PROJECT GV

MA4 - URB11, June 2017, Patrick Martin Sandqvist

TITLE PAGE

Title: LITTLE BIG BANG

Thesis Period: 01.02.2017 - 18.05.2017

Master Thesis
Spring 2017
MSc04 - URB
Group 11

Supervisor: Ole Pihl
Technical Supervisor: Niels Agerholm

Urban Design
Institute of Architecture & Design
Aalborg University

Patrick Martin Sandqvist
20151138

ABSTRACT

Today a field, tomorrow an urban neighborhood. The Project GV is the transformation of a field within an area where local communities have great expectations of becoming one of the leading university cities in Europe, where business and education will be the forces of the continued growth of the area. Project GV seeks to develop an urban environment that boost the local visions, by creating a vibrant space that will facilitate and inspire city life, through integration of the sites green surroundings. By the implementation of a green boulevard that runs throughout the site, and with buildings arranged according to natural flow lines and weather conditions, locals are indeed invited to live their everyday life outside in this new urban setting.

LOCATION

The project site is located 11 km north of the city center of Copenhagen, Denmark, by the edge of the city Lyngby, where the distance from the project site to the center of Lyngby is around 1,6 km. The particular area in which the project site is situated is called Trongårdens Byområde and is part of a larger area named Dyrehavegårds Jorder, which today is pure field area with vegetation and a minor protected forest of 1 ha (Lyngby – Taarbæk Kommune, 2016a), but the area is under development and in the north-western part of Dyrehavegårds Jorder, Novozymes started the construction of the company's future science park in fall 2016 (Lyngby – Taarbæk Kommune, 2017b).

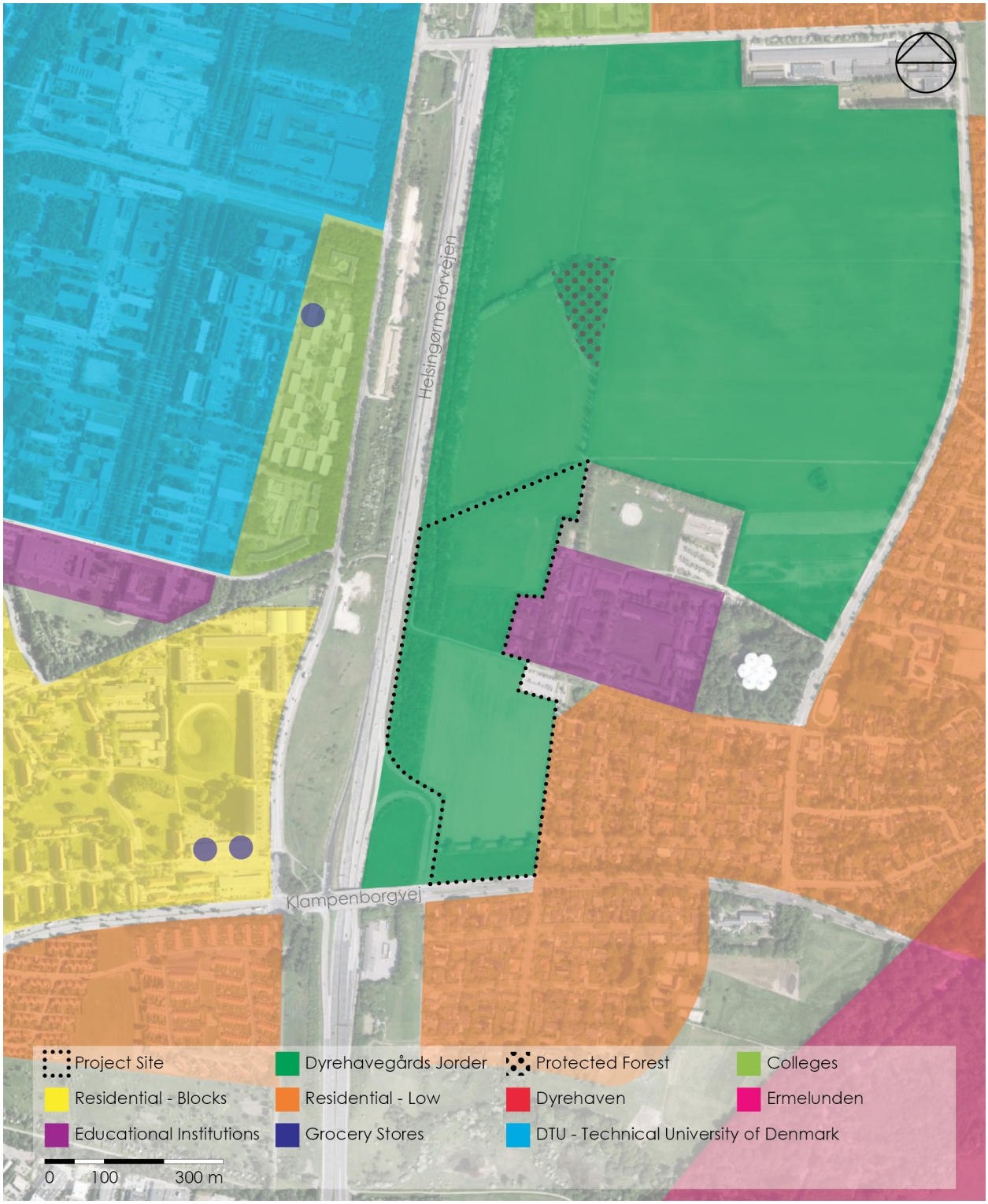
Size of the project site, approx. 139.100 m².

The location of the project site is surrounded by a motorway west of the site, going north and south with heavy traffic and pullution - especially mornings and afternoons when people are driving to and from work. There are also single family homes situated on the eastern edge of the area which must be taken into account when developing the project site.

