese activities.

Due to the direct access from both, the park and the Island, and thanks to the new diversified functions of the roof garden, people should be attracted from every direction of the site in order to actively use the new space.

4.4 three-dimensional development

roof garden specification

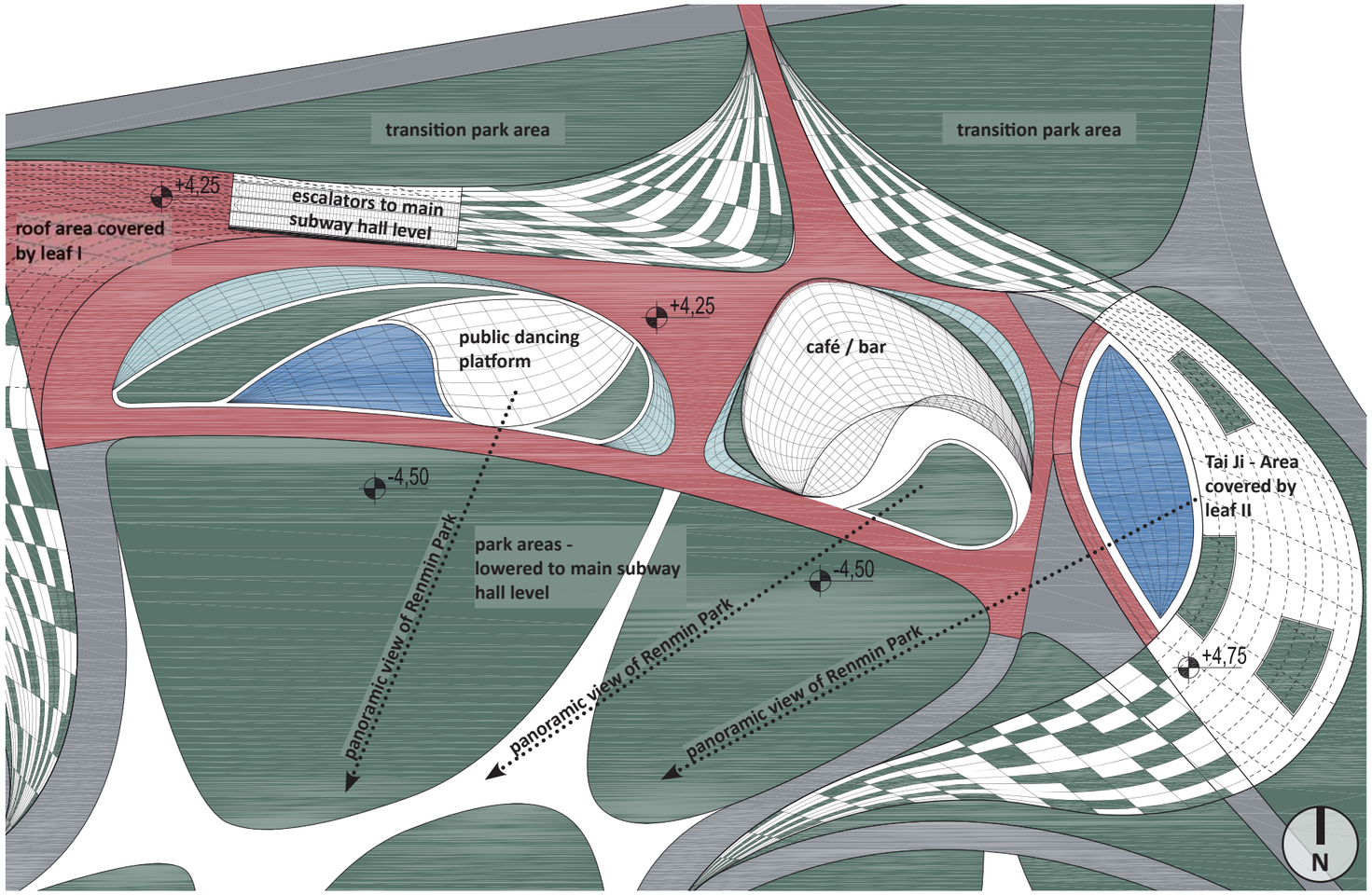


fig. 274_function diagram roof garden m = 1:500

- circulation paths (roof garden)
- water pool
- glass frames - visual connection to the underground subway hall
- park areas

In order to gain immediate access from the roof garden to the main subway hall, escalators were integrated in the design under leaf I. Glass frames, which are related the boundaries of the orginial Voronoi geometries, establish a visual connection and bring natural illumination to the subway hall.

Public dancing activities are a fundamental part of Chinese tradition and are performed by people of all ages. Therefore, a public dancing platform was installed at a certain location from where one has a great overview of Renmin Park.

Furthermore, a Tai Ji-area is hidden underneath leaf II which protects it from the traffic noise. Its orientation towards Renmin Park offers a nice panoramic view.

The new café and bar replaces the Starbucks café which was originally located directly next to Middle Xizhang Road. The new structure abstracted from the geomtry of the Yin Yang-symbol is acoustically protected from the traffic and creates an area for relaxing and for escaping the rush of the underground subway system.

Green areas and two water pools are added to additionally enforce the social characteristics of the roof garden.

4.4 three-dimensional development

park area adjustment

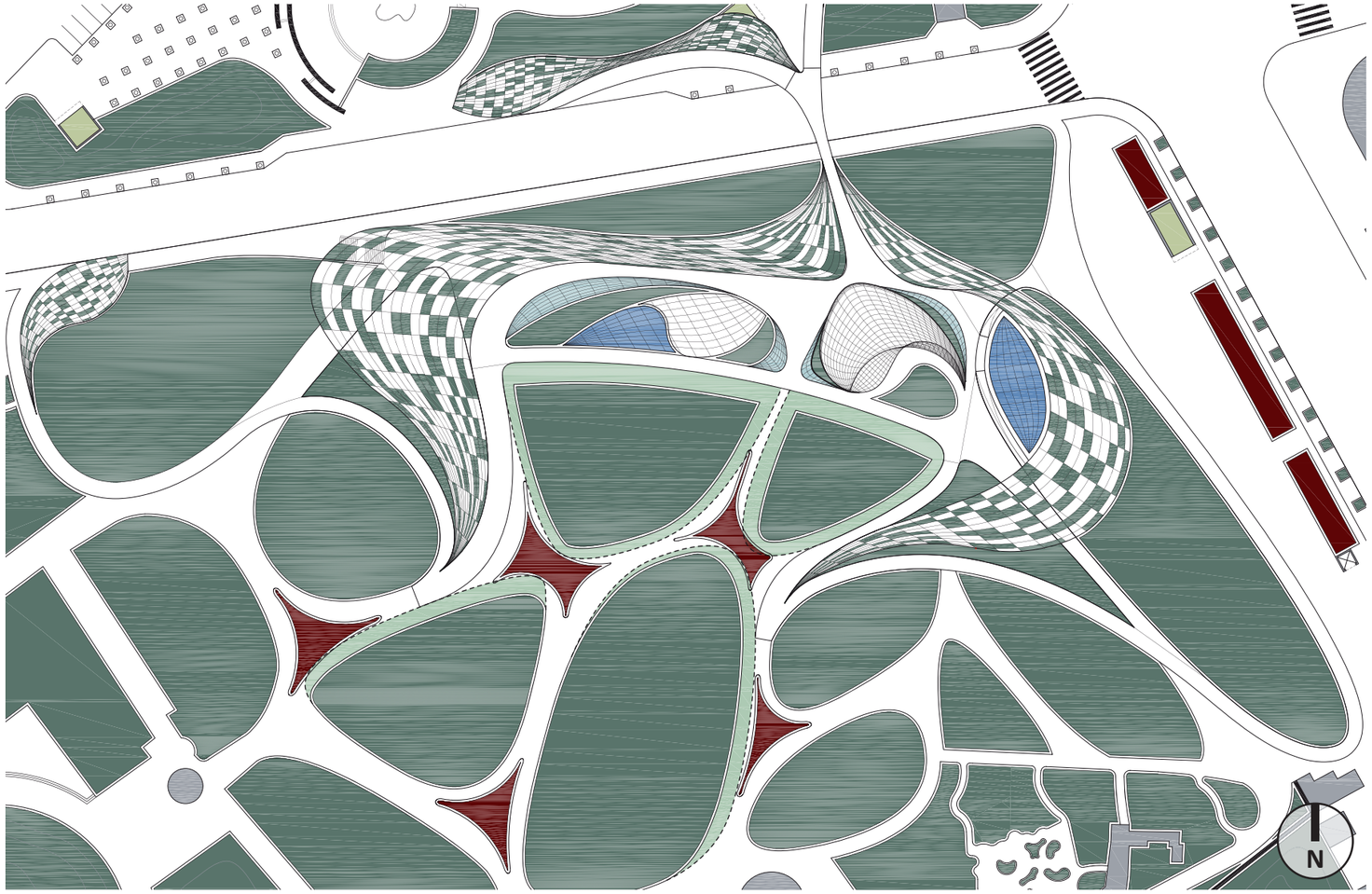


fig. 275_park area adjustment m = 1:1000

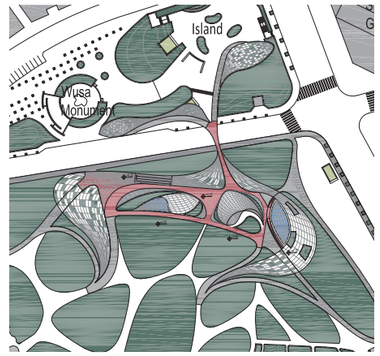


fig. 274_topview - detail roof garden

adjusted park areas

deleted parts of the new park areas

park areas

original green area outlines

The width of the circulation paths inside the new green zone pattern of Renmin Park are strongly impaired by the elevated ramps which connect the roof garden with the park area.

Therefore certain parts of the green zones are erased in order to broaden the paths. For keeping the original relation of the occupied space to the circulation space additional green areas are adjusted at the broadened cross-ways.

At the boarder between Renmin Park and the main subway hall the two greens are downsized to optimize the accessibility of the subway system.