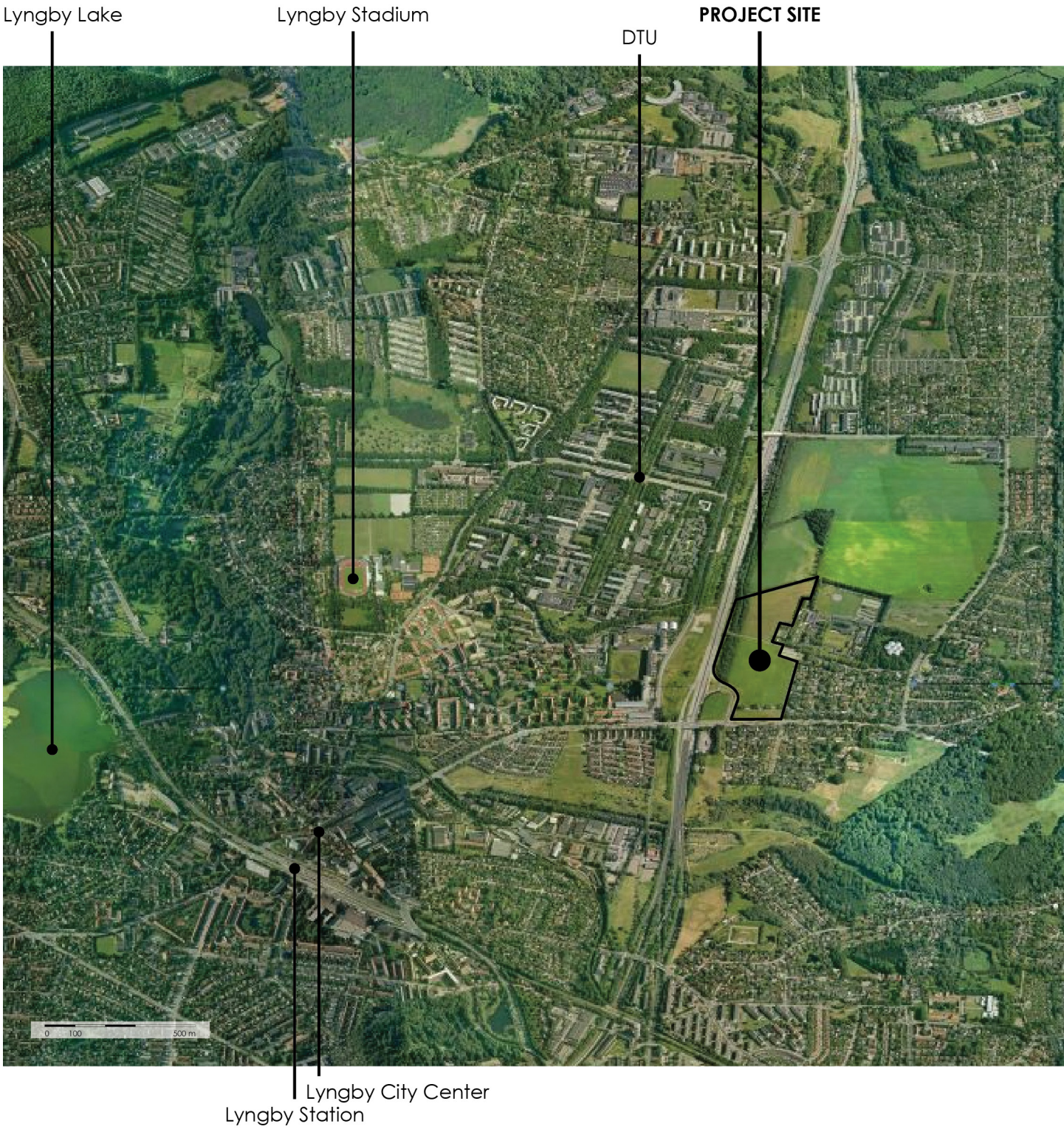
Close by are also a public school and a high school. DTU (Danmarks Tekniske Universitet) is situated nearby on the opposite side of the motorway. These groups of young people/students should hopefully find the project site attractive as well as its future residents and those who will have the area as their workplace.

The project site is characterized by its surrounding environment, where a great amount of vegetation and green space is found, and less than one kilometer east of the site is one of the entrances to the forest Dyrehaven, a forest that in the beginning was used for hunting by the Danish royalties when the forest was established by Frederik III in 1669 (Lyngby – Taarbæk Kommune, 2015b). and where the castle Eremitageslottet stands as a landmark on top of a small hill over viewing Dyrehaven's landscape and the sea Øresund east of Eremitageslottet. The castle was build during 1734-1736 in late baroque by Lauritz de Thurah, with the former Danish king Christian XI as building owner (Naturstyrelsen, 2017). In 1756 the public were allowed to access the forest (Lyngby – Taarbæk Kommune, 2015b) and today Dyrehaven which is part of the UNESCO Heritage List (Lyngby – Taarbæk Kommune, 2015b) is visited by 7,5 million people a year, making it the most visited nature area in Denmark (Lyngby – Taarbæk Kommune, 2015b) mainly used for recreational purposes by the public, where one e.g. can experience the wildlife, investigate ancient monuments, go horseback riding, play golf or enjoy open air theaters in the summer.

ill. 02 - World atlas



ill. 03 - District Map



ill. 04 - Context map

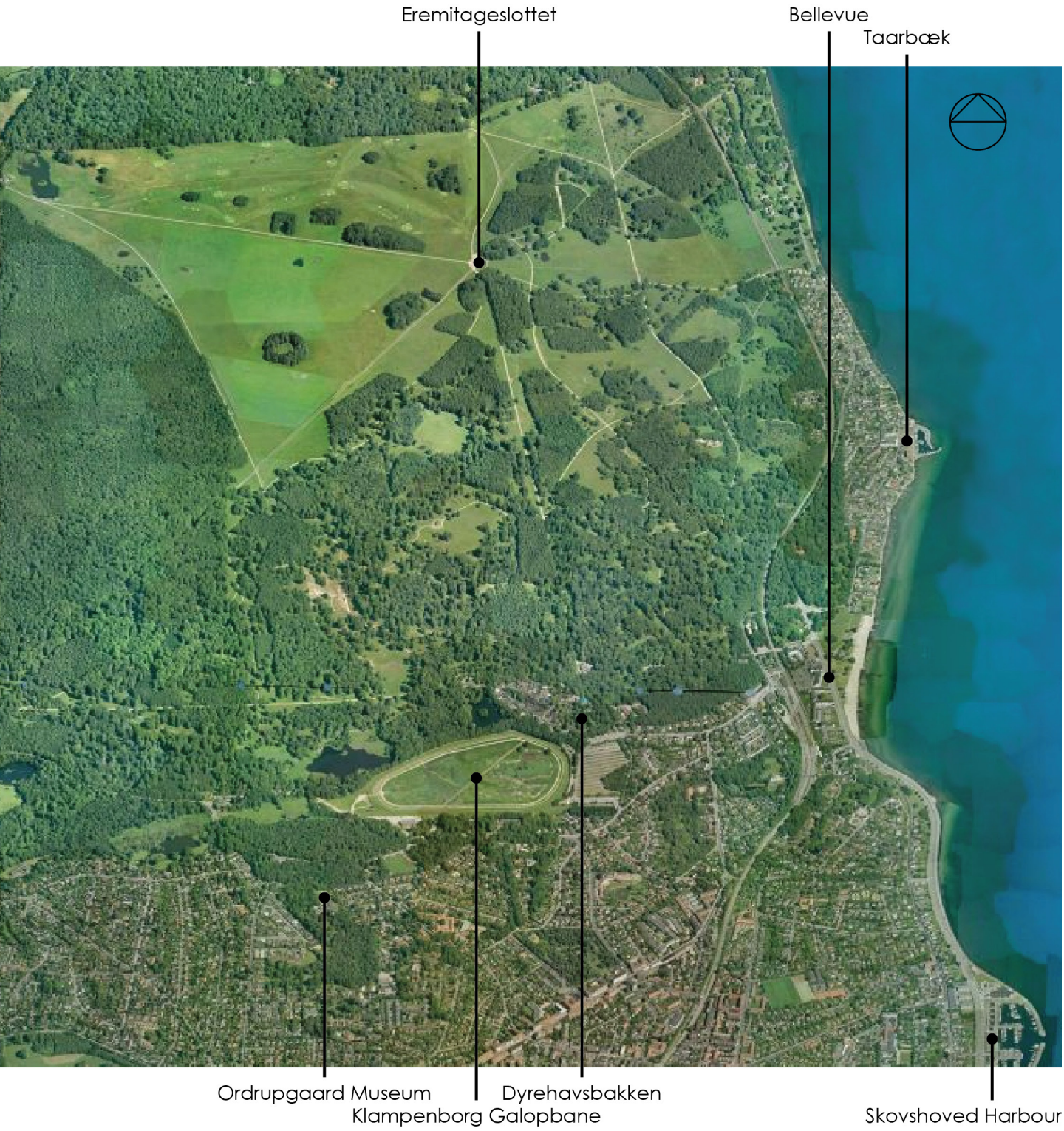

Eremitageslottet
Bellevue
Taarbæk
Ordrupgaard Museum
Klampenborg Galopbane
Dyrehavsbakken
Skovshoved Harbour

PHOTO REGISTRATION

The photos taken from the project site shows how the area and its surroundings look like today. It is hereby documented that a lot of green space and vegetation is found within the area.

During one visit of the site (Wednesday February 22nd), the local weather station (Jægersborg) had registered the wind conditions as "moderate breeze" (see Beaufort Wind Force Scale, page 72), with average wind speeds of 16 kts coming from west (Windfinder, 2017), which is the double wind speed compared to the monthly average (see page 71). At the site, it was in general the southern part of the area next to Klampenborgvej where these strong winds felt worst. It is likely that the sound barrier hills and vegetation along the motorway in west, helped to reduce the winds at the rest of the site.