4.5 3D visualization
function diagram

fig. 276_rendering 01

4.5 3D visualization

overview from south-west

fig. 277_rendering 02

4.5 3D visualization
overview from north-east

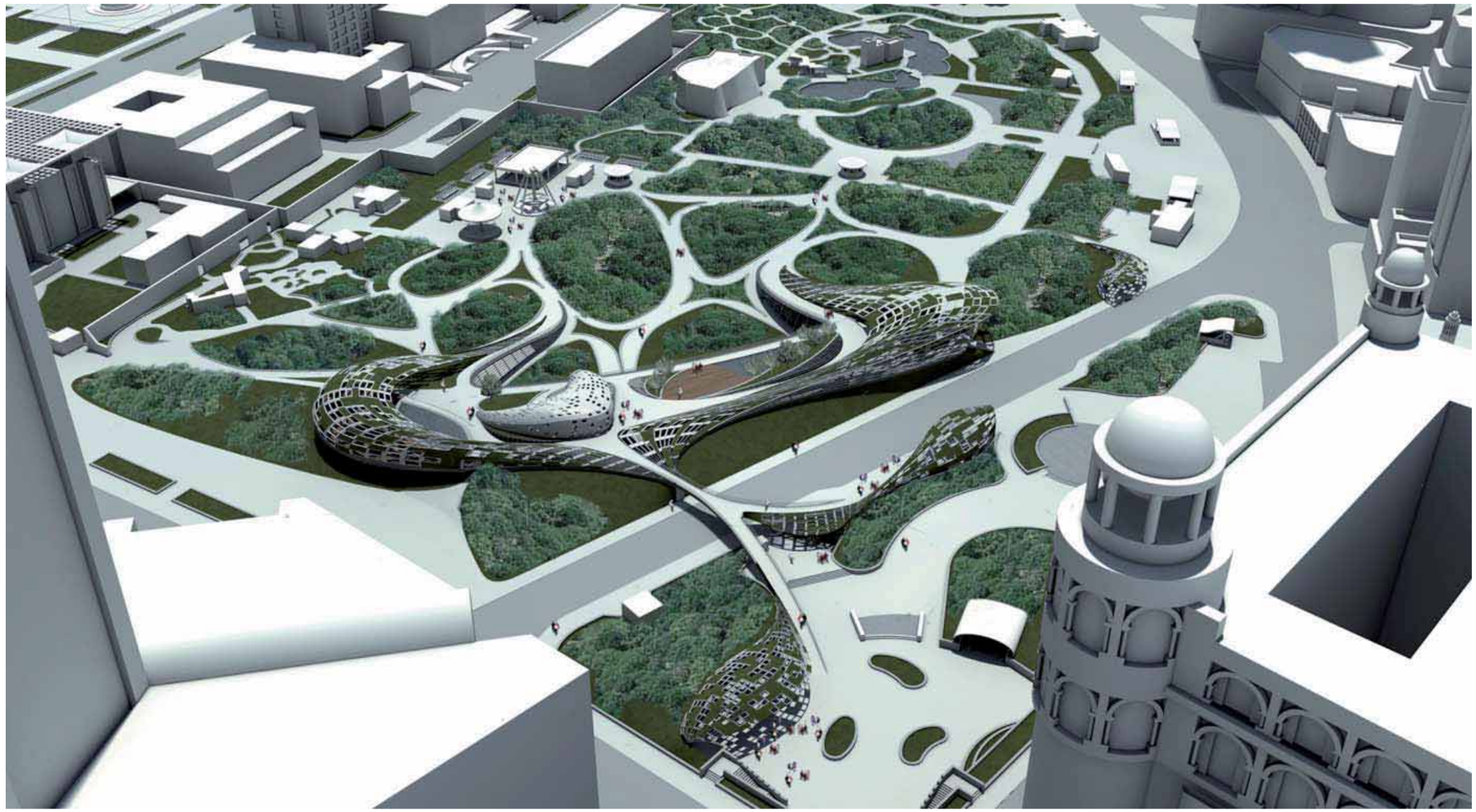


fig. 278_rendering 03

4.5 3D visualization

view from Renmin Park

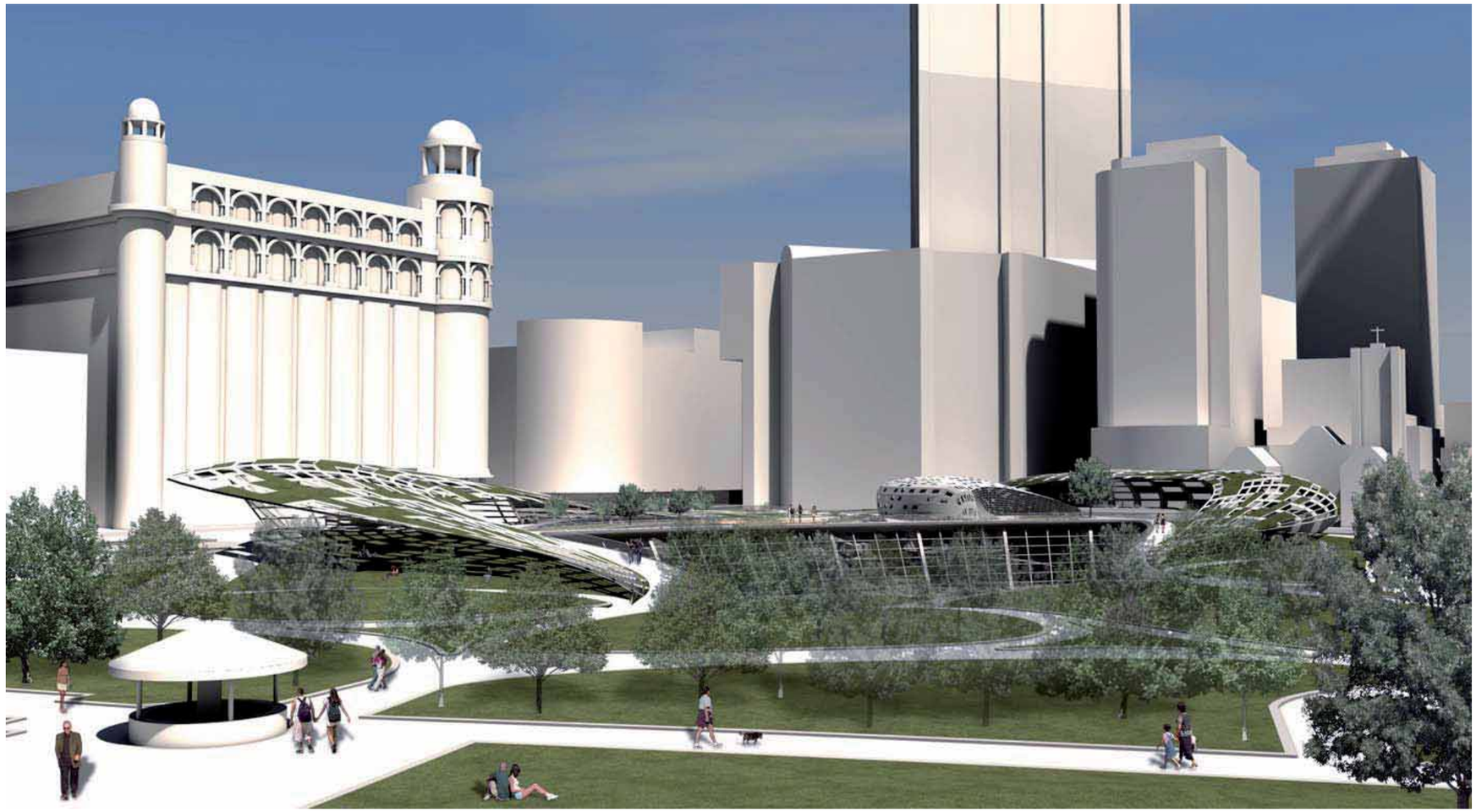


fig. 279_rendering 04

4.5 3D visualization

view from Middle Xizang Road

fig. 280_rendering 05

4.5 3D visualization

view from the Tai Ji area under leaf II

fig. 281_rendering 06

4.5 3D visualization

view main subway hall

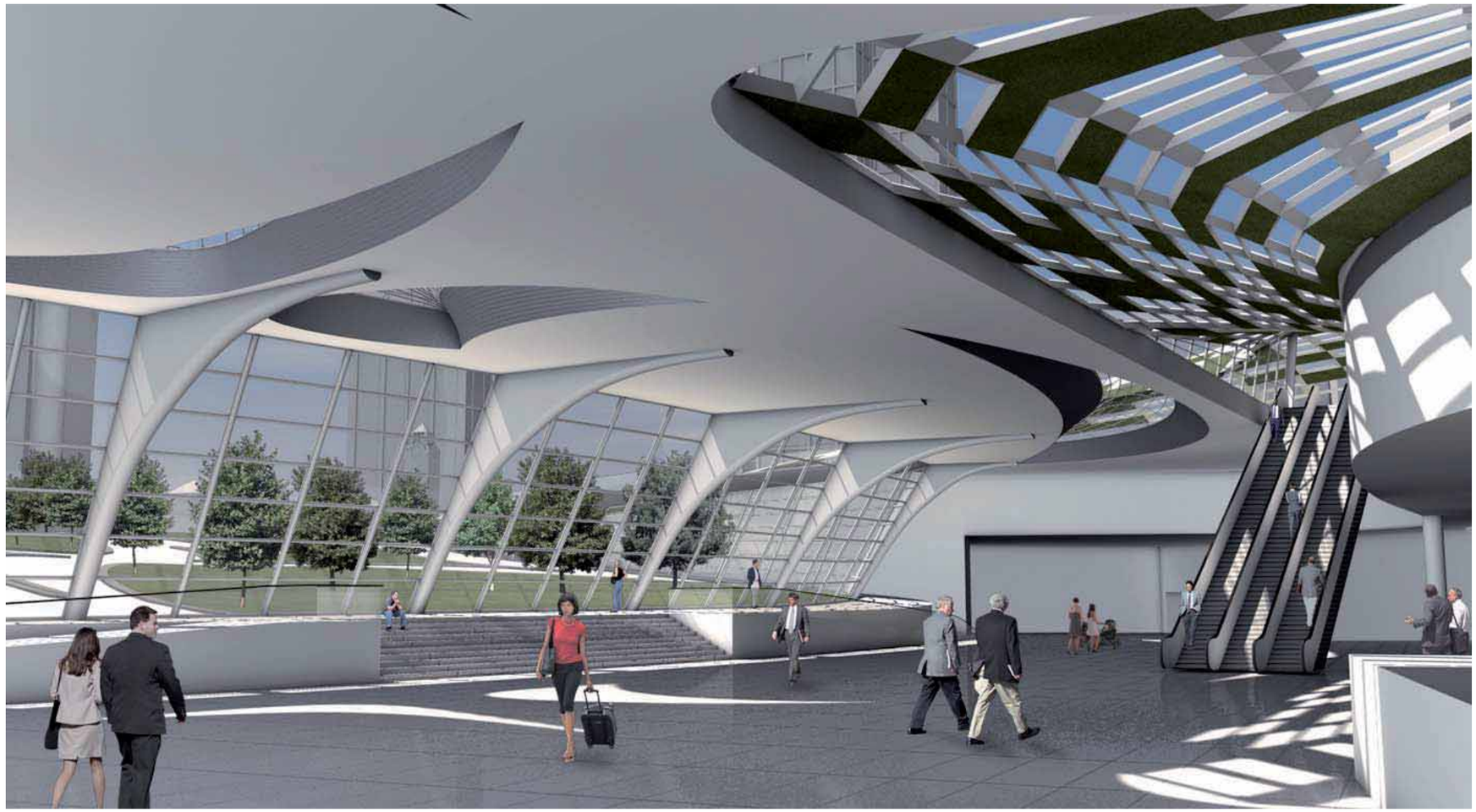


fig. 282_rendering 07

4.5 3D visualization

night view from north-east

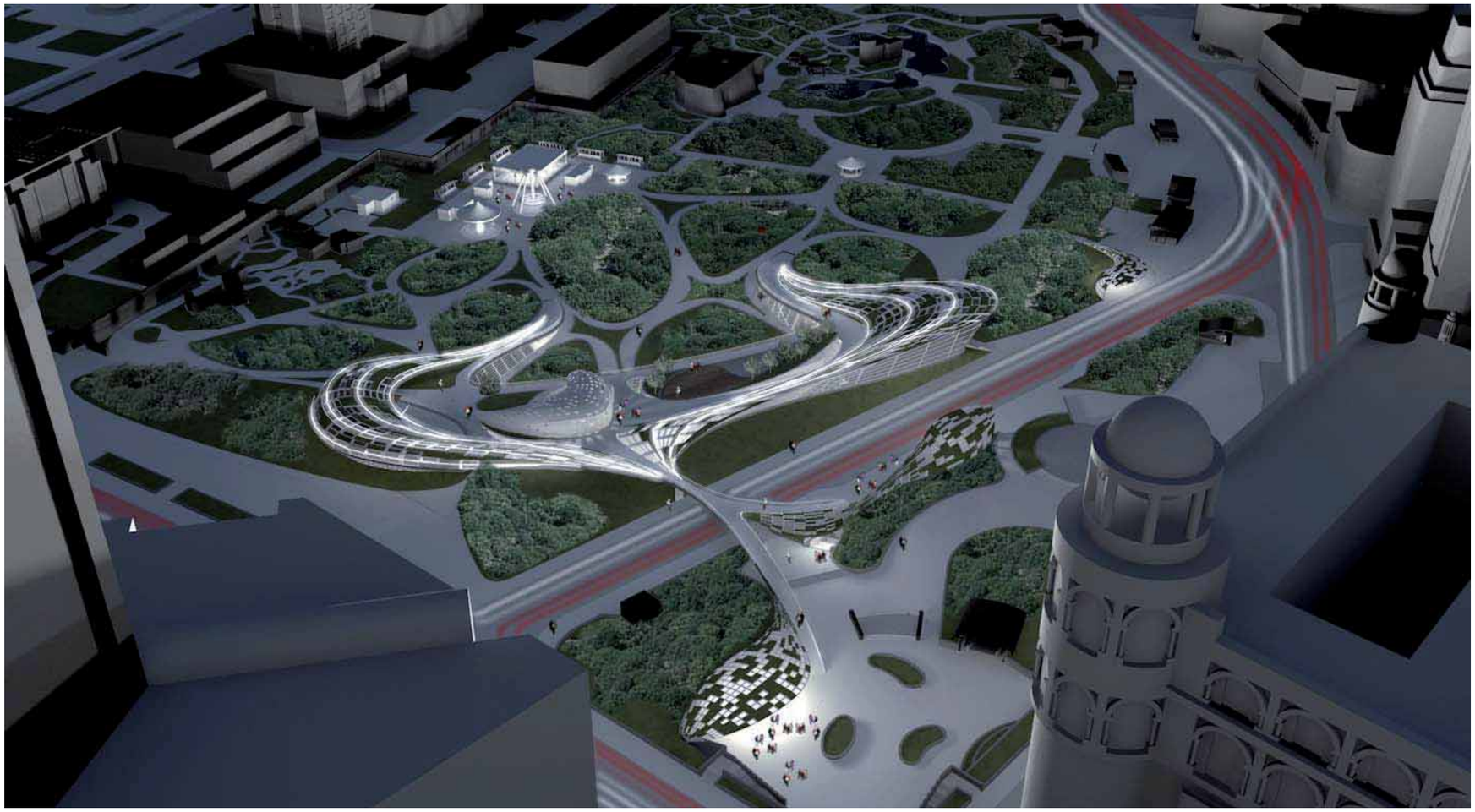


fig. 283_rendering 08

4.5 3D visualization

night view from south

fig. 284_rendering 09

4.6 plans and sections

area topview m = 1:2000

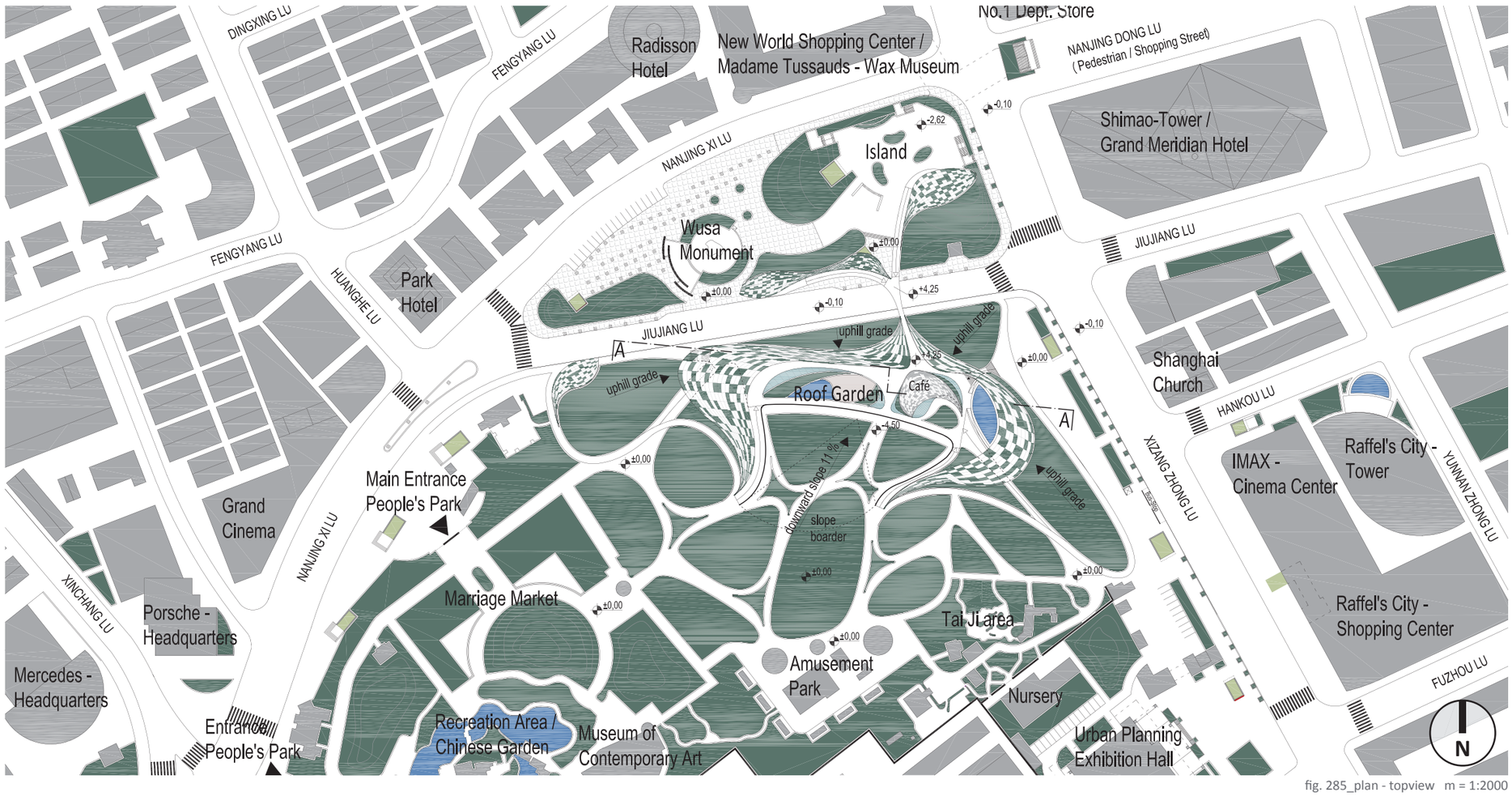


fig. 285_plan - topview m = 1:2000

4.6 plans and sections

floorplan - level +1 (roof garden) m = 1:500

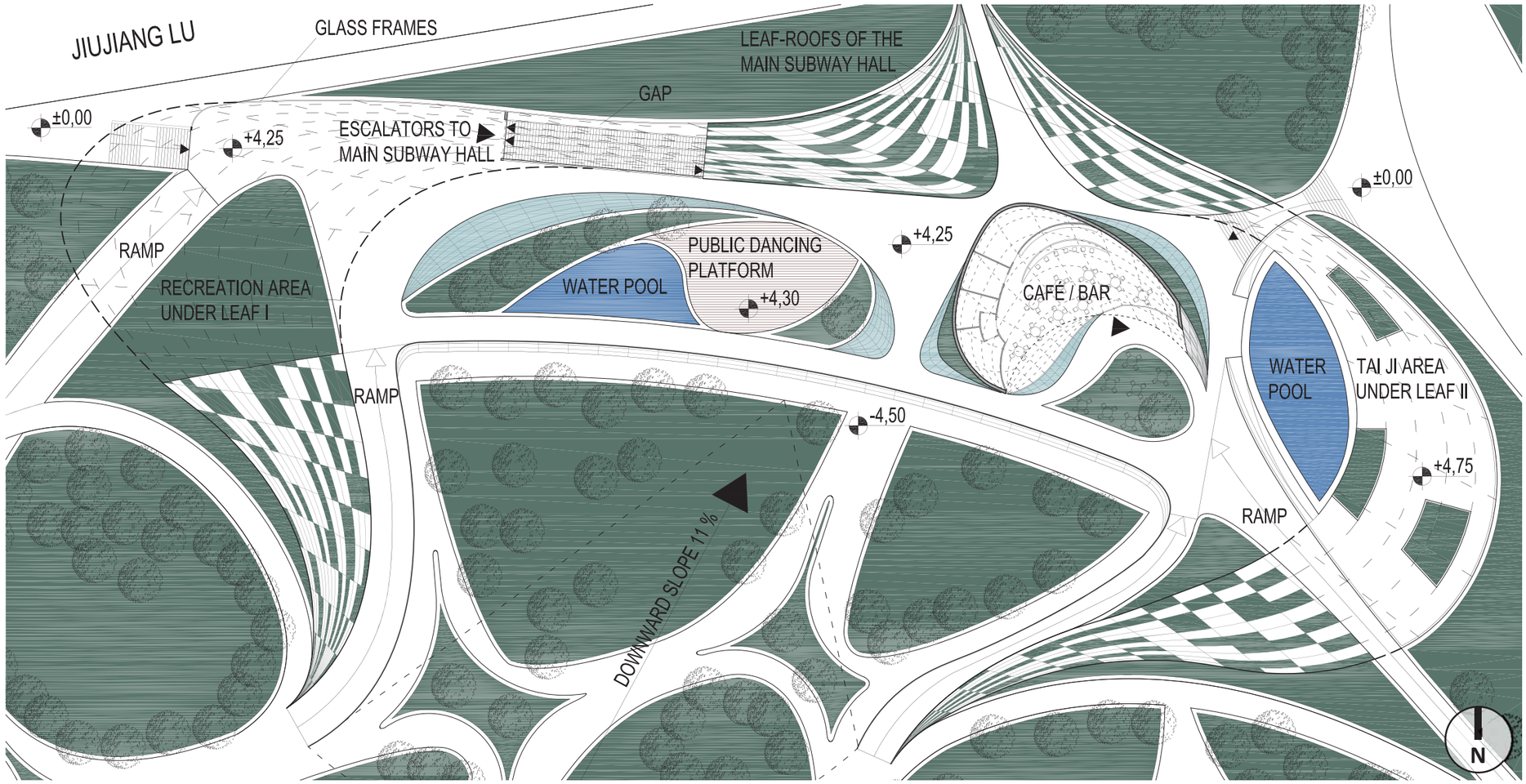


fig. 286_plan - level +1 m = 1:500

4.6 plans and sections

floorplan - level -1 (main subway hall) m = 1:2000

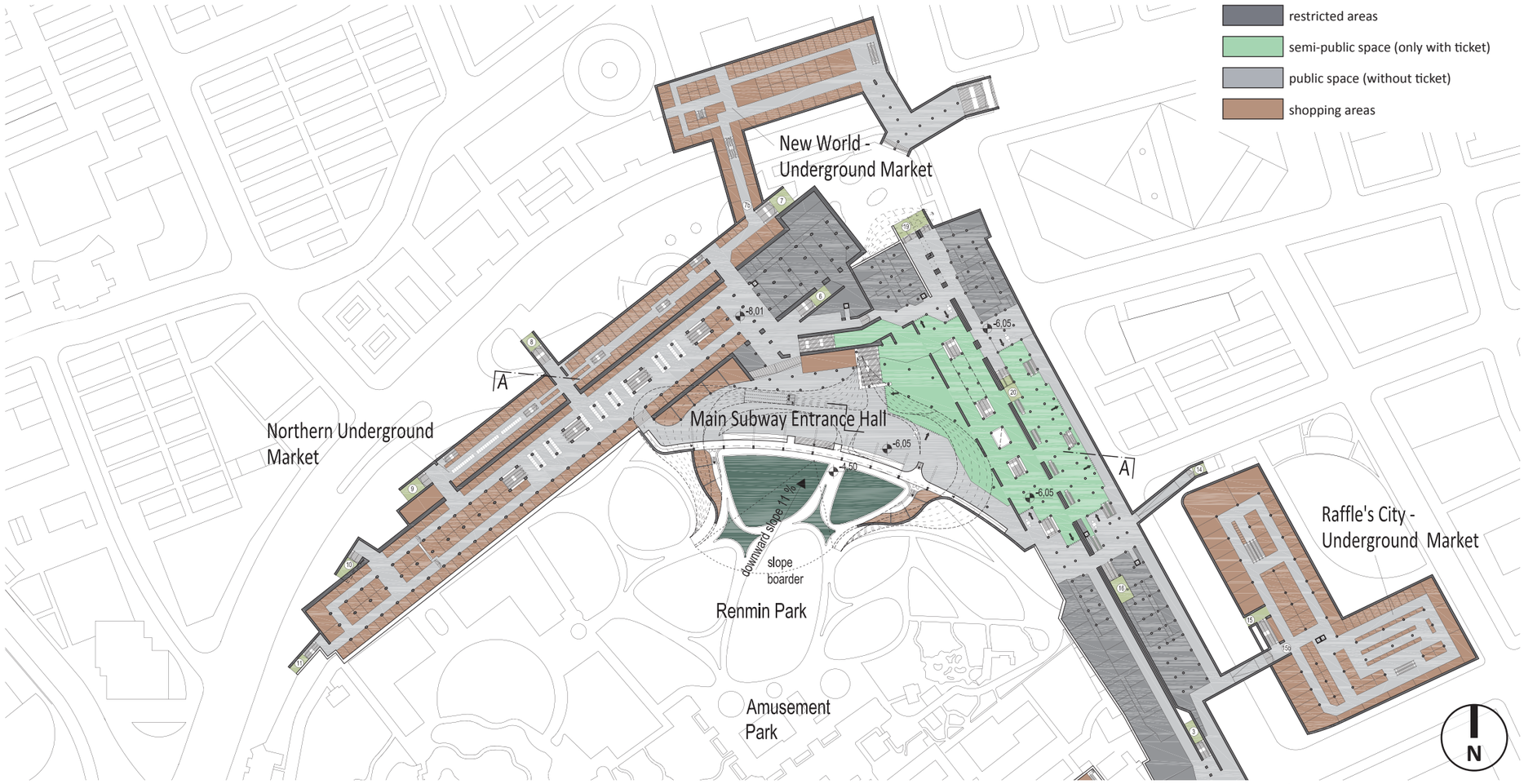


fig. 287_plan - underground m = 1:2000

4.6 plans and sections

floorplan - level -1 (main subway hall) m = 1:500

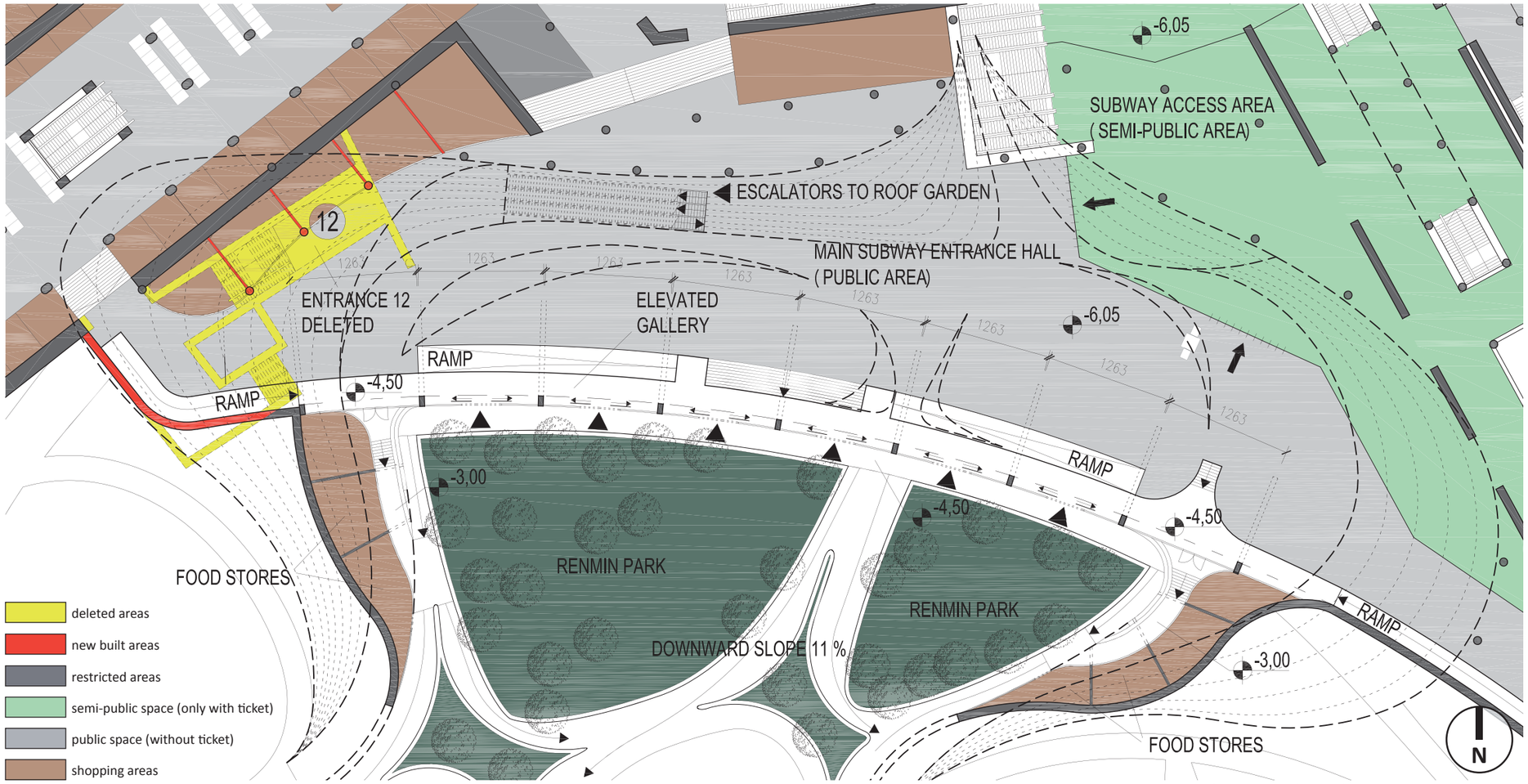


fig. 288_plan - level -1 (main entrance hall) m = 1:500

4.6 plans and sections

floorplan - level -1 (entrance No. 19) m = 1:500

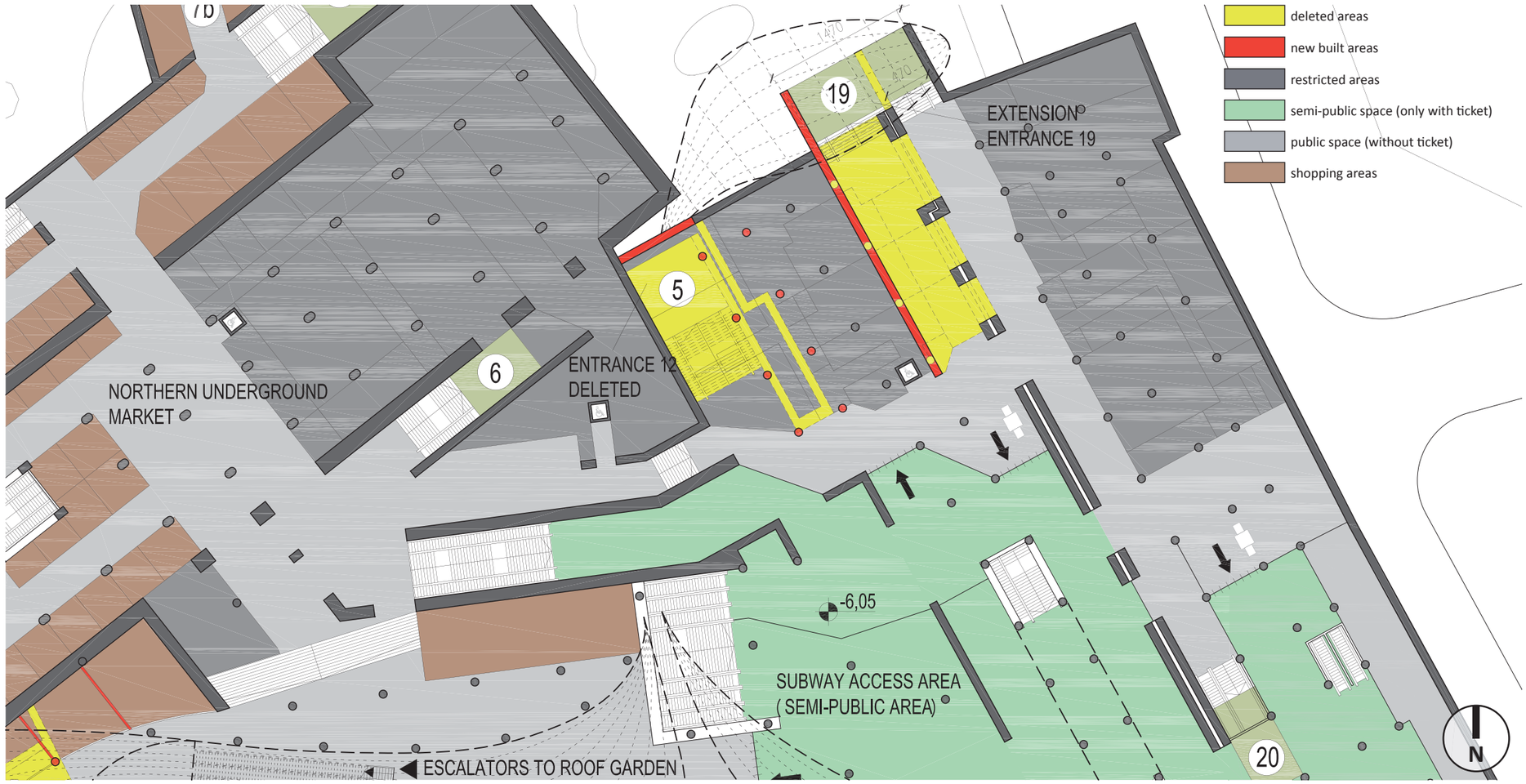


fig. 289_plan - level -1 (entrance no. 19) m = 1:500

4.6 plans and sections

section A-A m = 1:500

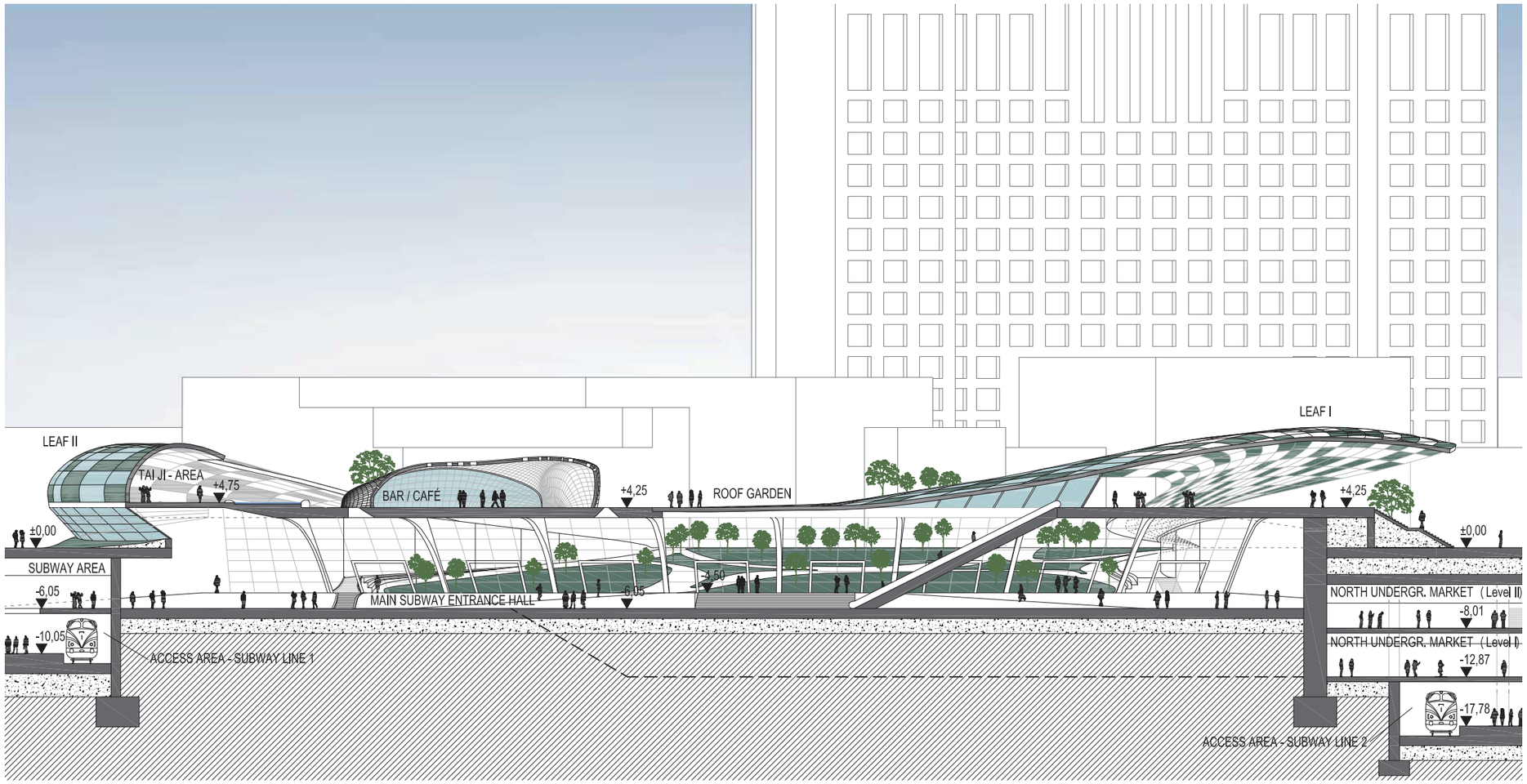


fig. 290_plan - section A-A m = 1:500

4.7 main design résumé

The Voronoi algorithm is an approved remedy in the architectural design process in terms of subdividing space efficiently. In our special case, the design intended to readjust and modify the areas of Renmin Park in order to establish a structural and visual connection between subway system and park. One condition though had to be fulfilled: the amount of green zones was not necessarily to be altered.

The specific analysis of the useability of each and every single green area, the definition of the directly influenced zones by the subway hub and the extraction of their center points, provided us with the necessary parameters to readjust the area‘s geometry via the Voronoi algorithm.

By using the orginal center points of the green areas for our calculation, the new system still corresponds to its original spatial position. Nevertheless, the specific size of the areas and their arrangement to each other, were now geometrically optimized. The interpretation of the Voronoi cells as occupied space and the area inbetween as circulation space, helped us to connect the abstract output of the theoretical method with the tangible architectural design and the form-finding process.

We considered the influence of intuitive design ideas based on the observations on site as very important for the project‘s further development. In order to re-inforce the metaphor of Renmin Park as “the green lung of Shanghai“ we used the shapes of leafs and buds to generate a continuous structure which evolves from the Voronoi algorithm. Concerning the idea of the three-dimensional de-formation of certain parts of the pattern, we focused on developing a slightly upraising landscape structure in order to antagonize the gigantic heights of the surrounding buildings.

The green panels of the leaf and bud constructions emphasize the idea of the continuous landscape and blur the limits between nature and architecture. The main goal of the design was to generate architecture with a high recognition value based on its spectacular shapes and the ability of integrating itself into the green area and recreation concept of Renmin Park.