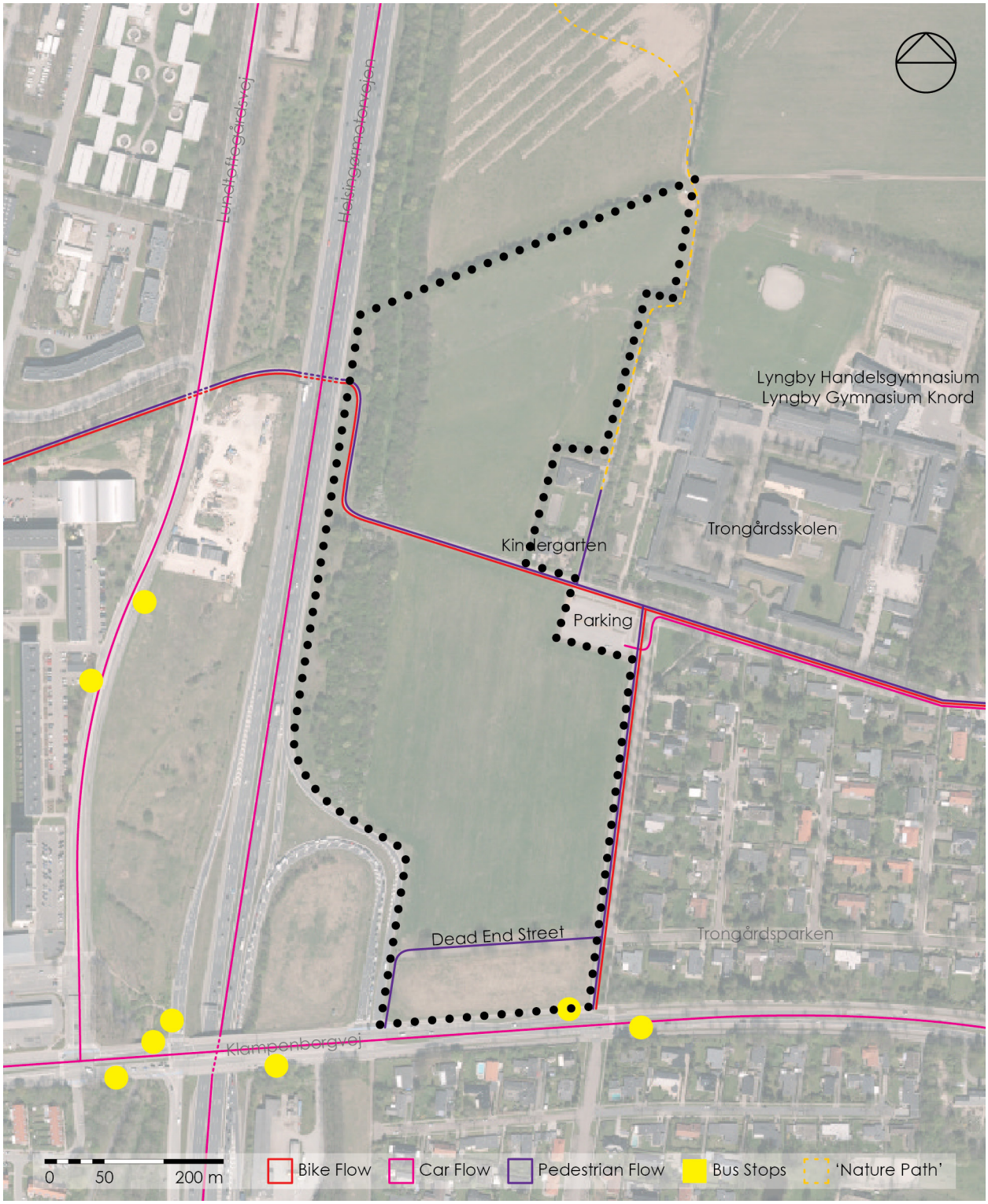
Page 8-9, *ill. 05 - 12*

INFRASTRUCTURE AND FLOW REGISTRATION

As the project site is currently a mark field, there is a limited amount of travels and flows within the site, as people have no proper paths or streets to walk and drive on. The flows are therefore mainly found on the eastern edge of the site facing the residential area, although the bike lane and pedestrian path crossing the site from Trongårdsskolen in east, through the project site, going under the motorway through a tunnel i west and enters the border zone of DTU, facilitate a rather high flow of young people, likely students going to and from school.

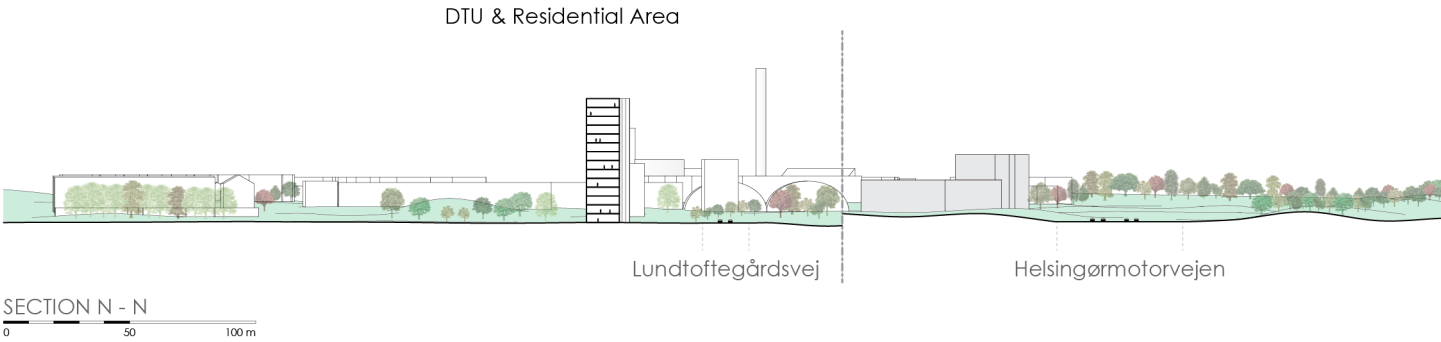
Regarding public transportation, by the southern end of the project site facing Klampenborgvej, from here people are able to take the yellow busses that drive around in the capital region of Copenhagen. Beside this zone, there is currently no other options of immediate access to public transportation.

The pathway that runs along the eastern part of the project site from the kindergarten and continues up north, is in relation to future development plans of the surrounding areas going to be transformed into a nature path, which will run through a future nature park area located in between the project site and the Novozymes science park.



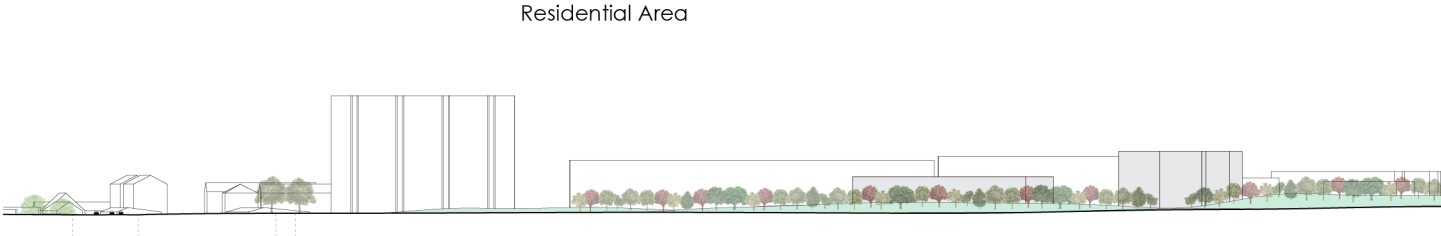
ill. 13 - Infrastructure and flow registration

SECTIONS OF PROJECT SITE



SECTION N - N

0 50 100 m



SECTION W - W

0 50 100 m

Page 12-13, *ill. 14 - 16*

Future Science Park

Educational Institutions & Residential Area

Trongårdsparken

Under Development

DTU & Colleges

Under Development

EREMITAGESLOTTET - BUILDING REGULATION

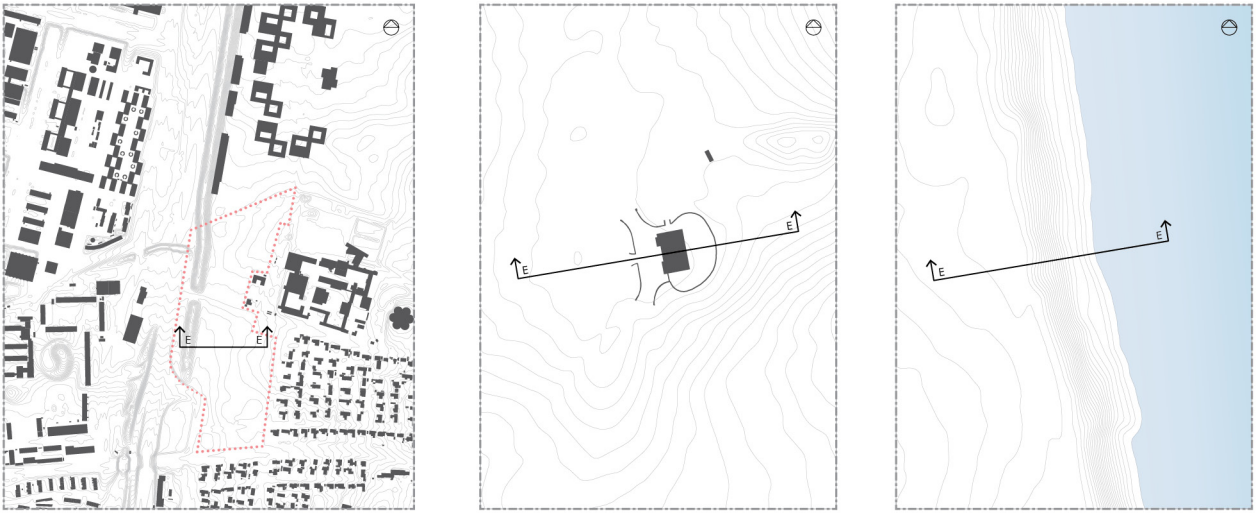
The municipality has currently not developed a local plan of the particular area where the project site is found, but research of the local plans for the surrounding areas revealed a significant concern regarding what is possible to develop within the project site.

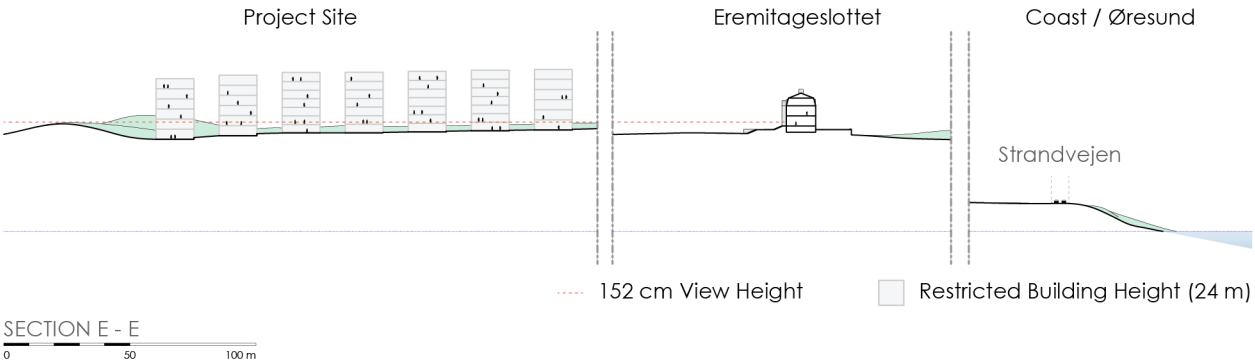
The local authorities, Lyngby-Taarbæk Kommune, and Naturstyrelsen (the government) has made an agreement regarding securing an unspoiled view of Eremitagesletten (western plain of Dyrehaven) and Hjortekær from Eremitageslottet, where it should be impossible to see buildings pointing up above in the background of the treetops of the forest (Lyngby – Taarbæk Kommune, 2016b, p. 17).

More precisely, the regulation says that from a height of 152 cm above the upper step of the stairway to Eremitageslottet, it should not be possible for the viewer to see buildings behind the border of Dyrehaven (Lyngby – Taarbæk Kommune, 2016a, p. 38), which have further lead to dividing the area of Dyrehavegårds Jorder into different zones regarding how tall a building is allowed to be. The project site is located in Zone C, saying that buildings within this zone can be up to 24 meter tall.

Section E-E (ill. 21) illustrates the 152 cm view line height from Eremitageslottet and the potential maximum building height of 24 meters within the project site.

LEFT *ill. 17 - Eremitageslottet*, MIDDLE *ill. 18 - Eremitageslottet Close Up*, RIGHT *ill. 19 - View of Eremitagesletten in front of Eremitageslottet*





SECTION E - E

0 50 100 m

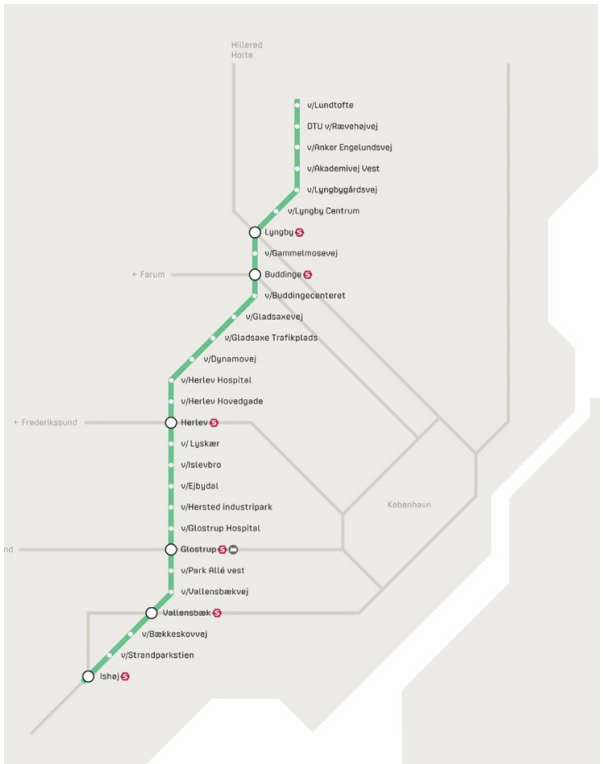
TOP ill. 20 - Section overview, BOTTOM ill. 21 - Eremitageslottet section

FUTURE INFRASTRUCTURE – HOVEDSTADENS LETBANE

In addition to the existing infrastructure in the area of the project site, a new light rail train system is under development, called Hovedstadens Letbane, which will make it easier, faster and more comfortable to travel across the capital region of Copenhagen (Hovedstadens Letbane, 2017b). It is expected that the first journey with the new light rail train system will take place in 2023/2024, and as a bonus, it is considered that the system will generate up to 20.000 new jobs (Hovedstadens Letbane, 2017b).

The light rail system will run from Lyngby in north to Ishøj in south, with a total distance of 28 km and 28 stations, where the two stops Lyngbygårdsvej and Akademivej Vest are within short distance from the project site on the other side of the highway Helsingørmotorvejen. The average speed of the trains is going to be 30 km/h including stops and will run with a frequency of 5 minutes in the day time during the week and 10 minutes during the evening and in the weekends (Hovedstadens Letbane, 2017b).

Comparing the trains of Hovedstadens Letbane with other types of public transportation, one single light rail train has enough space for 200-230 passengers at a time, which is equal to the amount of about four regular city busses. It is expected that the light rail train system will be used by 13-14 million travelers a year, where 4.000 daily travels will be made by commuters who switch from using cars as transportation method in favor of the future light rail train (Hovedstadens Letbane, 2017a).