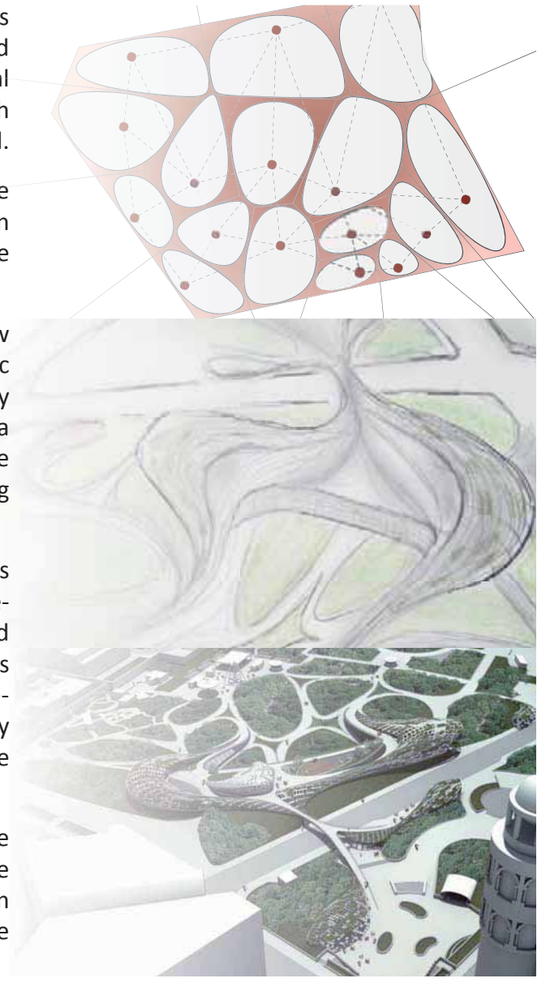


fig. 291_resume - chapter IV

CHAPTER V - SOLUTION STATEMENTS

This chapter focuses on the encountered problems on site and our solutions for each and every one of them. Every page contains a compact review of one specific problem depicting its positive and negative characteristics, as well as a three-dimensional diagram explaining the architectural improvements inbased on our new design.

A detailed comparison between the current situation and our architectural design, finally gives us an important feedback about the efficiency of our project.

The method as well as the form-finding process, are strongly related to the detailed site analysis and the prevailing problems, as the main purpose consists in generating a clear architectural language which reflects the specific needs of the site.

5.1 solution statement of problem I - urban barriers

improvement of urban connections

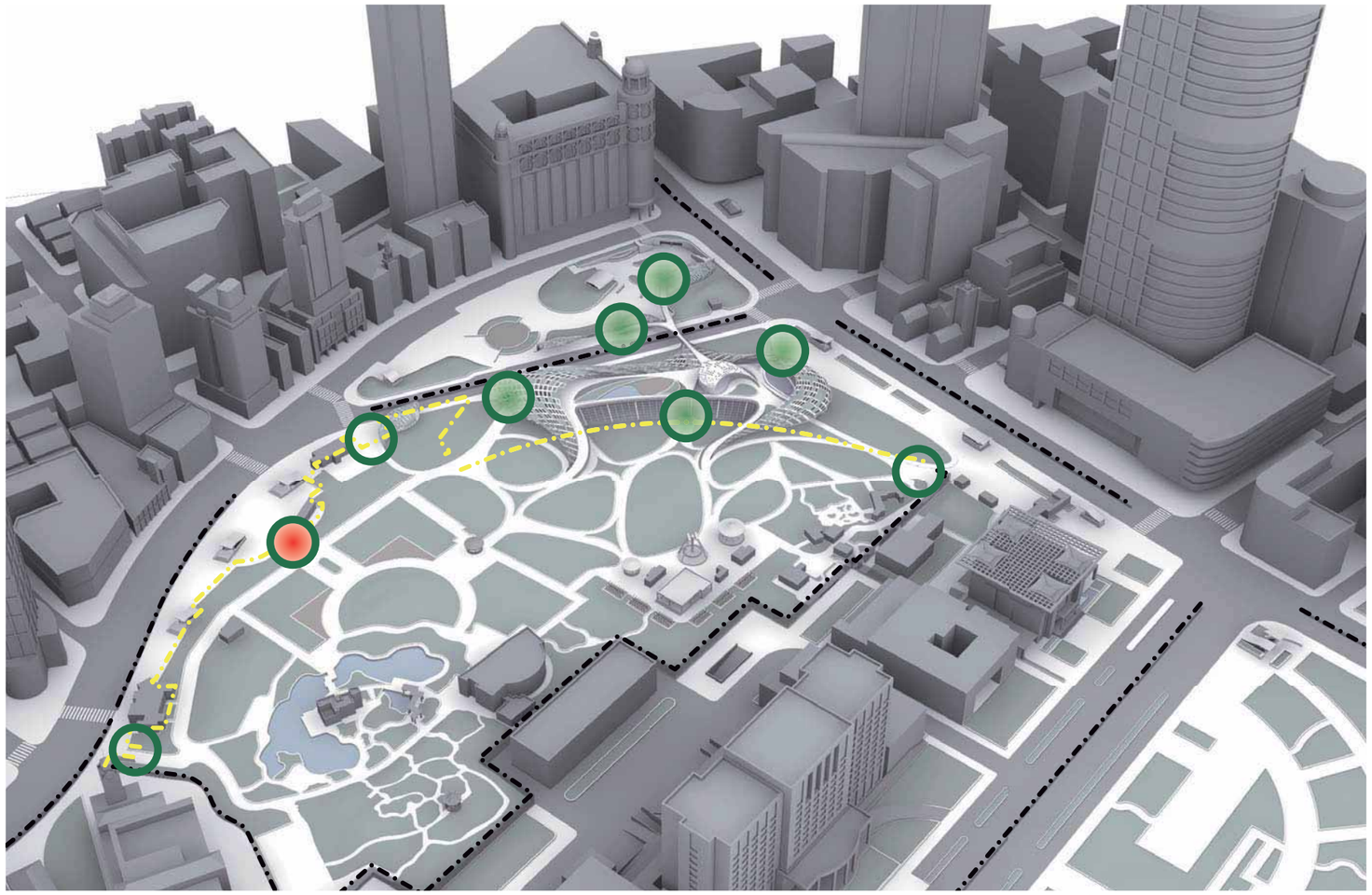


fig. 292_optimization of ubran connections

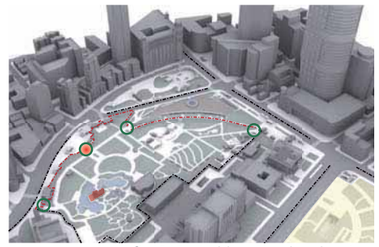


fig. 210_problem I - urban barriers

- \+ regulating the motor vehicle traffic
- \+ protection of non-public areas
- \+ fences do not limit the view
- − free access to park is constrained
- − fences do not have a real safety function
- − roof garden is sealed off from Renmin Park
- − gates were originally constructed to facilitate the collection of an entrance fee for accessing the park

existing entrances to the park / main entrance / new additional entrances

deleted urban barriers

SPECIFIC IMPROVEMENTS

- enhancement of Renmin Park's connectivity by deleting the majority of the fences
- increment of Renmin Park's accessibility by creating additional entrances within the area
- expansion of the park areas to the Island by the transition areas of the new designed roof garden

5.2 solution statement of problem II - connectivity between subway hub & park

improvement of the structural connections

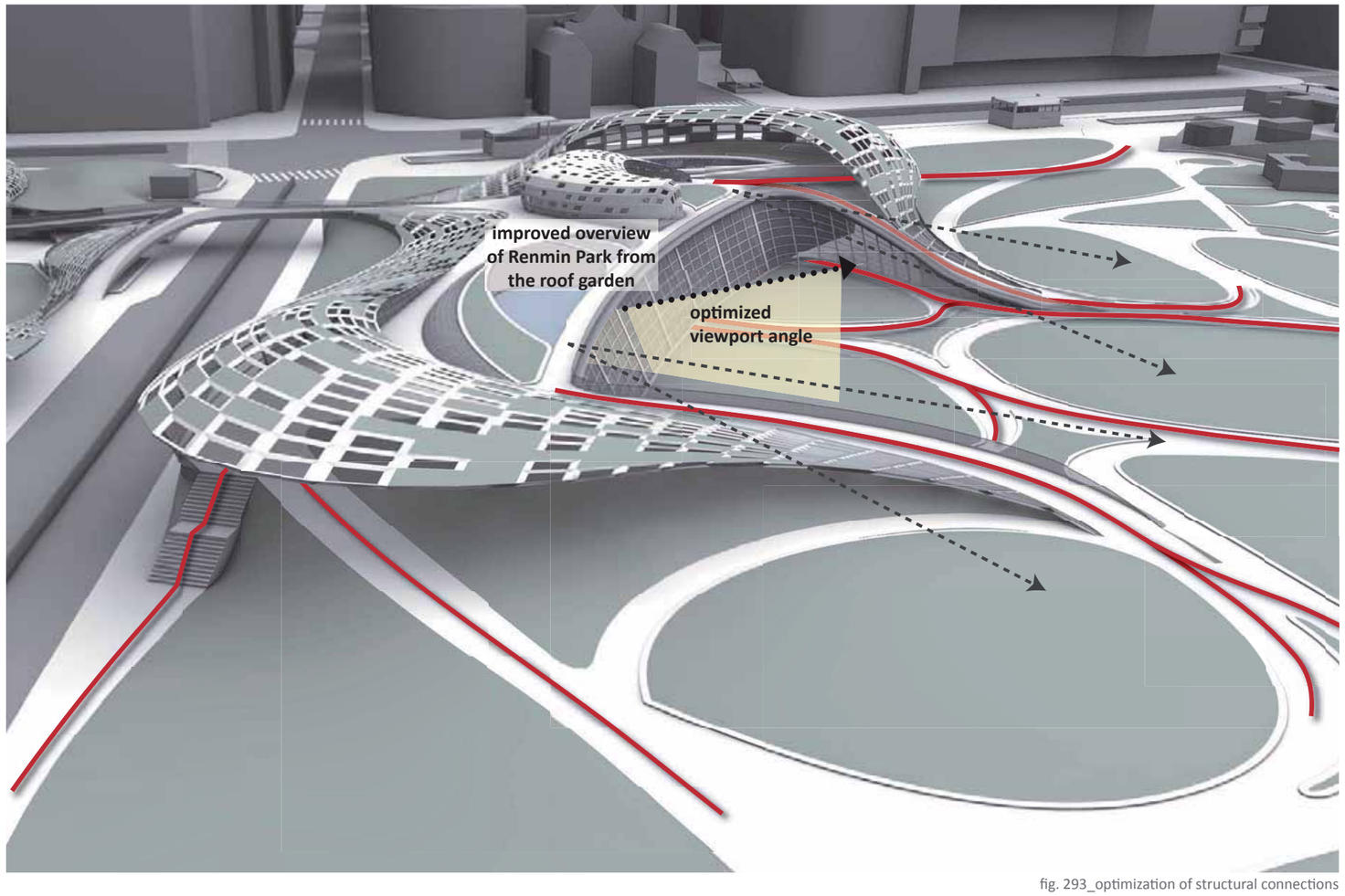


fig. 293_optimization of structural connections

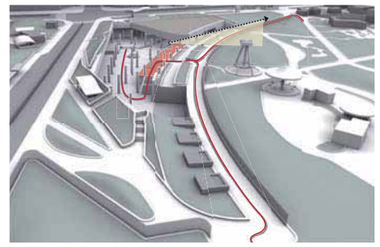


fig. 216_problem I - connectivity between hub & park

- (+) intervisibility between subway hub and park
- (−) park remains unnoticed
- (−) circuitous pathways between subway hub and park
- (−) food shops below gallery do not get any sunlight and need artificial illumination
- (−) gallery is just a transition area without any special functions and is missused as a homleless shelter in the cold periods of the year

connection between subway hub & park

SPECIFIC IMPROVEMENTS

- enhancement of the visual connection between the underground entrance hall and Renmin Park
- improvement of the natural illumination inside the subway areas
- the organic architecture and the new adjusted green areas merge into one contineous space
- improved overview of Renmin Park
- various new pathways enhance the connection between hub, park and roof garden

5.3 solution statement of problem III - roof garden accessibility

improvement of the vertical connectivity

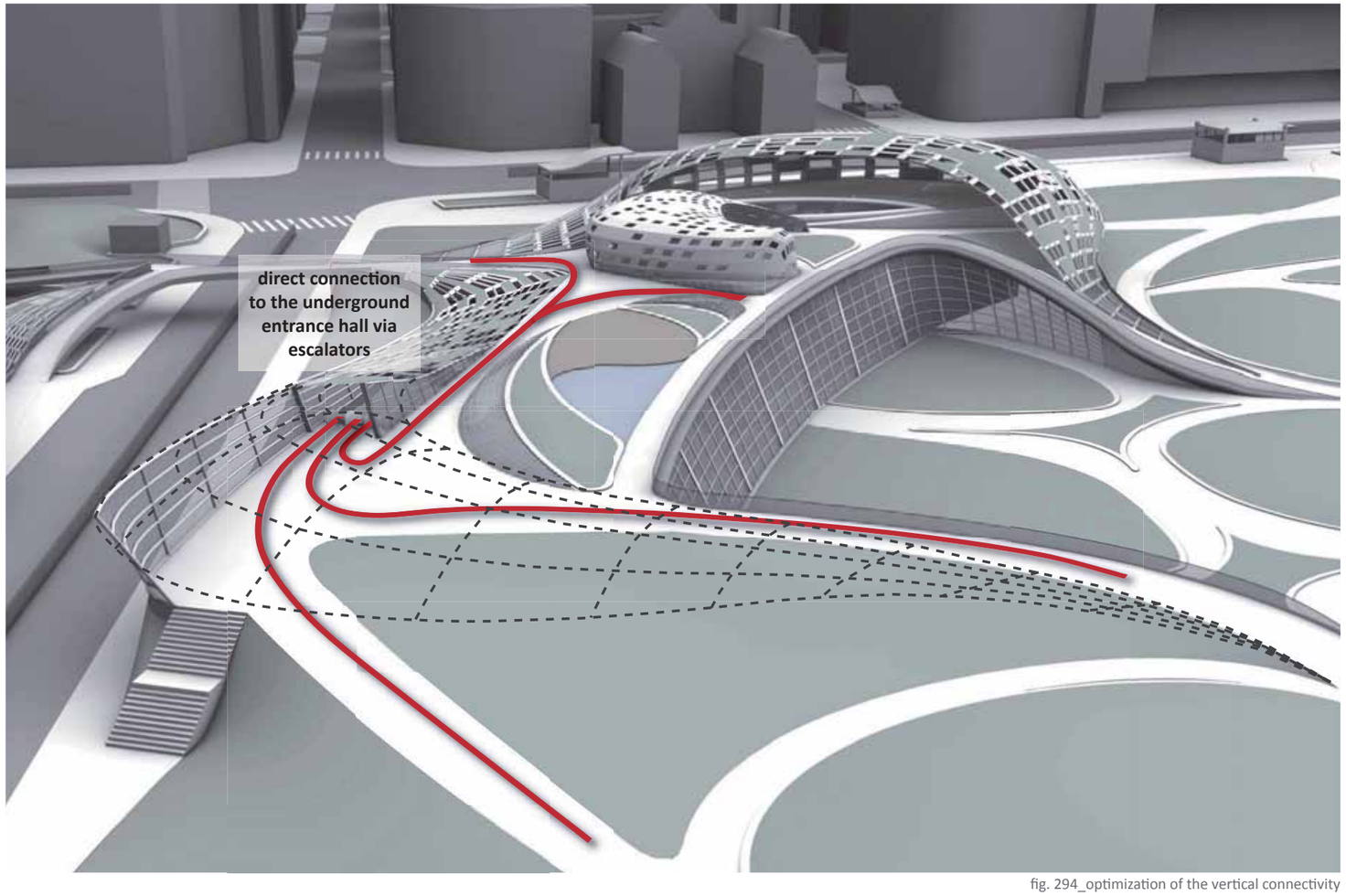


fig. 294_optimization of the vertical connectivity

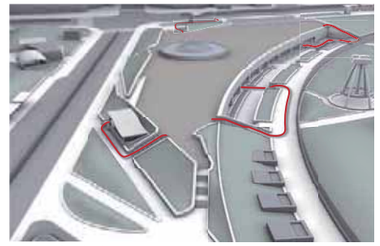


fig. 219_problem III - roof garden accessibility

- \+ roof garden is an extension of the park
- − direct connection to subway hub is missing
- − existing connections are not obvious
- − monotonous design of the roof garden
- − the area is not utilized to its full potential

connection between roof garden and the escalators

SPECIFIC IMPROVEMENTS

- the escalators establish a vertical connection between roof garden and the main subway hall underground
- the vertical connection improve the accessibility of the roof garden‘s special functions
- the escalators are hidden and protected by the organic design of the roof construction
- the escalators allow a fast connection to the subway system