LEFT *ill. 22 - 28 Light Rail Stations*, RIGHT *ill. 23 - Light Rail Stations Lyngby*

LYNGBY-TAARBÆK CITY OF KNOWLEDGE

Back in January 2012, the private association Lyngby-Taarbæk City of Knowledge was established and which today has more than 70 members united in a unique alliance, as the mebers of the association ranges from private companies to research and educational institutions, public authorities and housing associations, as well as common citizens. An exclusive mix of members within an association that has a goal of ensuring the continued growth and development of the city, but with an overall vision of developing the area of Lyngby-Taarbæk into one of the leading university cities in Europe, which includes the very best conditions for business, entrepreneurship, research and study (Vidensby, 2017a).

Through this ambitious partnership within the association's members, Lyngby-Taarbæk City of Knowledge have established the foundation for the development of an innovation district with the Technical University of Denmark (DTU) as a driver, creating a center for businesses and growth in a nearby university environment, which has never been seen before in Denmark (Vidensby, 2017a).

"Innovation districts are geographical areas where leading knowledge institutions and businesses are located alongside start-ups, incubators and accelerators. These areas also have good infrastructure and offer facilities for housing, offices and retail. The innovation districts illustrate a change in the location preferences of people and businesses, and a rethinking of the relationship between economic development, urban development and cross-industry networks." (Vidensby, 2017b)

In relation to Lyngby-Taarbæk City of Knowledge's wish and plans of a thriving knowledge-intensive innovation district, it is hard not the think of and draw parallels to the notion from the late American economist Julian Simon, saying: "The closer people live to each other, the more ideas they will develop and ideas creates new technologies and hereby new resources" (authors translation, Tvede, 2014).

With a keen focus on city life, entrepreneurship, globalization, traffic and new intelligent sustainable solutions, the DTU campus area and the city center of Lyngby is expanding and undergoing a great transformation, as new businesses, real estate developers and educational institutions are developing new projects here.

"Thanks to the City of Knowledge, Lyngby has become one of the country's most attractive cities in which to invest." (Mering, Vidensby, 2017a)

One of the initiatives by the Lyngby-Taarbæk City of Knowledge association is notable within the area of the project site, the construction of the future Novozymes science park and the related learning center.

STUDY CASES

Innovation Design District, Milan – Italy
In the area between the city districts of Milan, Porta Nuoava and Porta Volta, which has undergone one of the largest urban and architectural redevelopment in Europe (Mondadori, 2017), the new district Innovation Design District is situated here. With this central location in the heart of Milan, ideas are here turned into projects and the area has become a dynamic, vibrant and very popular place in the city. Not only to locals and tourists, but the environment here has also evoked interest by a number of renowned international companies within the finance and hi-tech sector, who have decided to locate their headquarters here (Mondadori, 2017).

"IDD means creating a network and to facilitate dialogue between some of the biggest brands in technology, finance, food and design in an initiative which sees Milan at the centre of the international stage."
(Mondo, Mondadori, 2017)

The Garibaldi, Isola and Varesine areas has been completely redesigned due to the large redevelopment of the Porta Nuova project, where citizens and visitors is now welcomed by a great mix of designer architecture and skyscrapers, a business center that includes various restaurants, urban green spaces and public areas reserved for pedestrians. The functions within the district is mixed as art galleries, artisan's workshops, cafes and concept stores is located alongside digital classes, next-generation consoles and start-ups, and is hereby creating a diverse atmosphere and mix of personalities. Although, based on content of architecture, art & culture, foods & wine and technology, visitors are invited to follow themed paths around the area of the Innovation Design District in relation to these subjects of content (Mondadori, 2017).

ill. 24 - Innovation Design District Milan

The Interlace, Singapore (OMA/Ole Scheeren)
Take a typical vertical tower, divide it into smaller pieces and then stack the pieces around diagonally. Voila, a skyscraper is turned into a puzzle consisting of 31 six-story building block, but where the residents are much closer to the ground floor. The Interlace was realized back in 2013 by OMA, with Ole Scheeren as architect in charge of the project (ArchDaily, 2015). The building blocks are arranged around large hexagonal communal courtyards, but the amount of green outdoor space is further increased by having smaller gardens on the roof tops of the lower building blocks, which can be used by the residents from the blocks that are stacked on top of them (Hobson, 2013).

Esfera City Center, Monterry – Mexico (Zaha Hadid Architects)
Despite a brief which originally called for 12 homogeneous towers that was to be developed in Monterry, Mexico, with an eight-lane motorway on one side of the project site and a low-density suburban residential neighborhood on the other, London based architecture studio Zaha Hadid Architects came up with an alternative solution. The company designed a series of nine story high wave-shaped apartment blocks, curving back and fourth around the site, surrounding a 30.000 m² public park that accompanies the building design. Planned to be constructed in three phases, where the first one is expected to be completed in 2018, the building complex named Esfera City Center will accommodate 981 apartments, ranging from 45 m² - 165 m² in size (Frearson, 2015).

TOP *ill. 25 - The Interlace*, BOTTOM *ill. 26 - Esfera City Center*

ARCHITECTURE AND WIND CONDITIONS

When it comes to the development of new buildings and urban spaces, particular in countries and areas that struggle with strong winds, such as the western wind in Denmark, it is of great importance to design according to these wind condition in order to get the best possible environmental conditions of the outdoor spaces.

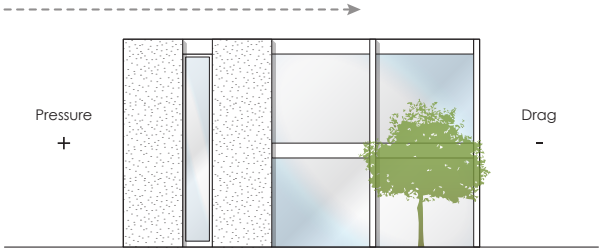
In his book Vindmiljø i Arkitekturen (Architecture and Wind Conditions, authors translation) (Bjerg, 2012), Søren N. Bjerg presents the reader for basic knowledge about wind and the forces regarding it, but also how the wind conditions look like according to various landscapes and topographies, as well as how the shape of buildings and their placement in relation to each other affect the flows of the wind. By the end of each chapter, Bjerg states some concluding remarks related to the topics he have described, almost as an ultra concentrated summary.