5.3 solution statement of problem III - roof garden accessibility

improvement of the connection between Island & roof garden

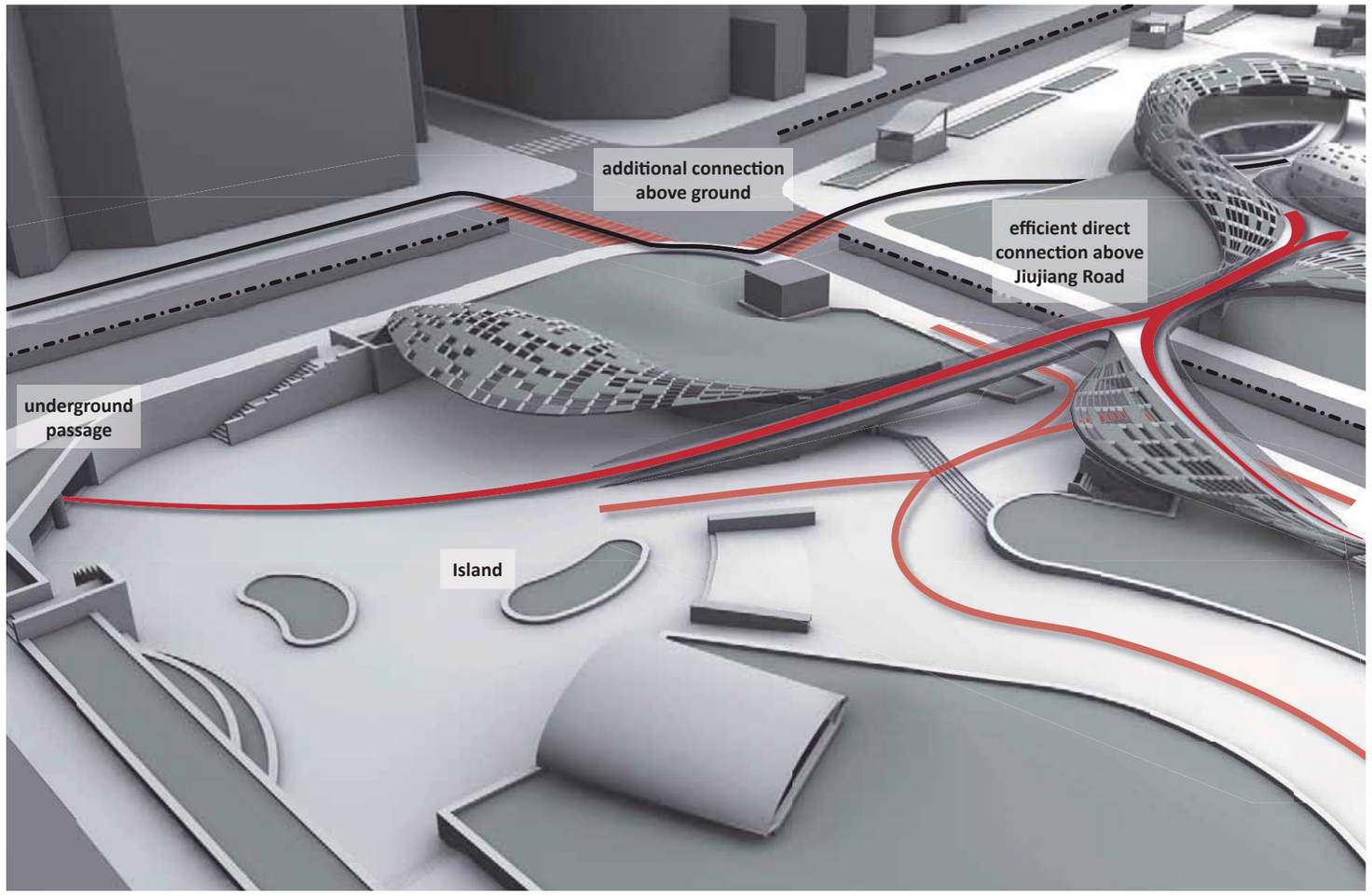


fig. 295_optimization of roofgarden accessibility from Island

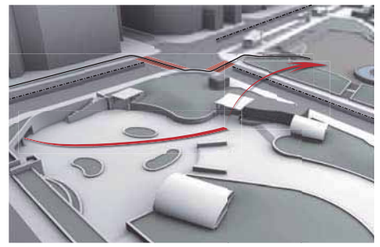


fig. 222_problem III - roof garden accessibility (Island)

- \+ efficient noise reduction due to the lowered surface of the Island
- − circuitous connection above ground between East Nanjing Road and roof garden
- − urban barrier on West Nanjing Road
- − long waiting intervals at the crossways

circuitous & overcrowded connection

connection between Island & roof garden

improved circulation space of the Island

urban barriers worth to be kept

SPECIFIC IMPROVEMENTS

- establishment of an efficient direct connection between underground passage and roof garden
- enhancement of the Island‘s circulation space by deleting exit 5
- alternate connection from East Nanjing Road & Jiujiang Road crossways to the roof garden is still available
- new direct connection to the bus stop at Jiujiang Road from both, the Island and the roof garden.

5.4 solution statement of problem IV - entrance dimensions

improvement of the entrances dimensions in relation to their frequencies

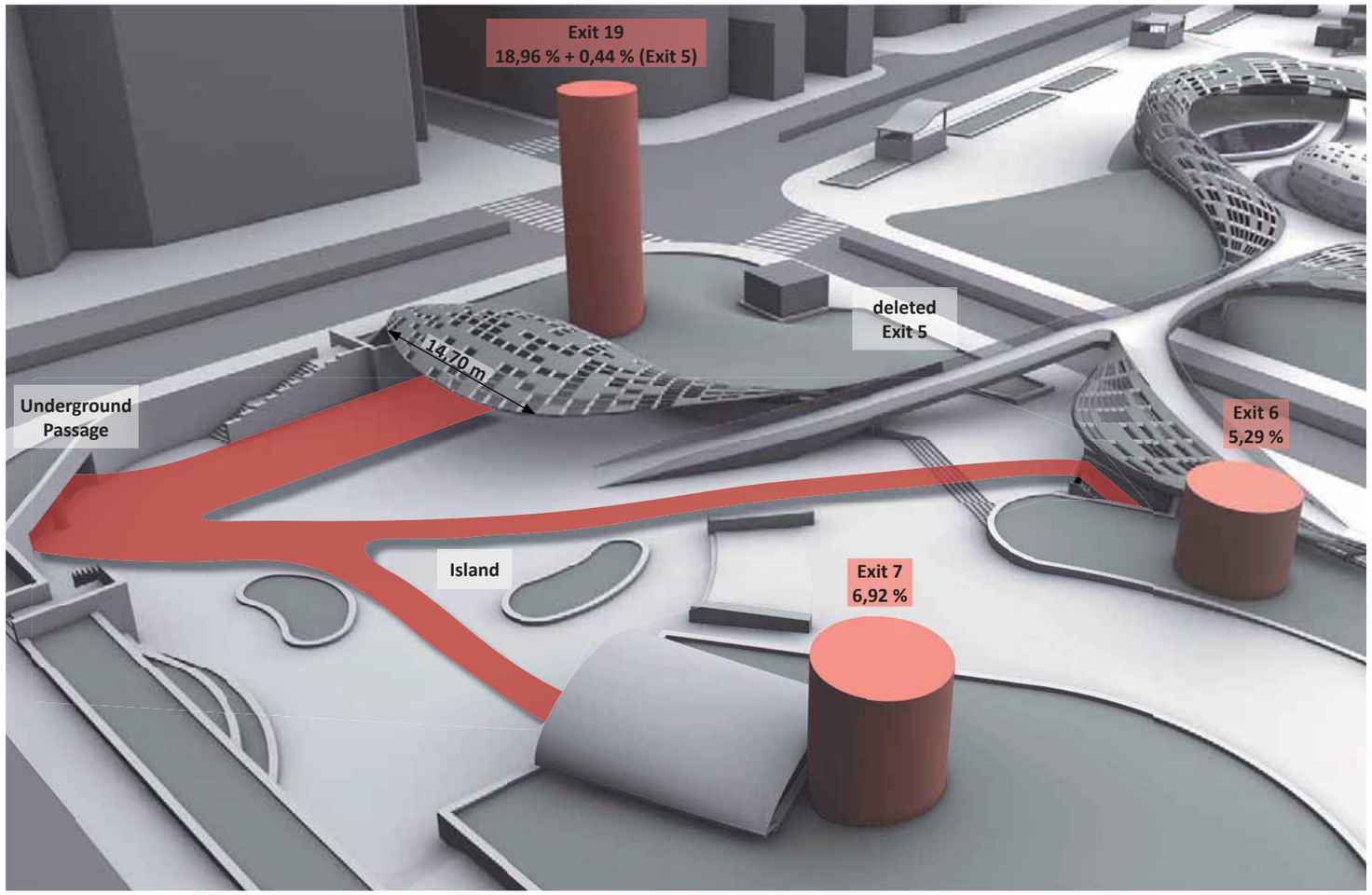


fig. 296_optimization of the entrance dimensions

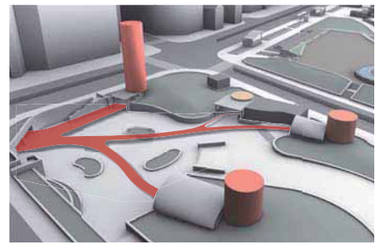


fig. 225_problem IV - entrance dimensions

(+) short distances between the crowded underground passage and the subway entrances

(−) diameters of exit 19 and exit 5 have no relation to the amount of people who are passing through

(−) exit 5 is redundant due to its very low frequency

amount of people who are entering / leaving the subway system

SPECIFIC IMPROVEMENTS

- new roof constructions for exit 19 and exit 6 according to the organic forms of the wing geometries
- enlargement of exit 19 to handle the crowd coming from the underground passage
- break-off of the redundant exit 5

5.5 solution statement of problem V - useability of park areas

segmentation and efficient orientation of Renmin Park

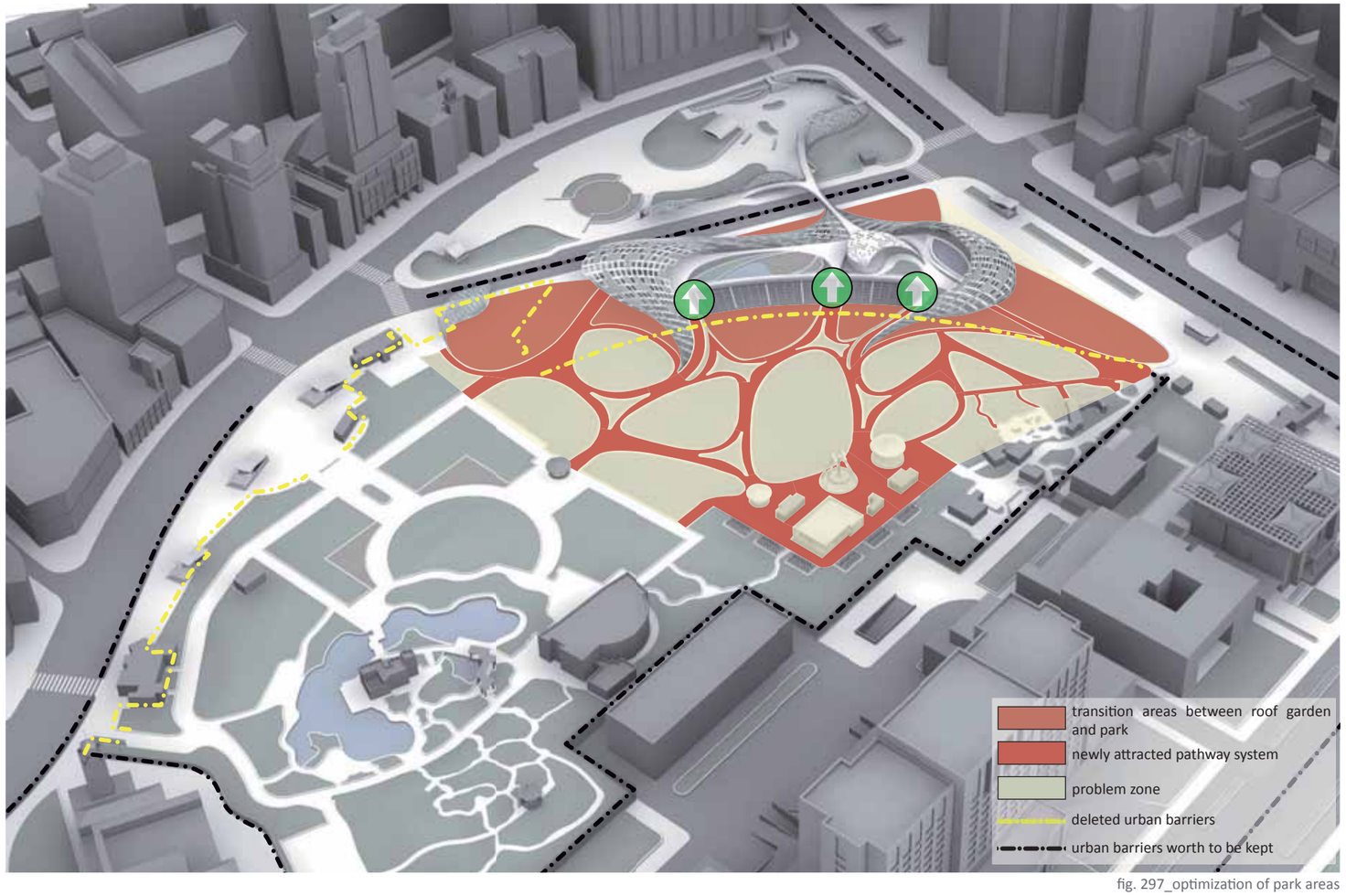


fig. 297_optimization of park areas

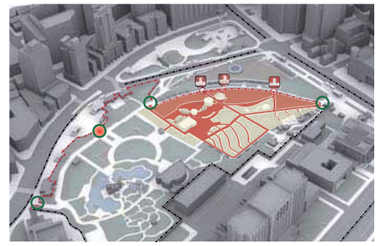


fig. 228_problem V - useability of park areas

- \+ various functions within the park areas
- \+ entertainment factor of the amusement park
- − accessibility of the problematic park area is limited (just two entrances)
- − pathways which lead to the hub are dead ends, obstructed by the fences.
- − the pathway system and the green areas of the park appear to be randomly arranged
- − the park's periphery is limited by the walkway in front of the subway hub.

SPECIFIC IMPROVEMENTS

- enhanced geometrical design achieved through the influence of the global attractor point
- better accessibility of the subway hub
- improved circulation space within the park area
- establishment of transition areas surrounding the subway hub
- no misleading dead-ends in the park's periphery

5.6 solution statement of problem VI - acoustics

reduction of noise pollution

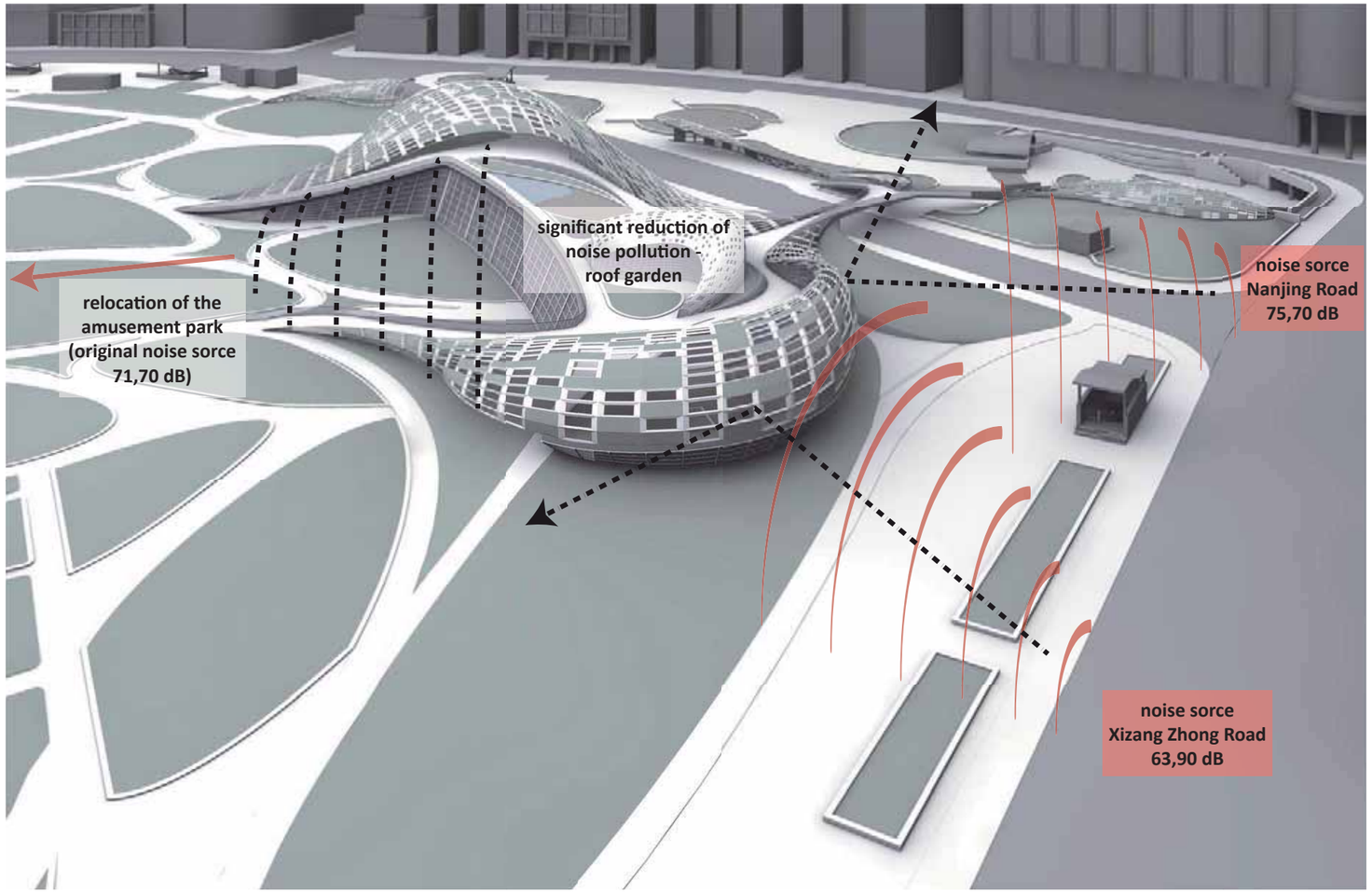


fig. 298_reduction of noise pollution

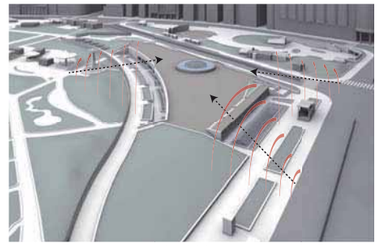


fig. 230_problem VI - acoustics

- (+) great area overview from elevated roof garden
- (−) position of the amusement park
- (−) no protection against traffic noise
- (−) monotonous area design of the roof garden
- (−) the high potential of the area is just partially performed

SPECIFIC IMPROVEMENTS

- reduction of the noise pollution of Middle Xizhang Road
- relocation of the noisy amusement park
- the green panels of the roof construction with its acoustic insulation symbolize a visual three dimensional extension of Renmin Park
- the roof construction is a visual barrier, separating the special functions of the roof garden from the high traffic of the surrounding streets

5.7 résumé

Chapter V highlights the design‘s high potential and focuses on showing specific improvements of the site‘s current problems. The proposed solutions are all originated in the main design concept and can be devided into constructural solutions and solutions which enhance the site‘s accessibility and connectivity.

CONSTRUCTURAL SOLUTIONS

The two leaf-like main roof constructions are a visual three-dimensional extension of Renmin Park and transform it, together with the Island and the subway hub, into one continuous organic space. Furthermore, their acoustic insulation panels notably reduce the heavy noise pollution on the roof garden, caused by the heavy motor vehicle traffic on Middle Xizhang Road.

ACCESSIBILITY/CONNECTIVITY SOLUTIONS

The new pathways and green areas guarantee better accessibility to the subway hub as well as improved circulation space within the park area due to their clear orientation towards the global attractor point. The newly applied transition areas prevent space limitations and misleading dead-ends in the park‘s periphery and connect the subway hub‘s geometry with the surrounding park.