Regarding wind conditions at the particular project site, wind roses from nearby weather stations (Jægersborg, ill. 89 and Flyvestation Værløse, ill. 90) are presented on page 71 together with reference wind roses from London and New York. From these local wind roses, it is seen that majority of the wind within the area of the project site is coming from a western direction.

Based on Bjerg's book, a number of the concerns regarding wind conditions effect on its surrounding, will in the following section be presented through short descriptions accompanied by diagrams to illustrate these physical effects of the wind.

MECHANICAL IMPACT

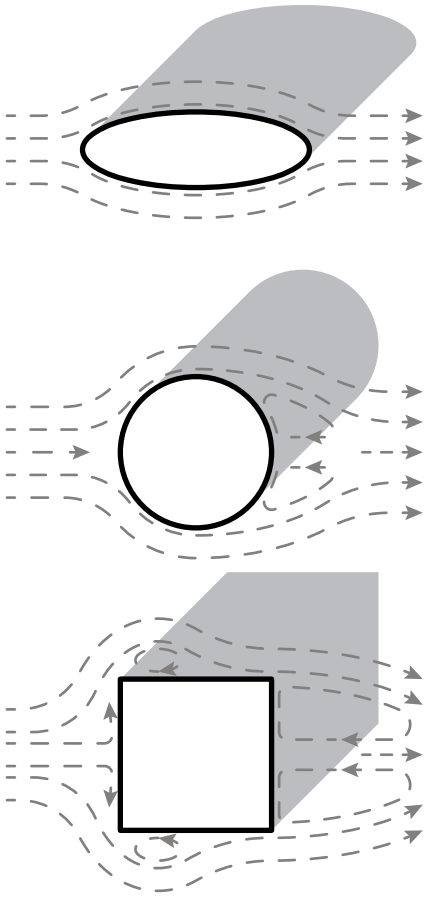
When wind streams meet an abject, the forces from the wind is transformed into pressure and drag forces, which affects the dimensioning of e.g. buildings in order for them to maintain stability and resist these forces. The mechanical impact's forces are exponential, making an increase of the wind speed the double, the mechanical impact becomes almost four times stronger. These conditions are of course also affecting the human body, where the mechanical impact starts becoming unpleasant at wind speeds of 4-5 m/s. Furthermore is turbulence with irregular wind streams making the mechanical impact feel more unpleasant compared to wind streams with a smooth flow.



PRESSURE RATIO AND SHELTER

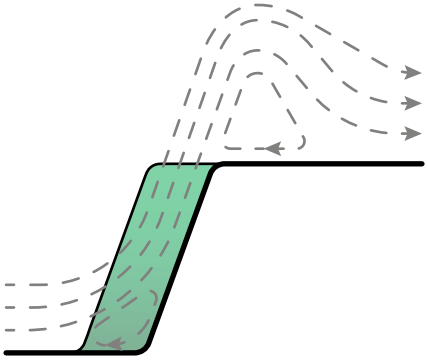
Deceleration of wind appears when the wind meets a physical object, where overpressure is generated at the windward and negative pressure at the leeward. An acceleration of the wind speeds occurs around these two pressure zones and inside of the zones, vortices of various velocities running in different directions are developed. These vortices of turbulence become more severe when the wind speed increases and hereby also the pressure difference between the windward and leeward.

Where the wind is decelerated, zones of reduced wind speeds happen to appear, with over pressure in the windward's shelter zone and negative pressure in the shelter zone of the leeward, which is also larger than the windward shelter zone. Within the zones, winds of various velocities will circulate.

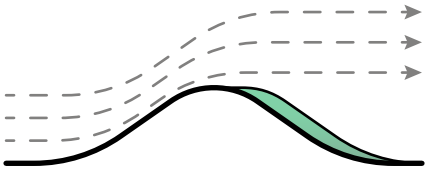


ill. 27-30

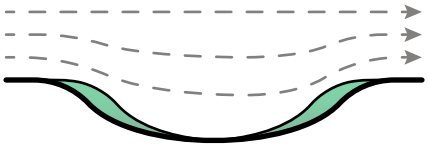
GEOMETRY
Turbulence and shelter zones are determined by the geometry of the object which the wind meets. Edges create a more turbulent environment compared to circular shapes or shapes with rounded corners, but it is only the shape of a drop that can generate a flow of wind streams without turbulence.



WIND CONDITIONS IN THE LANDSCAPE
The shape of the landscape affect the movements of the wind, where a planar landscape has little impact on the wind speed and direction, opposite to a landscape consisting of hills, where wind velocities and directions can change substantially due to the wind streams meeting with the terrain.

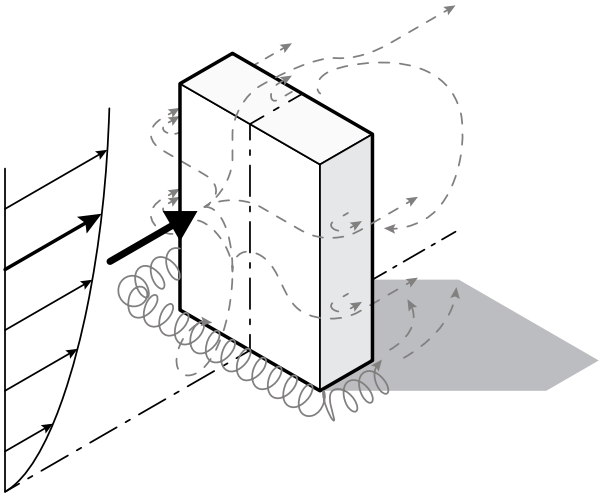


Comparing hills with valleys, the air masses are forced together when winds are flowing above hilltops, accelerating the wind velocity, whereas a valley will expand the air masses and decrease the wind speed.



When winds are met by a cliff or hill with a steep inclination, the wind profile is affected to run high above ground level on the top of the terrain.

WIND CONDITIONS AND HIGH RISES
Due to the high pressure from wind on the upper part of a high rise, which transforms the wind forces into vortexes that run down along the building façade, creating unpleasant spiral and corner turbulence by the foot of the high rise, have made this building typology rather unpopular regarding wind conditions. The issue becomes even greater when the building height increases or winds get stronger.