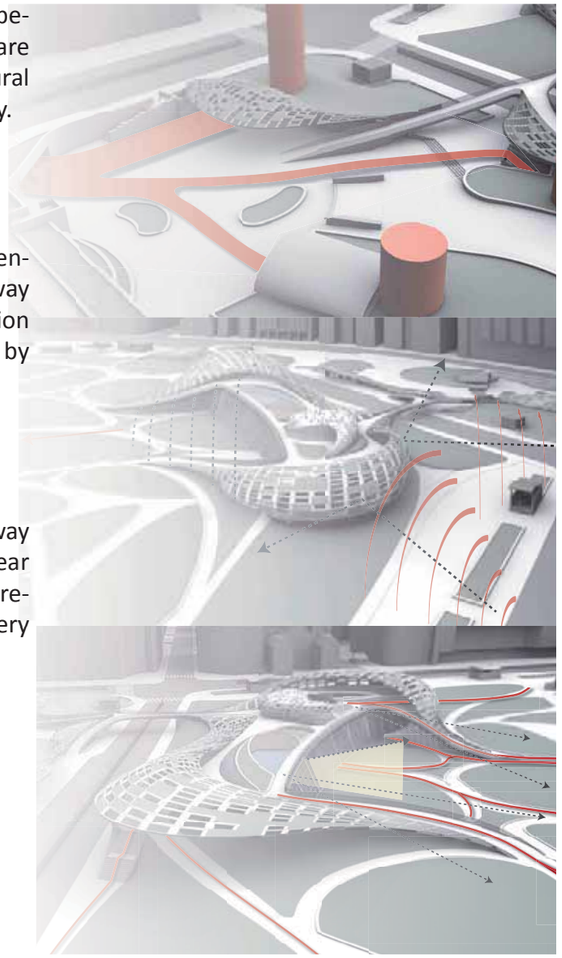


fig. 299_resume - chapter V

CHAPTER VI - ADDITIONAL CONCEPTS & DESIGN FAILURES

The main design proposal of chapter IV was not the only concept we developed. The following chapter introduces two additional design approaches including their different focal points and the reasons why they were discarded.

The first additional design mainly focuses on reinterpreting the collected data of the entrance/exit frequencies of the subway system by using different magnetic field simulations. Several pattern iterations according to the book “A Pattern Language“ are combined to a multi-layered abstract system which shows one possible way of dividing the area into occupied space and circulation space.

The second additional design takes up the idea of redirecting the surrounding urban influences to a global attractor point which in turn becomes the new center of the subway hub. This design process is based on a subdivision of Renmin Square into several iteration steps and primarily focuses on optimizing the site’s circulation paths.

Both design approaches are very radical concepts in the way of dealing with existing structures on Renmin Square. They make a clean sweep concerning current pathway systems and social functions and try to apply a fully new global arrangement of occupied space and circulation space.

6.1 concept I - magnetic field displacement

locating the vortex input-points from the traffic access system

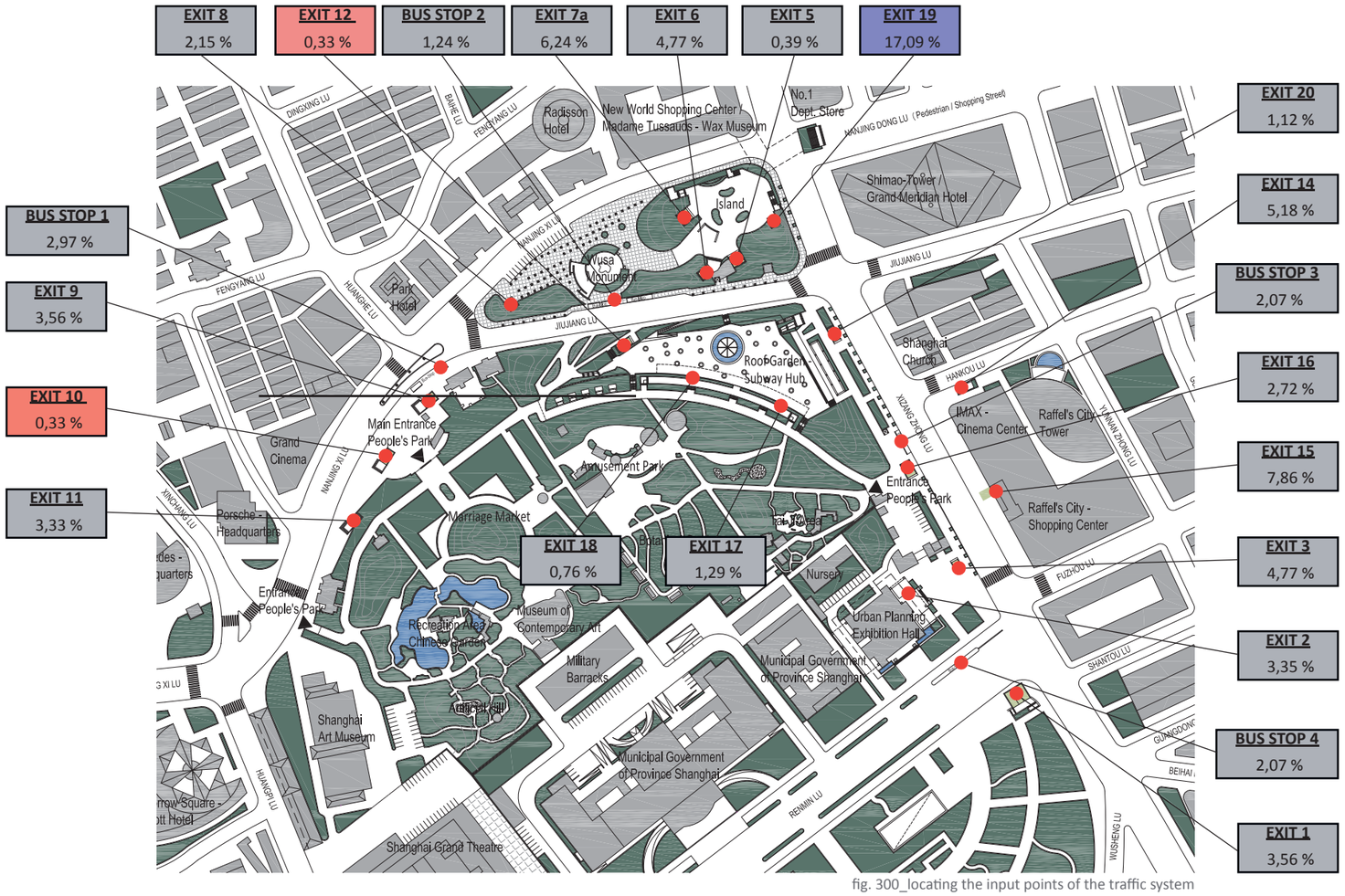


fig. 300_locating the input points of the traffic system

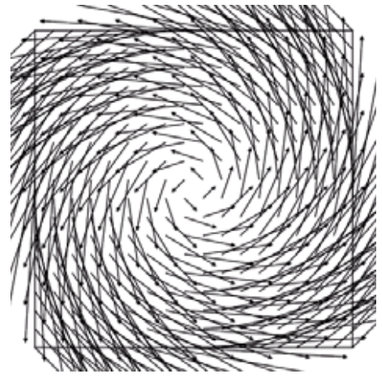


fig. 301_vector field (vortex)

traffic access points / subway entrances

In order to generate a magnetic field seveal input parameters have to be located on site.

The subway entrances and the bus stations symbolize the traffic access points of Renmin Square. Therefore their positions are calculated in order to use them as vortex center points in the magnetic field simulation.

According to the detailed site analysis the entrance and exit frequences will be transformed into specific roatation parameters for the vectors.

6.1 concept I - magnetic field displacement

calculation of the vortex rotation value (traffic access system)

DATA SHEET
Vortex Rotation - Traffic Access System

Subway Entrances / Exits & Bus Stops

Subway Entrance / Exit	Intensity [%]	Percentage Value	Lower Rotation Limit [rad]	Upper Rotation Limit [rad]	Vortex Rotation [rad]
1 (Xizang Zhong Road)	11,38%	11,38	-3,1416	3,1416	**1,7877**
2 (Urban Planning Museum)	3,71%	3,71			**0,5833**
3 (Xizang Zhong Road)	5,29%	5,29			**0,8303**
5 (West Nanjing Road)	0,44%	0,44			**0,0686**
6 (West Nanjing Road)	5,29%	5,29			**0,8303**
7 (West Nanjing Road)	6,92%	6,92			**1,0877**
7b (New World Shopping Center)	3,63%	3,63			**0,5696**
8 (West Nanjing Road)	2,38%	2,38			**0,3740**
9 (West Nanjing Road)	3,95%	3,95			**0,6210**
10 (West Nanjing Road)	0,37%	0,37			**0,0583**
11 (West Nanjing Road)	3,69%	3,69			**0,5799**
12 (West Nanjing Road)	0,37%	0,37			**0,0583**
14 (Hankou Road)	5,74%	5,74			**0,9024**
15 (Raffle's City Shopping Center)	12,84%	12,84			**2,0175**
15 (Fuzhou Road)	8,72%	8,72			**1,3690**
16 (Xizang Zhong Road)	3,01%	3,01			**0,4735**
17 (People's Park)	1,29%	1,29			**0,2024**
18 (People's Park)	0,76%	0,76			**0,1201**
19 (West Nanjing Road)	18,96%	18,96			**2,9783**
20 (Xizang Zhong Road)	1,25%	1,25			**0,1956**

Bus Stop	Intensity [%]	Percentage Value	Lower Rotation Limit [rad]	Upper Rotation Limit [rad]	Vortex Rotation [rad]
1 (Bus Stop - Park Hotel)	2,97%	2,97	-3,1416	3,1416	**0,4671**
2 (Bus Stop - West Nanjing Road)	1,24%	1,24			**0,1949**
3 (Bus Stop - Xizhang Zhong Road)	2,07%	2,07			**0,3248**
5 (Bus Stop - People's Ave)	3,56%	3,56			**0,5599**

fig. 302_data sheet - traffic

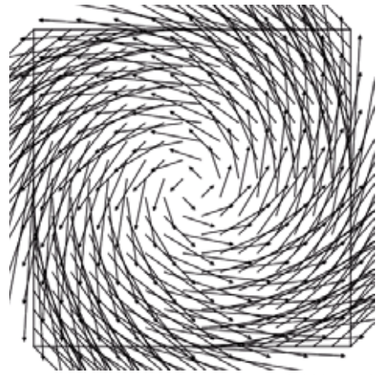


fig. 301_vector field (vortex)

The spread sheet to the left illustrates the translation of the intensity values into vortex rotation values. The intensity percentages are equivalent to a certain roation value between 3.1416 (100%) and 0 (0 %).

By rotating a vector it is possible to control the type of singularity. That means:

- **PI (3.142) or -PI (-3.142) is an attractor or a sink**
- **O is a source / repulsor**
- **-PI/2 (-1.571) is a clockwise vortex**
- **PI/2 (1.571) is a couter-clockwise vortex**
- **Inbetween values give all sorts of spirally goodness**

6.1 concept I - magnetic field displacement

magnetic attractor field diagram of the current traffic access system

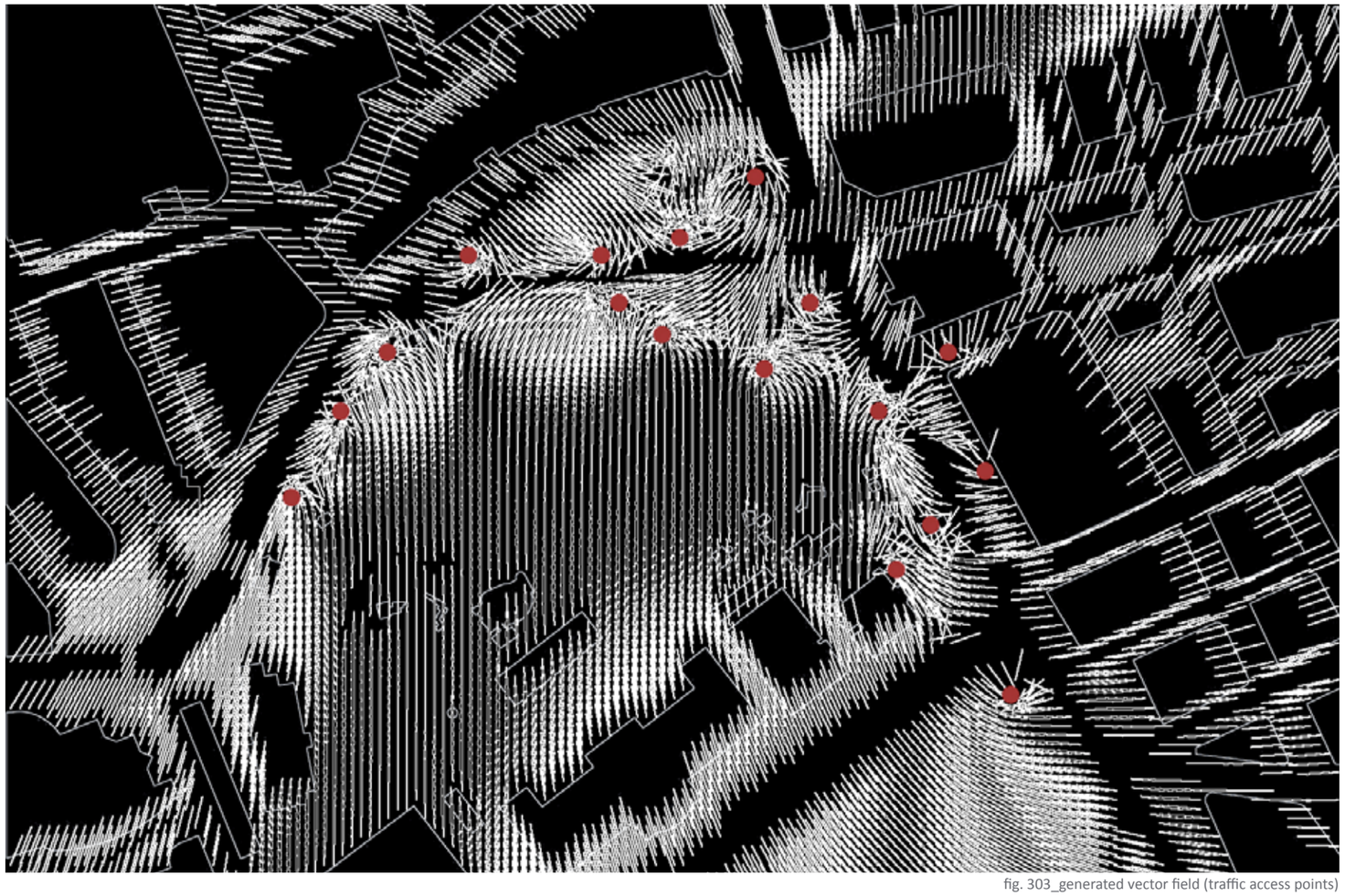


fig. 303_generated vector field (traffic access points)

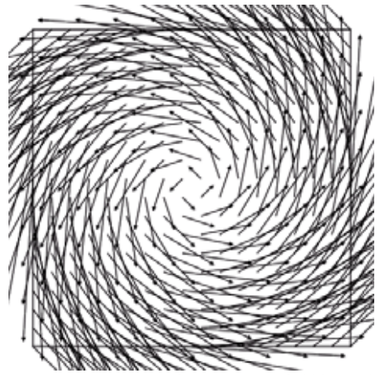


fig. 301_vector field (vortex)

traffic access points / vortex points

The diagram to the left shows a magnetic vector field generated by the traffic access points and their specific frequences.

The strength of a point's frequency value controls the amount of influence to the vectors and the grade of rotation.

The generated pattern contains turbulance areas which are multi-influenced be several input points and areas with a uniform vector orientation. These areas can be interpretated as less attracted additional zones of the traffic access system.

6.1 concept I - magnetic field displacement

locating the vortex input-points from the urban attractor system

fig. 304_urban attractors m = 1:3000

ATTRACTOR POINTS (fixed geometries)

1) Raffle's City Shopping Center
2) New World Shopping Center
3) IMAX Cinema Center
4) Grand Cinema
5) Museum of Contemporary Arts
6) Shanghai Art Museum
7) Urban Planning & Exhibition Hall
8) Shanghai National Museum
9) Grand Theatre
10) Barbarossa Cocktail Bar
11) Amusement Park

ATTRACTOR POINTS (street systems)

12) Pedestrian Area West Nanjing Road
13) Shopping Street East Nanjing Road
14) Shopping Street Fuzhou Road
15) Food Street Jiujiang Road
16) Food Street Huanghe Road

An urban attractor point is located at certain buildings and streets of the Renmin Square area that correspond directly with the urban system of Shanghai.

Because of sociological and cultural needs people from all over the city are getting attracted by these points, independent from their location in the urban network.

The definition of the points is related to local research and observations on site.

6.1 concept I - magnetic field displacement

calculation of the vortex rotation value (urban attractor system)

DATA SHEET
Vortex Rotation - Urban Attractor System

Street Systems

Street	Intensity [%]	Percentage Value	Lower Rotation Limit [rad]	Upper Rotation Limit [rad]	Vortex Rotation [rad]
1 (Pedestrian Area East Nanjing Road)	24,19%	24,19	-3,1416	3,1416	3,1416
2 (Shopping Street West Nanjing Road)	15,32%	15,32			2,4061
3 (Shopping Street Fuzhou Road)	11,29%	11,29			1,7729
4 (Food Street Jiujang Road)	4,84%	4,84			0,7598
5 (Food Street Huanghe Road)	8,06%	8,06			1,2664

Fixed Geometries

Geometry	Intensity [%]	Percentage Value	Lower Rotation Limit [rad]	Upper Rotation Limit [rad]	Vortex Rotation [rad]
1 (Raffle's City Shopping Center)	13,22%	13,22	-3,1416	3,1416	2,0768
2 (New World Shopping Center)	9,03%	9,03			1,4183
3 (IMAX Cinema Center)	1,56%	1,56			0,2457
4 (Grand Cinema)	1,37%	1,37			0,2153
5 (Museum of Contemporary Arts)	0,81%	0,81			0,1266
6 (Shanghai Art Museum)	1,29%	1,29			0,2026
7 (Urban Planning & Exhibition Hall)	2,90%	2,90			0,4559
8 (Shanghai National Museum)	2,58%	2,58			0,4052
9 (Grand Theatre)	2,26%	2,26			0,3546
10 (Barbarossa Cocktail Bar)	0,16%	0,16			0,0253
11 (Amusement Park)	1,13%	1,13			0,1773

fig. 305_data sheet - urban

Approximated Human Density

Urban Attractors & Connectors	~ People / Day	Intensity
1 (Raffle's City Shopping Center)	8200	13,22%
2 (New World Shopping Center)	5600	9,03%
3 (IMAX Cinema Center)	970	1,56%
4 (Grand Cinema)	850	1,37%
5 (Museum of Contemporary Arts)	500	0,81%
6 (Shanghai Art Museum)	800	1,29%
7 (Urban Planning & Exhibition Hall)	1800	2,90%
8 (Shanghai National Museum)	1600	2,58%
9 (Grand Theatre)	1400	2,26%
10 (Barbarossa Cocktail Bar)	100	0,16%
11 (Amusement Park)	700	1,13%
1 (Pedestrian Area East Nanjing Road)	15000	24,19%
2 (Shopping Street West Nanjing Road)	9500	15,32%
3 (Shopping Street Fuzhou Road)	7000	11,29%
4 (Food Street Jiujang Road)	3000	4,84%
5 (Food Street Huanghe Road)	5000	8,06%

fig. 306_data sheet - urban attractors

By rotating a vector it is possible to control the type of singularity. That means:

- **PI (3.142) or -PI (-3.142) is an attractor or a sink**
- **O is a source / repulsor**
- **-PI/2 (-1.571) is a clockwise vortex**
- **PI/2 (1.571) is a couter-clockwise vortex**
- **Inbetween values give all sorts of spirally goodness**

6.1 concept I - magnetic field displacement

magnetic attractor field diagram of the current urban attractor system

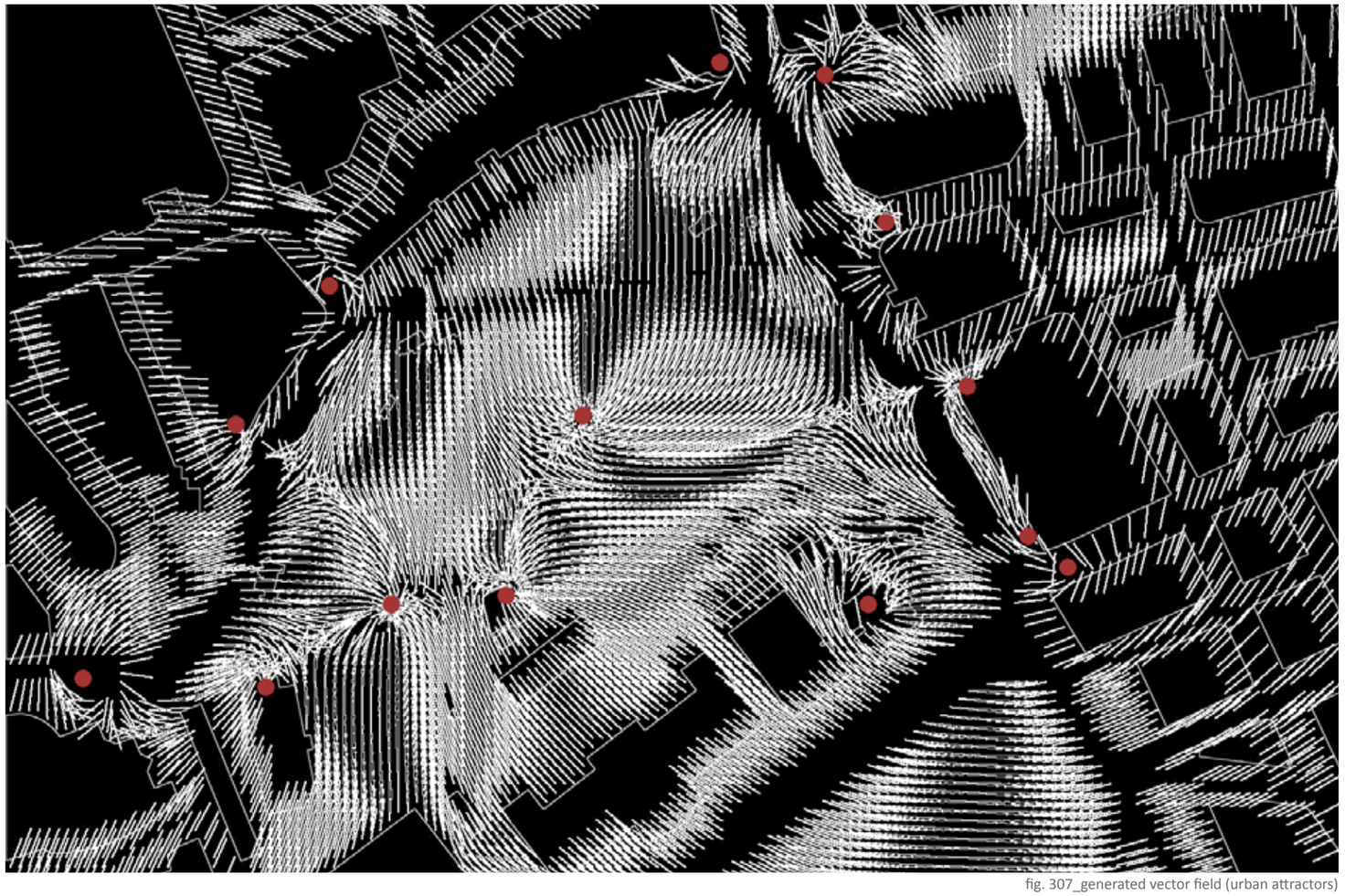


fig. 307_generated vector field (urban attractors)

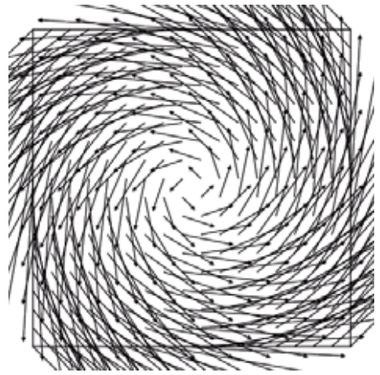


fig. 301_vector field (vortex)

urban attractors / vortex points

According to the principles of the traffic access-magnetic field the diagram to the left shows the specific vector orientation caused by urban attractor areas.

High turbulance areas can be interpreted as important zones which are influenced by two or more attractor points. They symbolize the rough geometrical boarders of certain areas within Renmin Square to represent the social needs of the city caused by the urban environment.

6.1 concept I - magnetic field displacement

magnetic attractor field diagram - combination of current traffic access system & urban influences

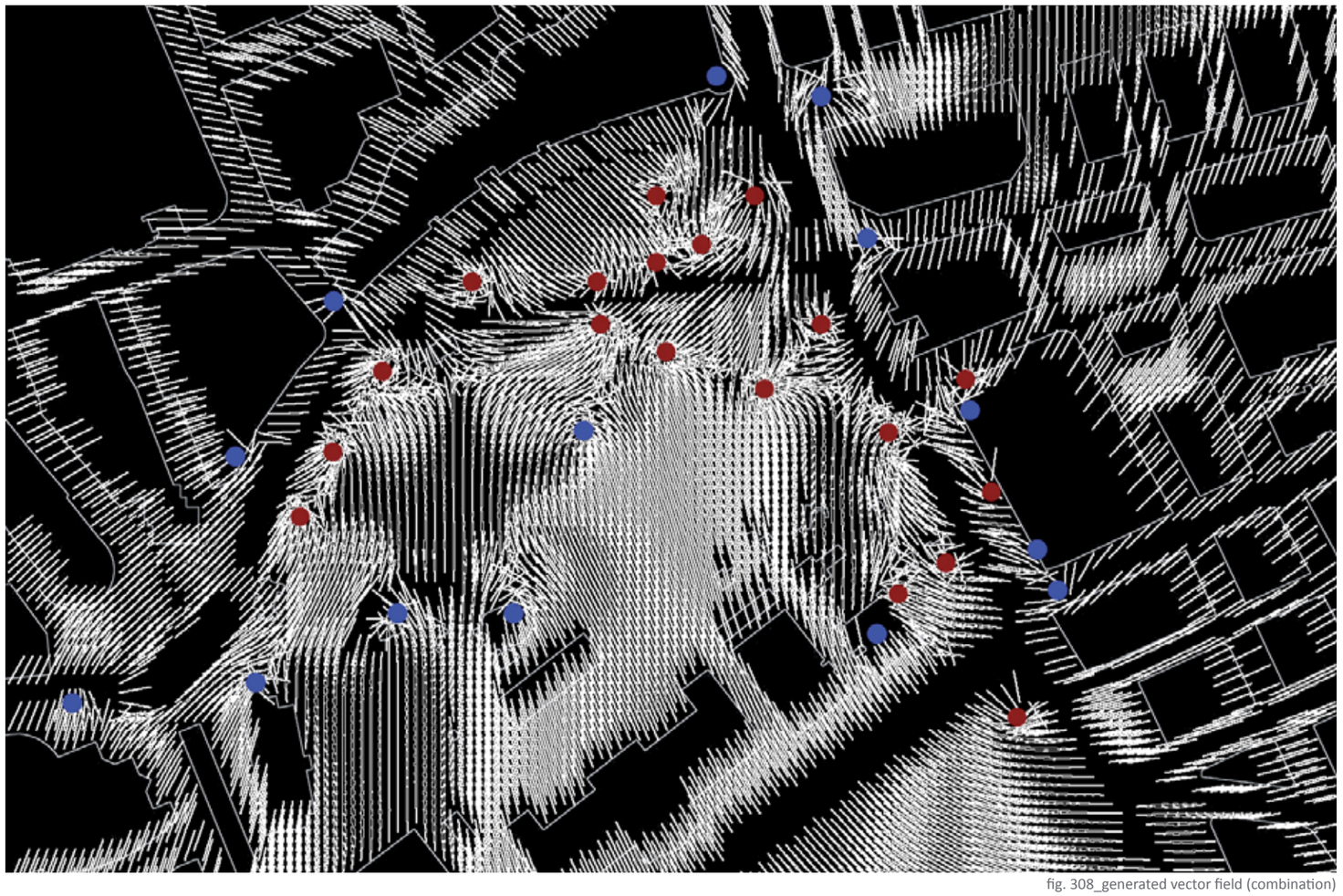


fig. 308_generated vector field (combination)

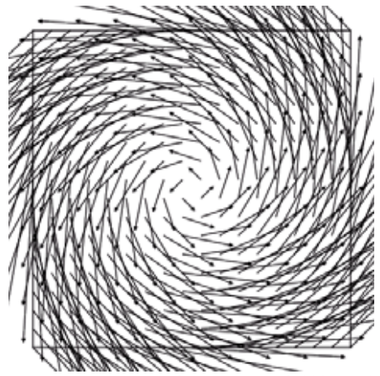


fig. 301_vector field (vortex)

traffic access points / vortex points

urban attractors / vortex points

The diagram to the left shows a combined magnetic field, including the vector deformations caused by the traffic access system and the urban attractor system.

It represents the relationship between the local conditions of Renmin Square Subway Area and the social influence by the surrounding urban network.

6.1 concept I - magnetic field displacement

magnetic attractor field diagram - combination of current traffic access system & urban influences

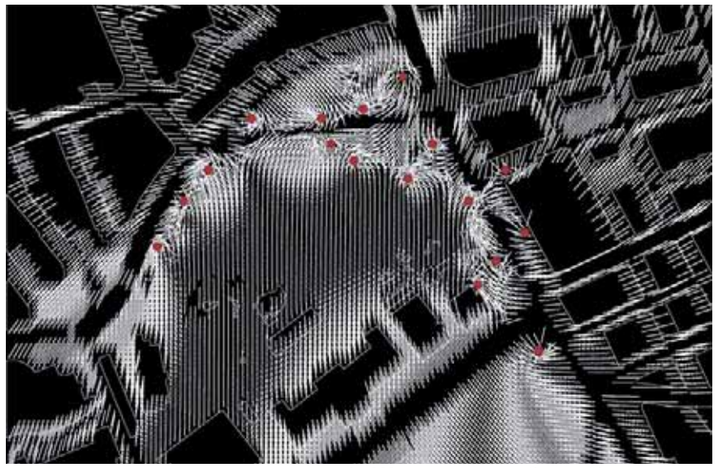


fig. 309_generated vector field (traffic access points)

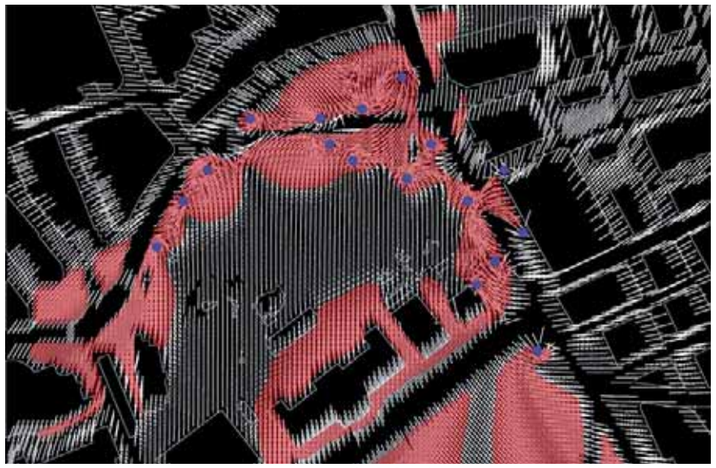


fig. 310_heigh attracted areas (traffic access points)

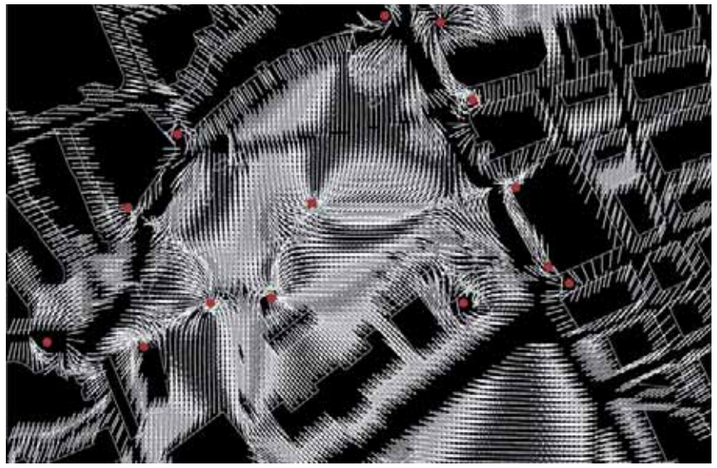


fig. 311_generated vector field (urban attractors)

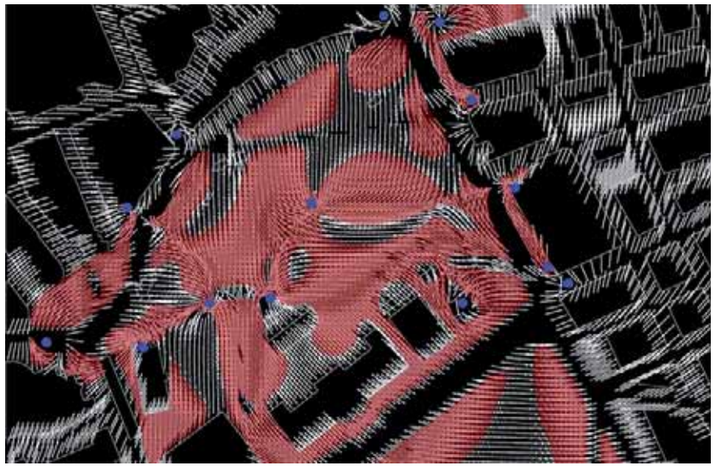


fig. 312_heigh attracted areas (urban attractors)

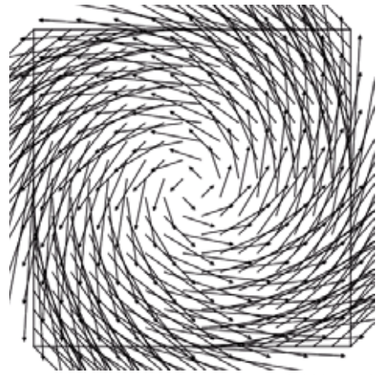


fig. 301_vector field (vortex)

The different interpretations of ***High Attracted Areas*** show that the urban attractor system is deverging from the local traffic system.

The bus stations and the subway entrances generate a high attracted field at the boarders of Renmin Square while the green areas of the park mostly persist as non-attracted „gray space“.

For this reason the positions and attractor values of the traffic system have failed in achieving the needs of the city.

In order to find a proper new solution for dividing the space of Renmin Square, we used the pattern of the urban attractor system as a direct reference to the needs of the city. The goal was to generate several different zones which can be further analysed and subdivided.

6.2 concept I - pattern language
generating a specific pattern tree

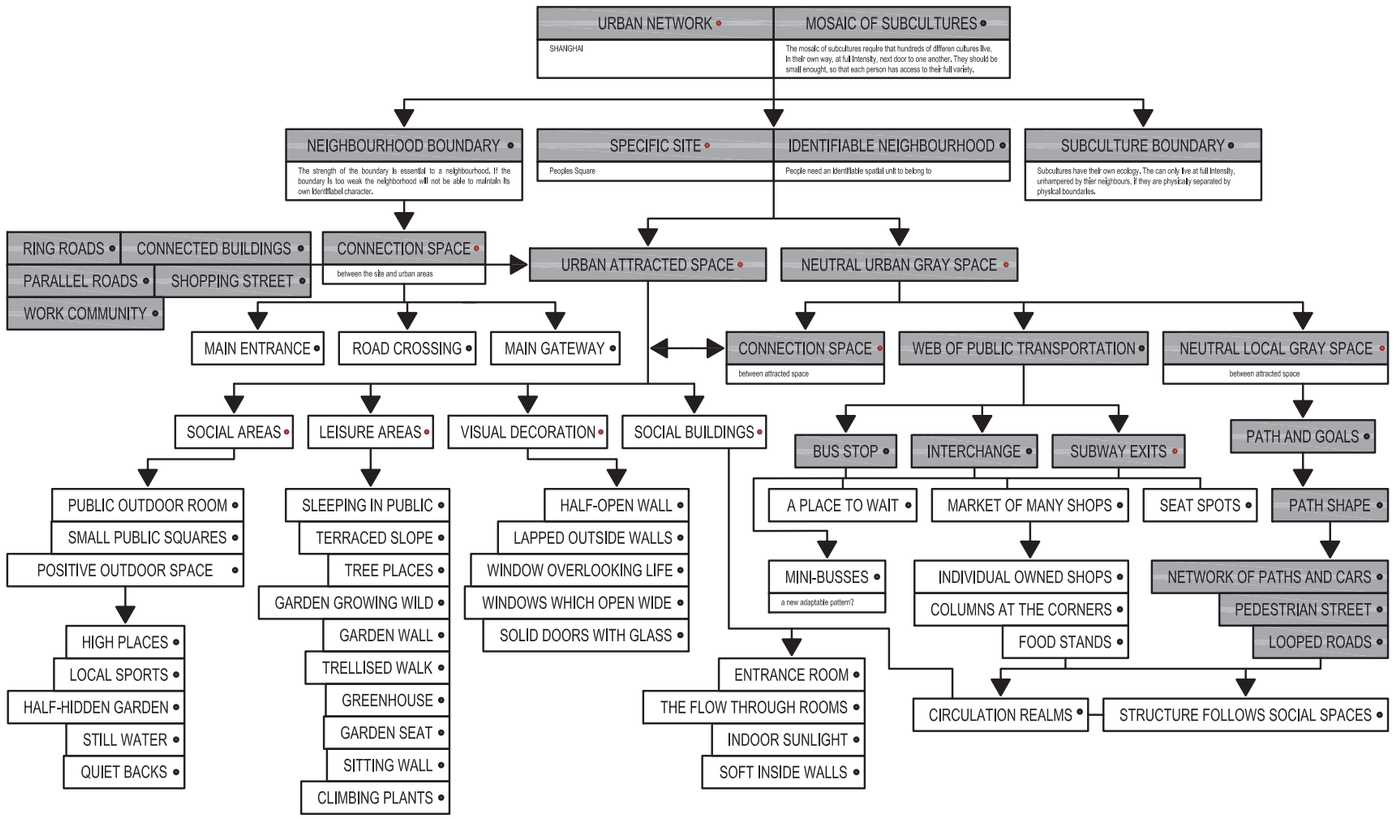


fig. 313_specific pattern tree

In order to generate a complex function diagram we generated a pattern tree according to the book „A Pattern Language“. Most of the patterns were directly extracted from the book‘s pattern vocabulary, some of them were adjusted according to the specific functions of the site.

„At the core of the book is the point that in designing their environments people always rely on certain ‚languages‘, which, like the languages we speak, allow them to articulate and communicate an infinite variety of designs within a formal system which gives them coherence. [...]

The patterns are ordered, beginning with the very largest, for regions and towns, then working down through neighbourhoods, clusters of buildings, buildings, rooms and alcoves, ending finally with details of construction.

This order, which is represented as a straight linear sequence, is essential to the way the language works. [...] What is most important about the sequence, is that it is based on the connections between the patterns. Each pattern is connected to certain ‚larger‘ patterns which come above it in the language; and to certain ‚smaller‘ patterns which come below it in the language. The pattern helps to complete those larger patterns which are ‚above‘ it, and is itself completed by those smaller patterns which are ‚below‘ it.“ [16]

6.2 concept I - pattern language

generating pattern iteration I

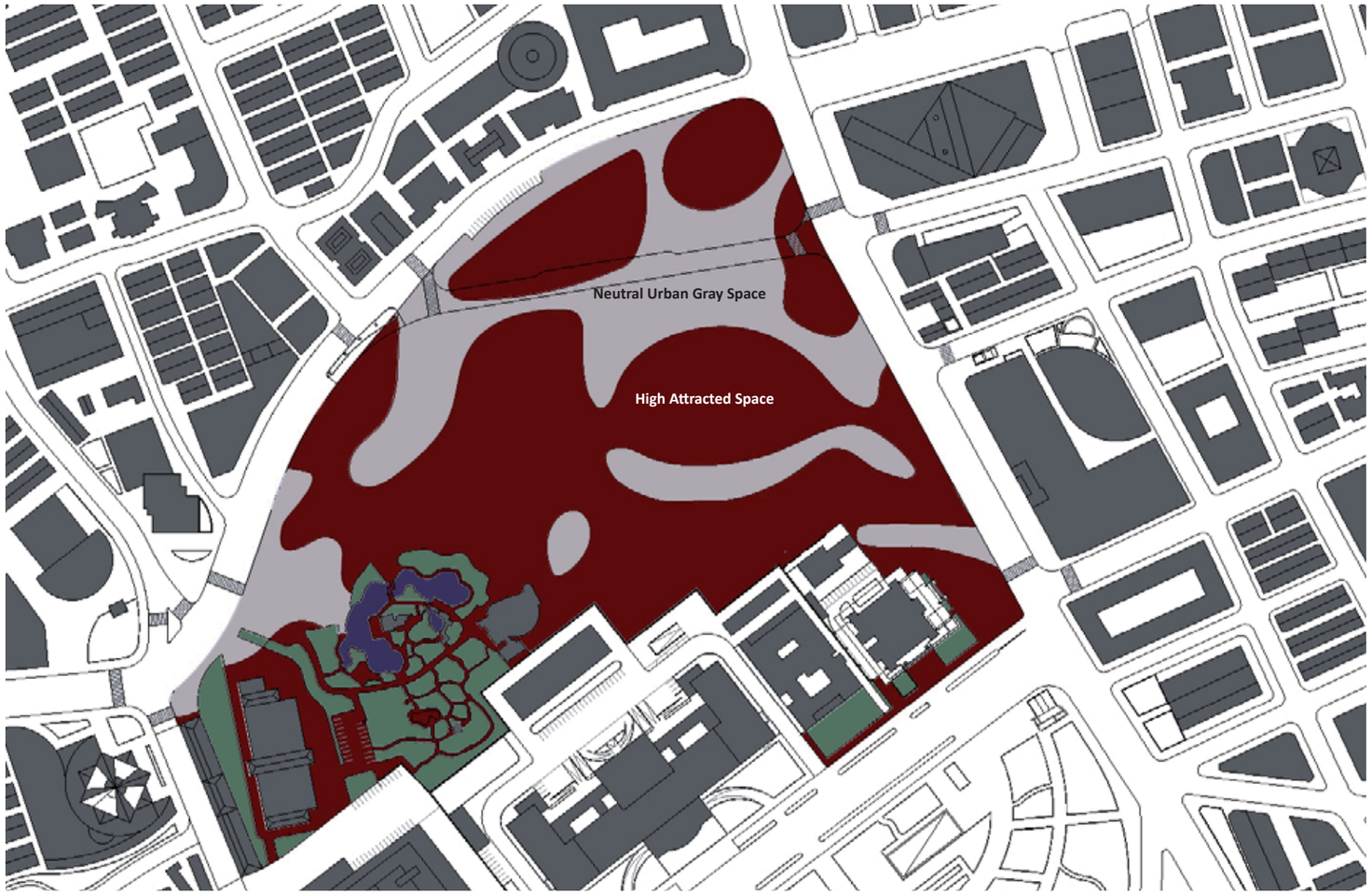


fig. 314_diagram - pattern iteration I

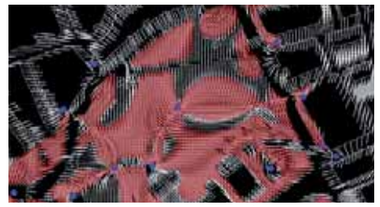


fig. 312_heigh attracted areas (urban attractors)

The first iteration of the ***Pattern Tree*** is dividing the site in two main areas which are both directly related to the needs of the city and to the attractor points of the urban network.

The ***Heigh Attracted Areas*** are marking the zones of high urban influence and density at Renmin Square. They further symbolize zones of strong social interactions on site and a connection to the sociological functions of the buildings and areas in the urban neighbourhood.

The ***Neutral Gray Space*** is less influenced by the urban attractors and works therefore as a connection between the high attracted areas and and as a hub between the access points to the underground subway area and the social activities on the urban level above ground.

The division lines of both areas represent the boarder between two different kinds of space in the same way like a subway entrance does. In order to refine ***Pattern I*** it is necessary to use the local system of existing subway access points in the next interation step and combine it with the new defined urban network of ***Pattern I.***

6.2 concept I - pattern language

generating pattern iteration II

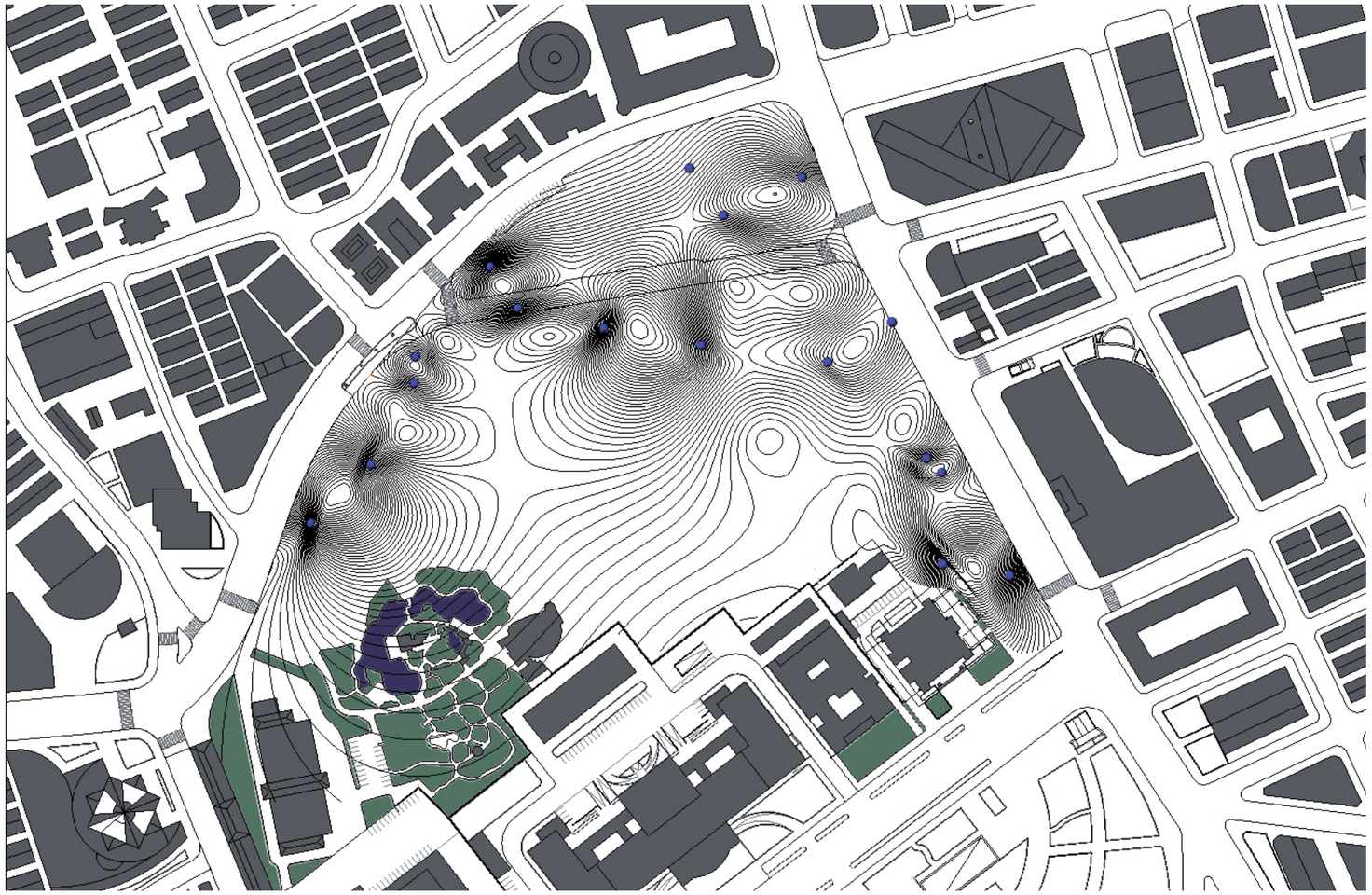


fig. 315_diagram - pattern iteration II (isopotential lines)

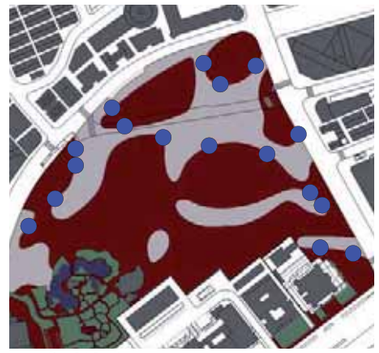


fig. 316_diagram - relocated subway entrances

Because of our previous analysis with magnetic fields, the location of the entrances to the subway stations and the bus stops need to have a direct relation to the urban needs.

Therefore we relocated them at the boarders between ***Neutral Urban Gray Space*** and the ***High Attracted Areas*** in order to generate a crossover between these two different urban systems.

The entrance frequencies of our research on site are based on the surrounding local conditions. After changing the location these values are no longer significant.

In this step we generated a magnetic field by using the new located traffic points as charges with uniform values. The resulting ***Isopotential Lines*** simulate the new local traffic system in relation to the urban needs.

6.2 concept I - pattern language

generating pattern iteration III

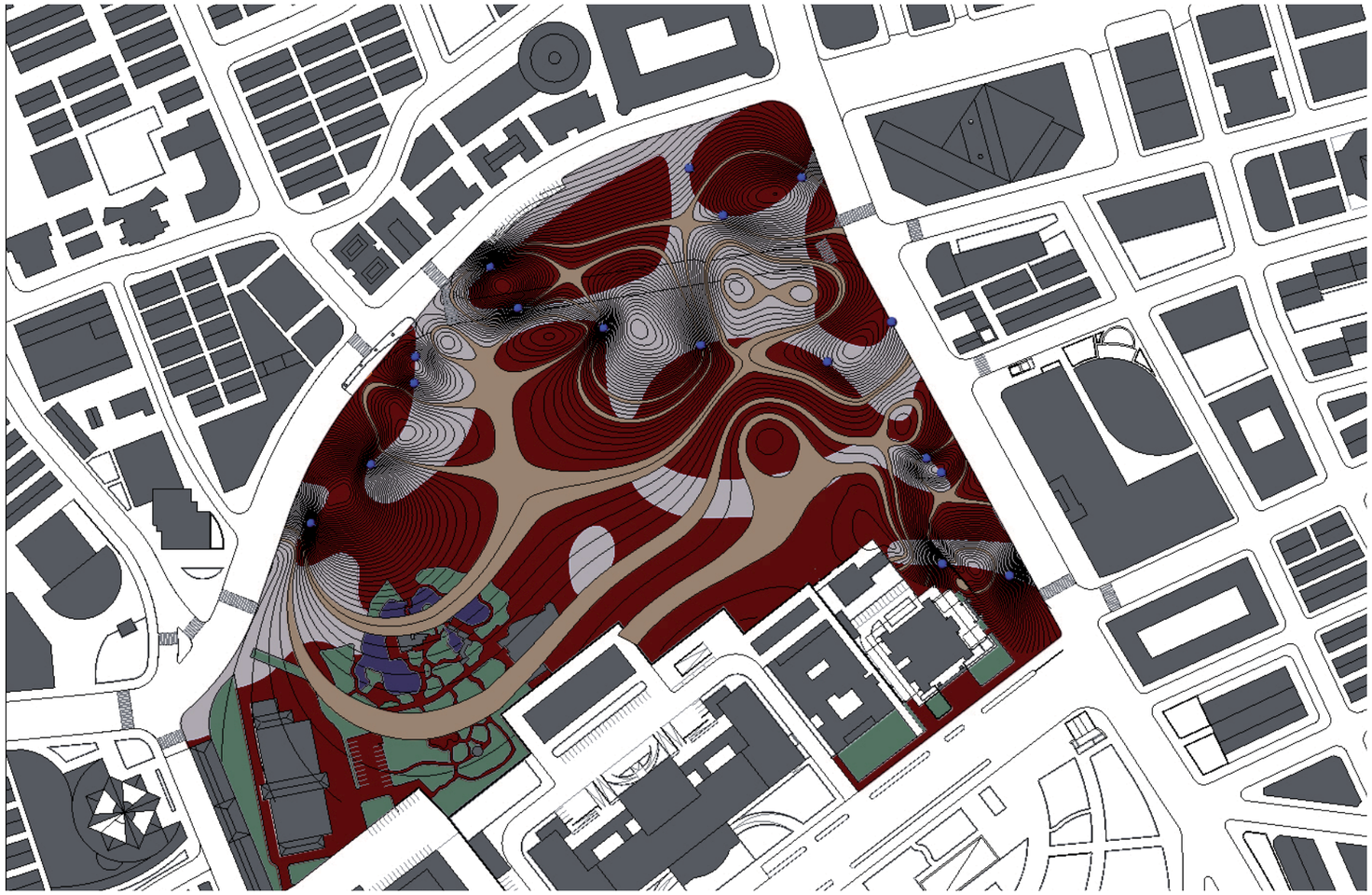


fig. 317_diagram - pattern III (overlay of pattern I & II)

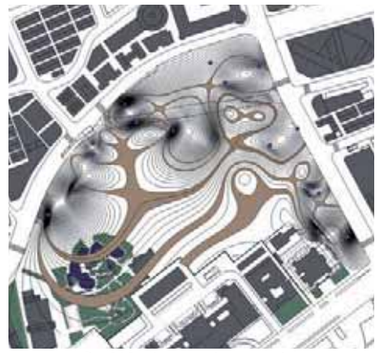


fig. 318_diagram - isopotential gray space

high attracted space (pattern I)

neutral urban gray space (pattern I)

isopotential gray space (iteration II)

existing green areas

The ***Isopotential Gray Space*** is located inbetween the magnetic fields which are generated bey the relocated uniform traffic attractors.

Similar to the previous magnetic simulation of the urban needs, the isopotential lines of this diagram show areas of heigh density and attraction as well as the ***Local non-attracted Gray Space*** that connects the heigh attracted areas.

Pattern I and ***Pattern II*** are combined in order to generate a new output pattern which simulates the combined needs of the urban network and the local traffic system.

6.2 concept I - pattern language
three dimensional development

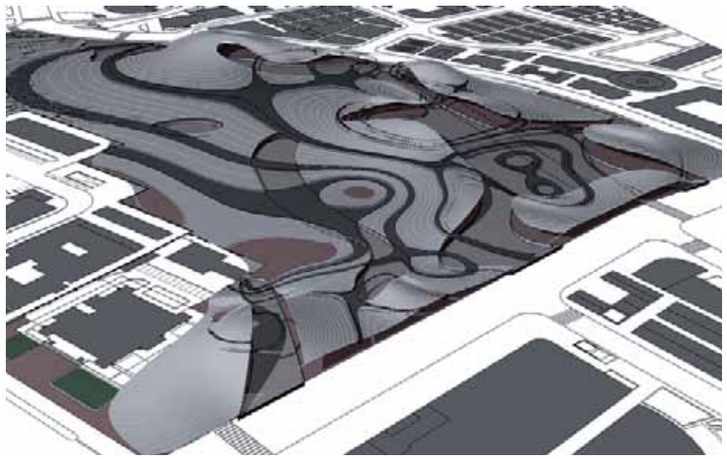


fig. 319_concept rendering 01

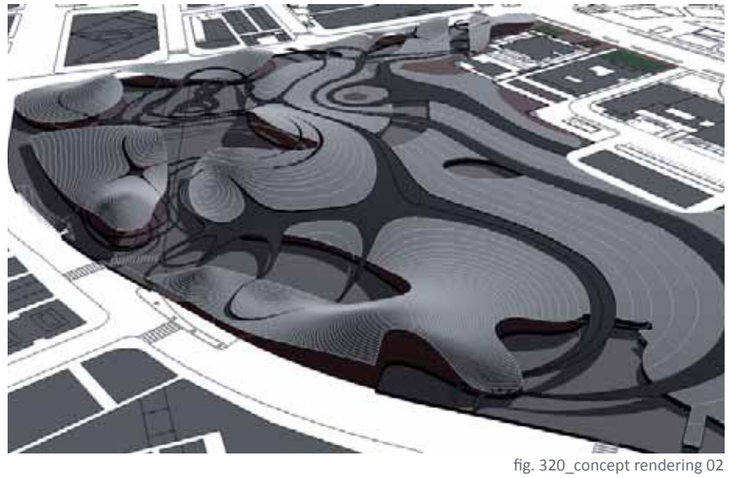


fig. 320_concept rendering 02

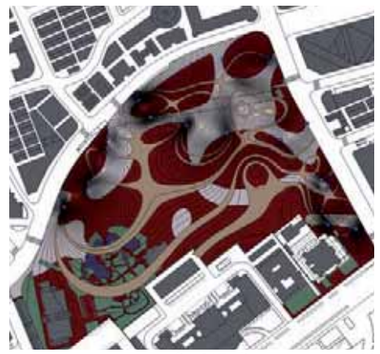


fig. 317_diagram - pattern III

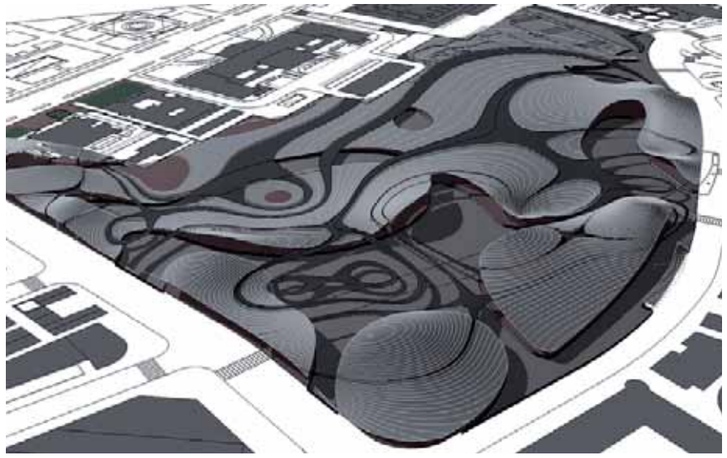


fig. 321_concept rendering 03

fig. 322_concept rendering 04

In order to get three dimensional information from ***Pattern II*** the isopotential lines are interpreted as height lines. The resulting 3D surface is then combined with ***pattern I***. The ***Neutral Urban Gray Space*** and the ***Isopotential Gray Space*** are cutted out from that surface in order to create a ***Combined Woven Space*** which covers the ***Heigh Attracted Areas***.

So the generated 3D system is based on four different layers as a result of the needs of the urban environment and the local traffic situation.

The site is divided in different parts of different scale ready to be subdivided in the further iteration steps.

As we showed in our ***Pattern Tree*** these areas should provide space for social functions, local public infrastructure and multi-layered recreation zones.

6.3 concept II - space subdivision
redirecting the urban influences

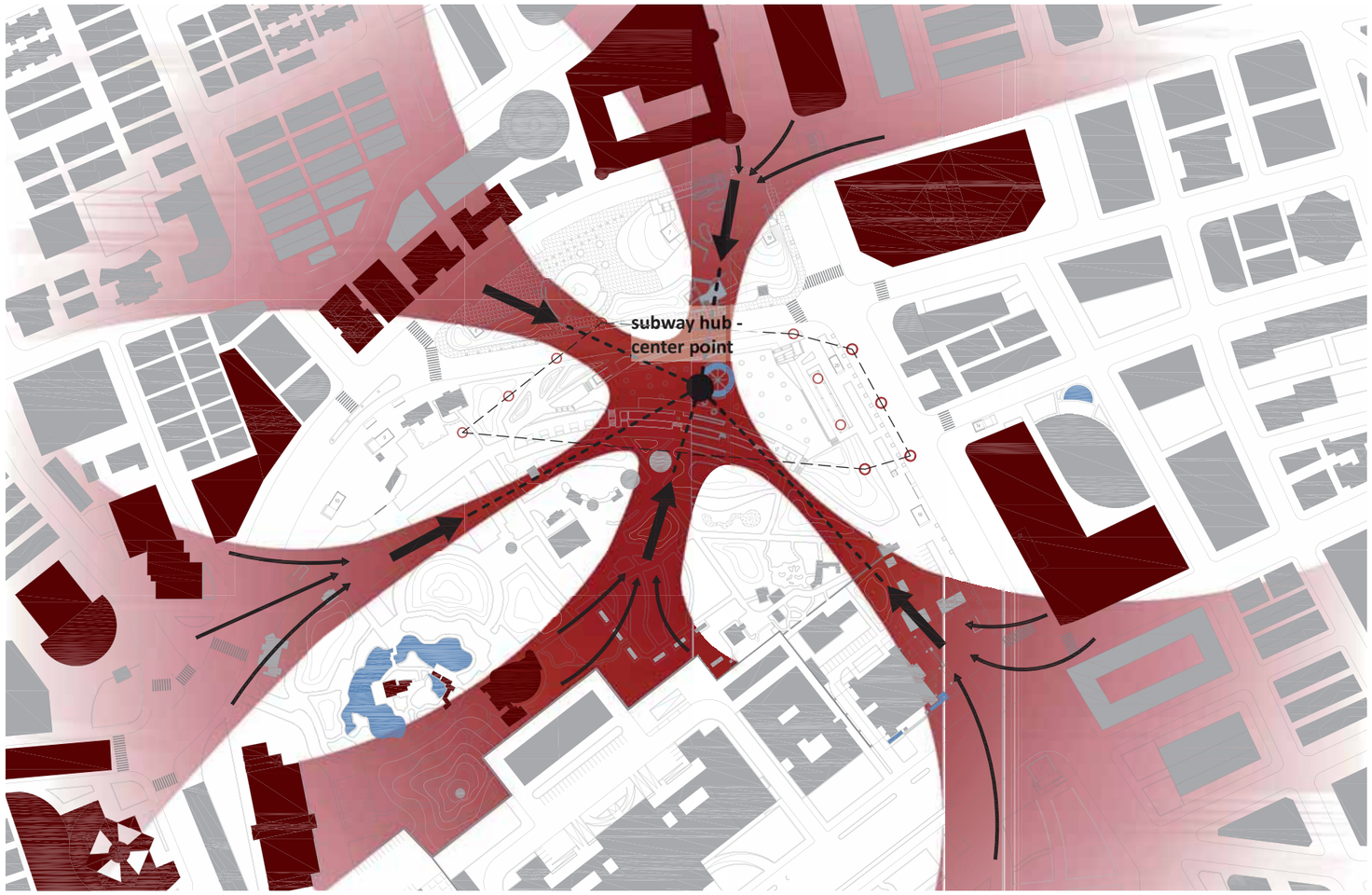


fig. 323_diagram - redirecting the urban influences

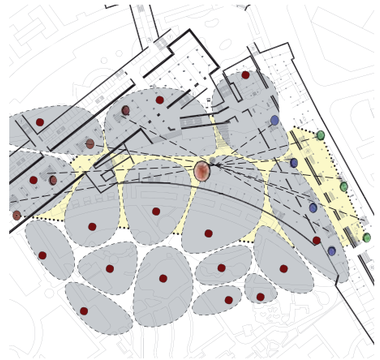


fig. 324_Location of the global attractor point

areas of urban influence

neutral urban environment

According to the diagram on page 86 the centerpoint with its neutral position to the subway access areas works as the initial parameter for the design concept.

The five main urban influence areas which are defining the zones of high human density at the boarders of Renmin Square are redirected to the center point of the subway system.

The ubran influences are now focused on a mutual point at the site in order to generate a new centralized subway hub.

6.3 concept II - space subdivision

primary circulation space

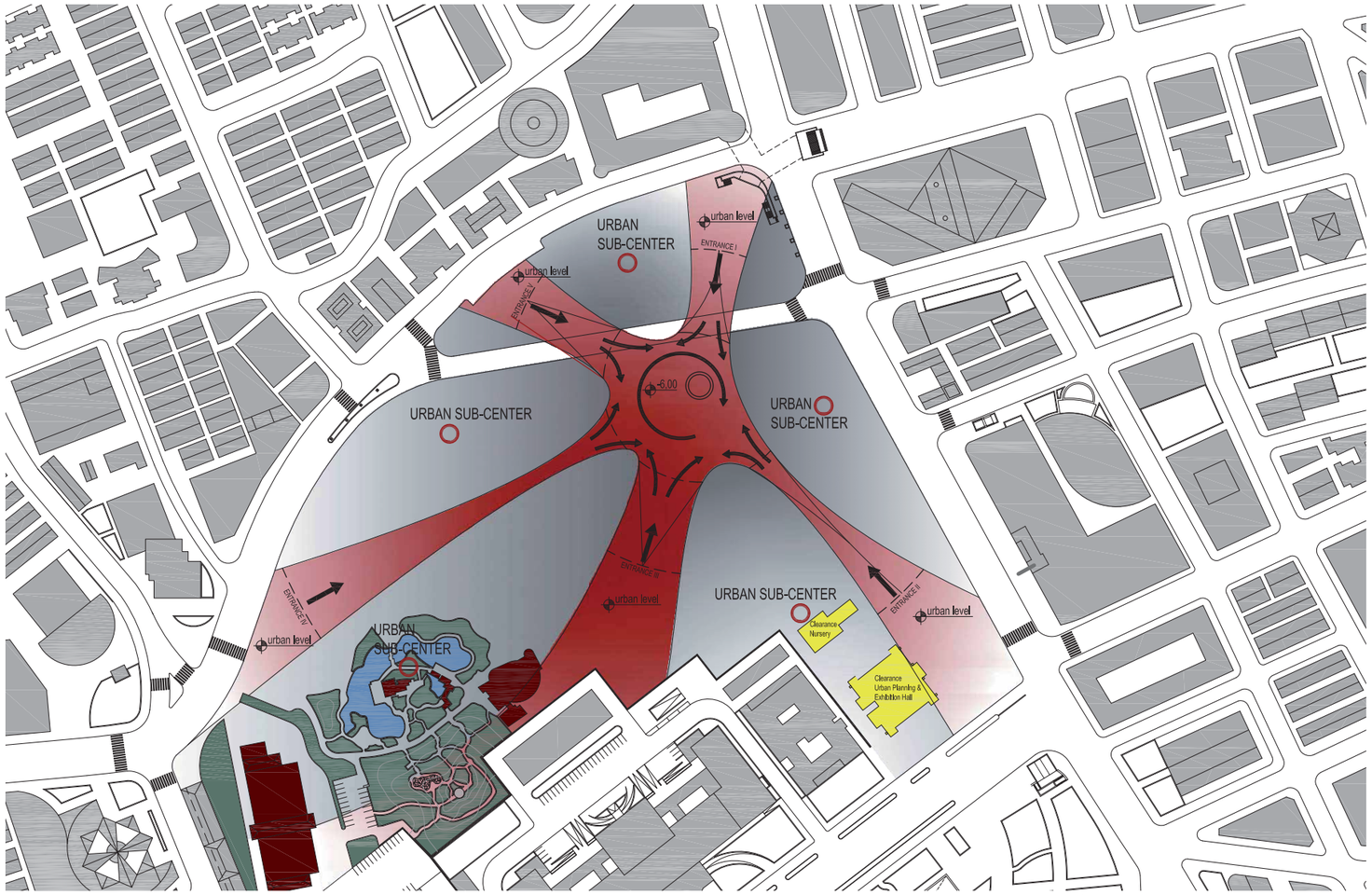


fig. 325_diagram - primary circulation space

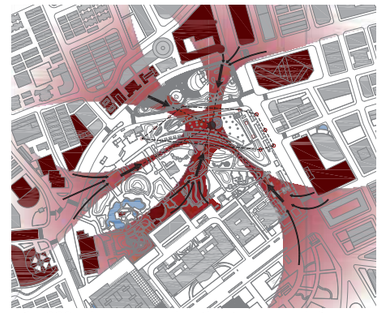


fig. 323_diagram - redirecting the urban influences

primary occupied space

primary circulation space

integrated existing buildings

erased existing buildings

The urban influences define the boarders of the primary circulation system. This system is optimized for accessing the subway areas underground and the primary urban occupied space which lies inbetween.

The red coloured area around the defined center point works as the new hub to lead people from the different urban environments efficiently to the subway traffic system and the other way around.

In this iteration step important existing buildings have been considered while buildings and areas which are not working with the new system were erased.

6.3 concept II - space subdivision

secondary circulation space

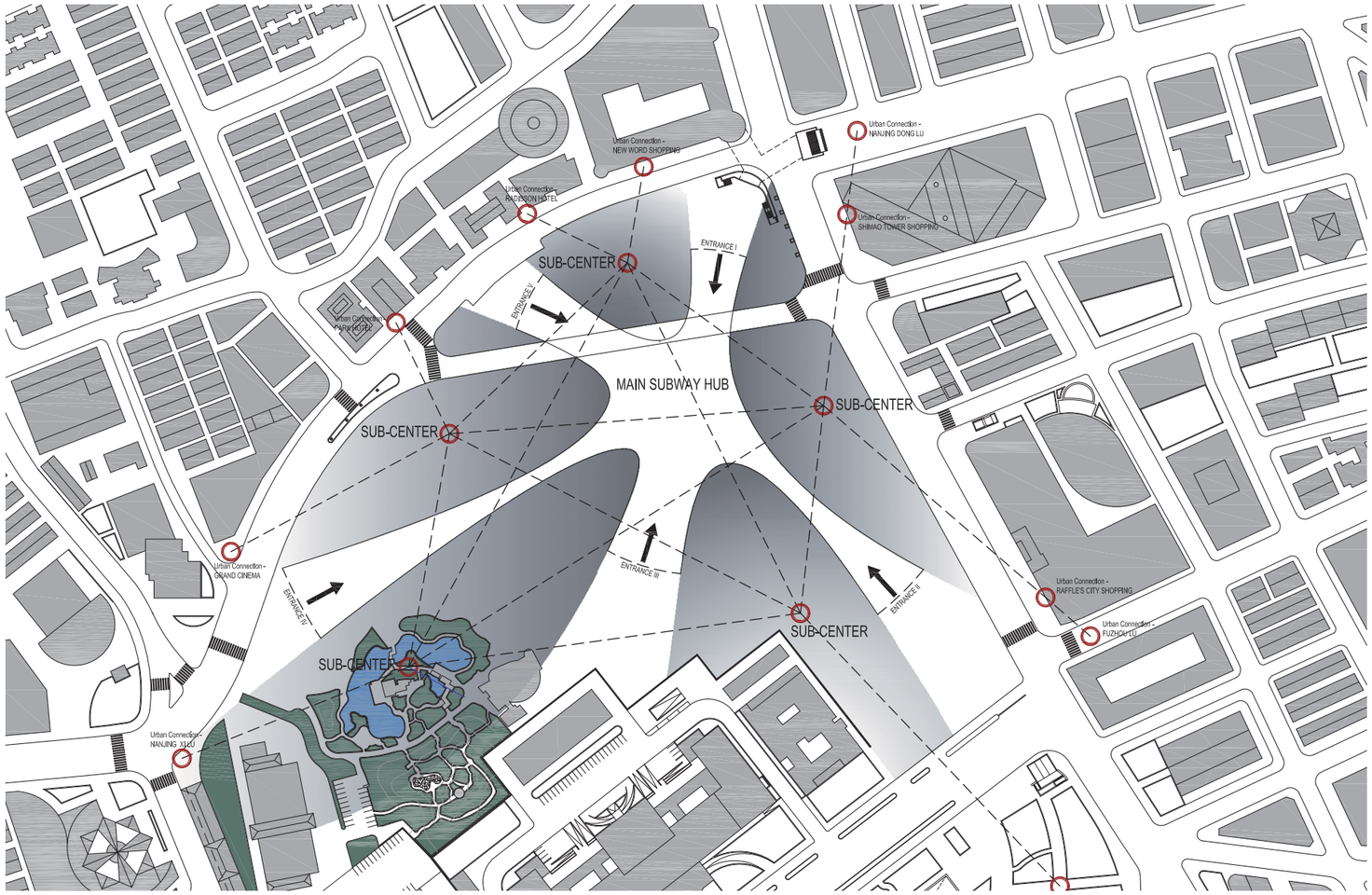


fig. 326_diagram - secondary circulation space

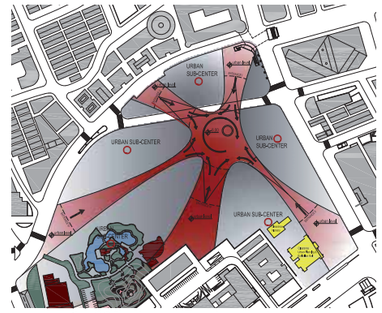


fig. 325_diagram - primary circulation space

urban sub-centers

primary occupied space

The sub-centers of the primary occupied space are connected to important locations of the surrounding urban network and to every other sub-center on the site in order to generate a second circulation system above ground.

The new network is able to direct people to certain points and special functions on site or can be used as an urban shortcut system to efficiently transit from one urban location to another.

6.3 concept II - space subdivision

secondary circulation space

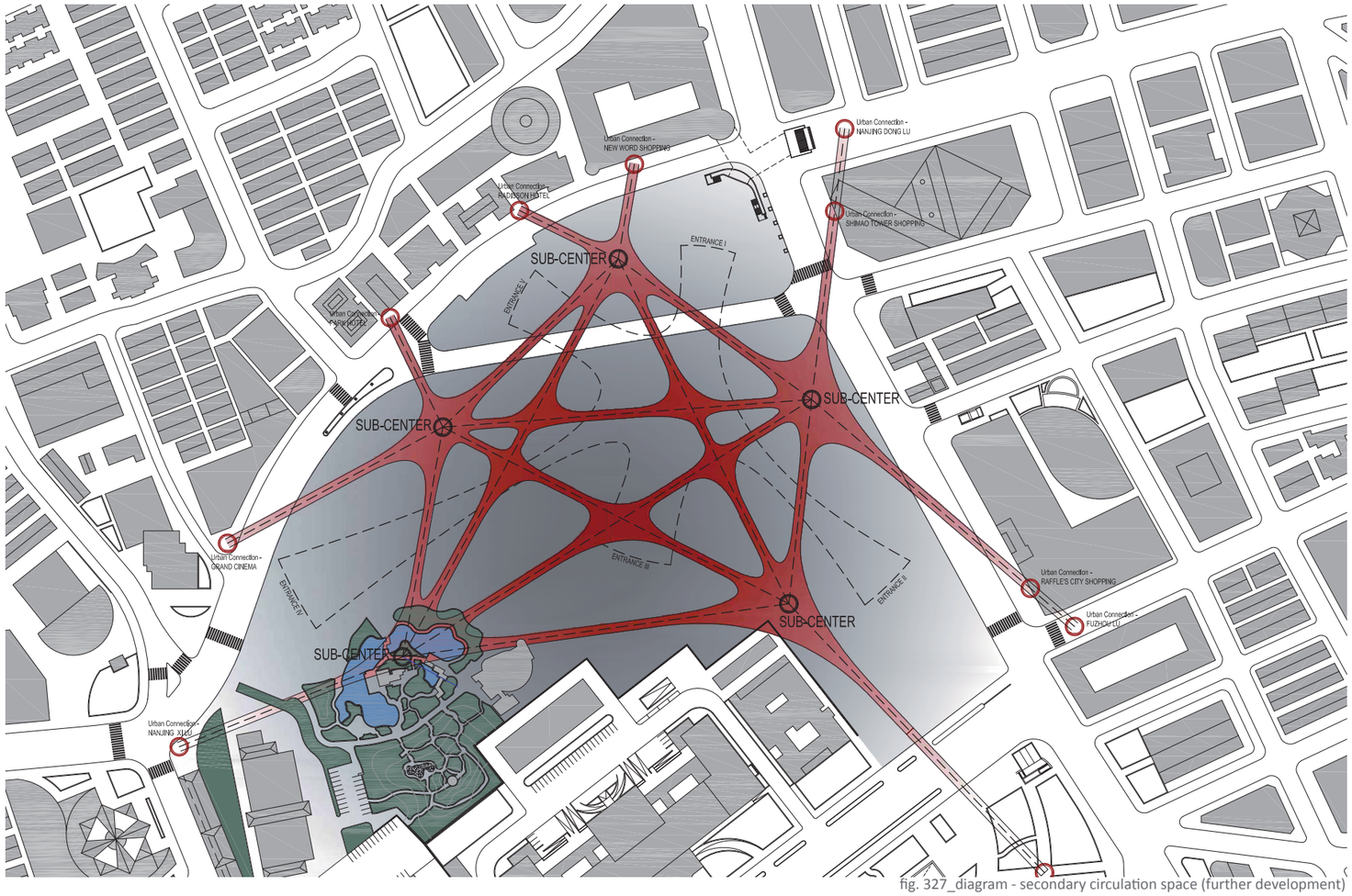


fig. 327_diagram - secondary circulation space (further development)

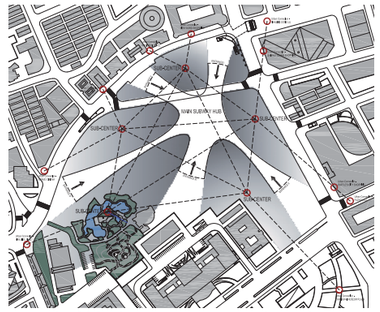


fig. 326_diagram - secondary circulation space

urban sub-centers

secondary ocupied space

secondary circulation space

The resulting secondary ocupied space works as transition area between the primary traffic space, the park and special function zones and the secondary traffic system which establishes the connection to the urban environment.

In the next step the secondary ocupied space will be deformed in three dimensions for being able to connect the different height levels of the site.

6.4 concept II - three dimensional deformation

function diagram

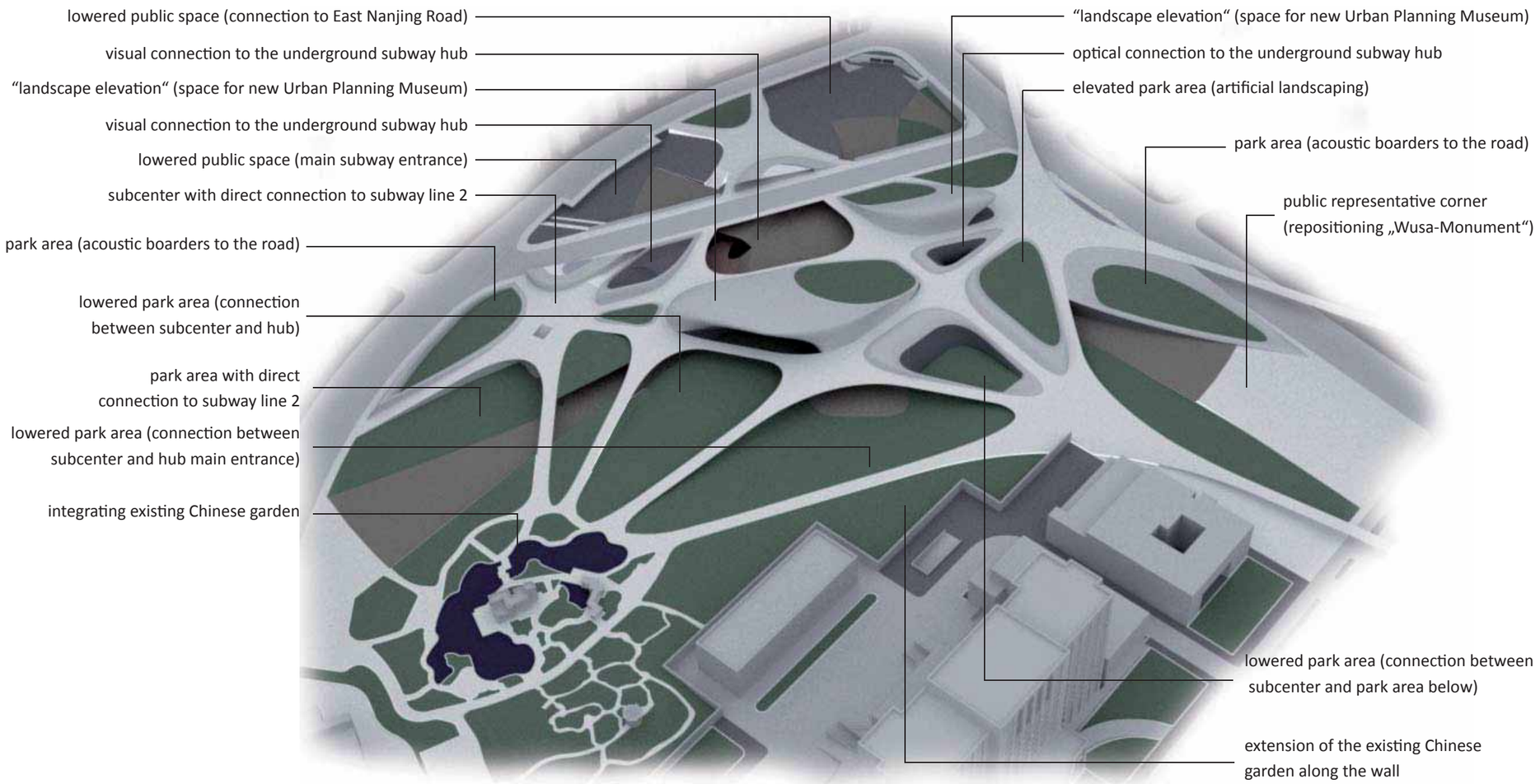


fig. 328_3D diagram - functions

6.5 résumé

The simulation of the collected site parameters via magnetic fields in the first concept showed an abstract differentiation of highly and low influenced areas of Renmin Square. Therefore, the diagrams worked well as a tool for analyzing and reinterpreting the numeric data in order to transform it into visual outputs.

Additionally, the generated pattern tree, which was considered the theoretical spine of the design process, provided us with specific knowledge about the site's social needs and their hierarchies and importance in the global urban system.

Nevertheless, the design attempt failed in terms of translating the method into a precise architectural language. Diagrams and simulations could not be interpreted one-to-one as geometrical input for the form-finding process. The method and the actual development of architectural forms have to be separate processes in the design.

The same applies to the second design concept: the redirection of urban influences and the subdivision of space by connecting certain sub-centers, do not generate buildable architecture. It is a way to classify the area according to the social forces of the urban environment.

For this reason, the iteration steps of both concepts have to be seen as three-dimensional diagrams of the respective design method and cannot be interpreted as architectural space configurations. They are rather a three-dimensional multi-layered mirror image of the current configuration of Renmin Square, which helps to understand the needs of the site but does not answer the question of finding new architectural solutions.

In addition to that, both design proposals neglect special areas of the current site which are definitely worth to be preserved. Making a clean sweep of Renmin Square is most probably not the right way to efficiently enhance this special area with all its different influences and characteristic features.

fig. 329_resume - chapter VI

In a special area like Renmin Square, with all its different urban layers, it is impossible to find new and efficient architectural solutions by just following a linear design process. Analysis and design method, the two main focal points of this thesis, are intimately intertwined and cannot be dealt with separately. Ideas, perceptions and failures from one process, automatically influence the other. Working in a team allowed us to focus simultaneously on these important processes and to constantly discuss and redevelop them.

The high human density in the subway areas, the special sociological meaning of Renmin Park for the entire city, the mixture of special functions within the site and the cultural and touristic influences of the surrounding environment, create a high grade of complexity and made it necessary to start by understanding every single layer of the system before being able to discover its main architectural problems. For the specific site analysis we put special emphasis on 2D and 3D diagrams which formed the basis of and provided essential knowledge for the further project development.

The two discarded design concepts helped us to uncover the problems and difficulties of such complex systems. We therefore decided to deal with the theoretical design method and the actual form-finding process in two individual steps:

The magnetic field simulations and the idea of redirecting the urban influences gave us the necessary insight on how to transmute the collected data within a parametric system. This information was then used to enhance the site‘s geometry in the future design process which, in turn, led to an improved sociological status of the site.

In our opinion, methods are not necessarily defining the architectural form. Based on the site parameters, they are describing the abstract skeleton behind the design. Design methods represent theories which help to overcome architectural problems. Buildable architecture arises from interpreting the method‘s output in relation to the specific future needs of the site.

In our case, the Voronoi algorithm provided us with a new theoretical arrangement of occupied and circulation space, which is still related to the site‘s original geometry. By combining this data with a strong design metaphor, we were able to create architecture, which solves the site’s main problems and optimizes the important relationship between the subway system and the park areas.

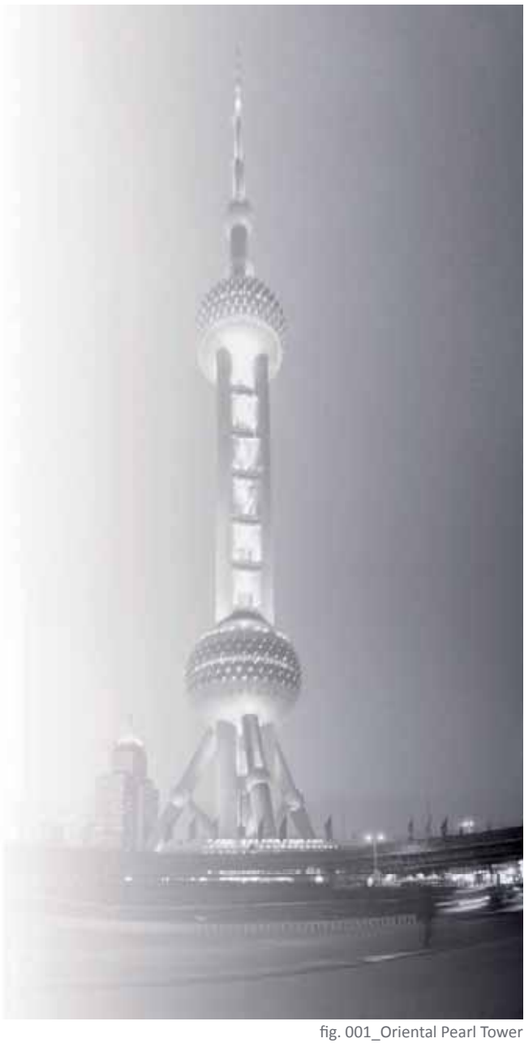


fig. 001_Oriental Pearl Tower

[1] www.wikipedia.org
[2] *ibid.*
[3] Shanghai literature and art publishing group, 2009 Shanghai Basic Facts (Shanghai 2009), p.99
[4] *ibid.*, p.6
www.wikipedia.org
[5] *ibid.*
[6] cf. Shanghai literature and art publishing group, 2009 Shanghai Basic Facts (Shanghai 2009), p.41
[7] *ibid.*, p.40
[8] *ibid.*, p.41
[9] *ibid.*
[10] www.parkhotel.com.cn
[11] www.mocashanghai.org
[12] www.smartshanghai.com
[13] www.wikipedia.org
[14] *ibid.*
[15] Klein R., Concrete and abstract Voronoi diagrams (Springer 1989), p.12
[16] Christoper Alexander, Sarah Ishikawa, Murray Siverstein with Max Jacobson, Ingrid Fiksdahl-King, Shlomo Angel, A Pattern Language. Buildings - Towns - Construction (New York 1977), p.12

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LIST OF ILLUSTRATIONS