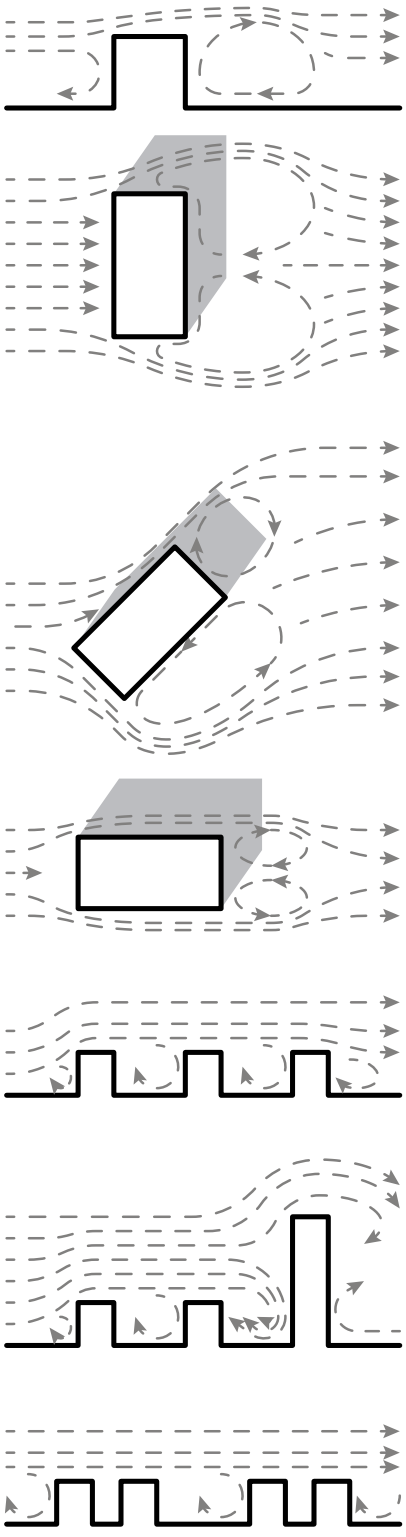
ill. 31-34

WIND DIRECTIONS NEAR BUILDINGS
Changes in the wind direction have a significant effect on where turbulence and shelter zones around a building is found, which can both increase the turbulence and shelter zones.

LOW AND CLOSE
By having a building structure consisting of low buildings located close to each other, the wind is pushed above these buildings, which gives less turbulence within the open spaces of the buildings. Using vegetation with sheltering effect could further enhance the reduction of turbulence in between this building structure.

BLOCK COMPLEXES
The large surfaces and exposed character of the block complexes generates a rather turbulent wind environment in the surrounding open spaces, especially near the corners of the building blocks and the area between them, where the wind speed can be accelerated. In this case, sheltering vegetation is recommendable to decrease the turbulence and wind velocity, in order to get a more acceptable outdoor environment near the block complexes.

COURTYARD BUILDINGS
In general the building structure prevents winds from generating turbulence within the space of the courtyard, as the courtyard is sheltered from all directions by the building structure. Although, strong winds and concerns regarding heights of the courtyard building structure, turbulence is not completely prevented and can occur within the courtyard area.

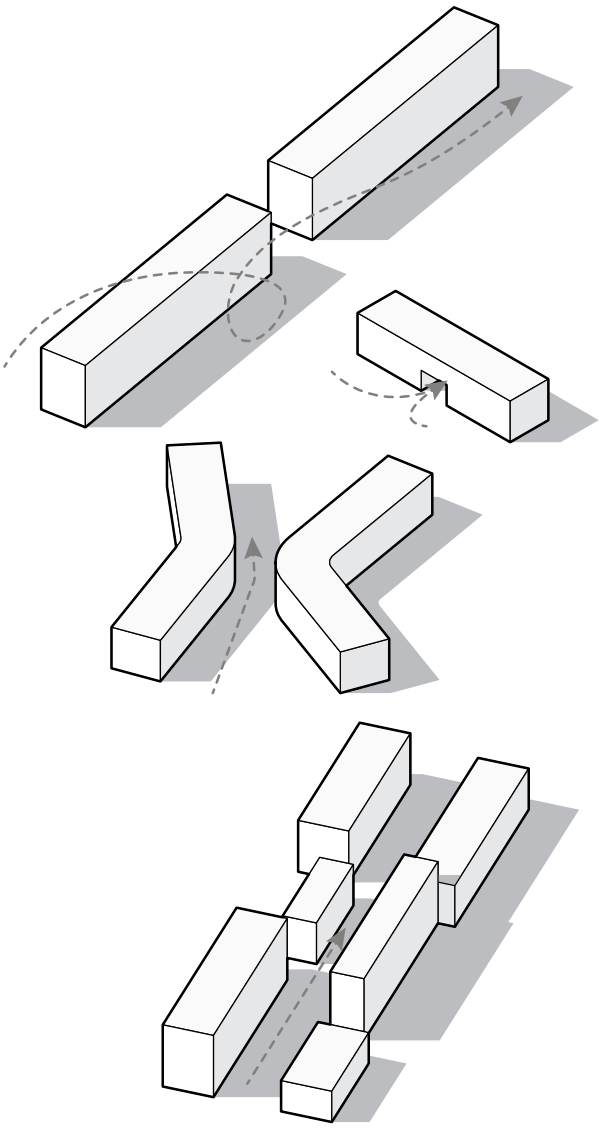


ill. 35-41

BARRIER EFFECT
Buildings where the length is much greater compared to the height, a barrier effect can occur as wind streams are forced over the buildings, creating powerful turbulence on the buildings' leeward.

FUNNEL AND GATE EFFECT
The compression of the wind as it flows through a small passage or opening, increases the wind's velocity as the space becomes smaller and smaller. When the spaces enlarges again, the wind speed will start to decelerate.

CORRIDOR EFFECT
Long, straight and narrow streets without obstacles to pass for the wind, gives excellent conditions for the establishment of corridor effect if the wind direction is parallel with these streets.



ill. 42-45

THE SOCIAL LIFE OF SMALL URBAN SPACES

In his documentary film "The Social Life of Small Urban Spaces", the American urbanist William H. Whyte investigates peoples' behaviour throughout the day and at various settings in a couple of North American cities, mainly New York. Some of his findings and conclusion are more obvious than others, but throughout the movie it is revealed that we all are very alike when we act in the public space and that several of our behaviours are made subconsciously, which from the viewers perspective looks a bit odd and irrational, but also quite humoristic. At several scenarios, William H. Whyte manages to predict people's actions during the film, e.g. a great example of these unconscious behaviours takes place when a couple of men are having a conversation with each other next to a small stair. At one point during their chat, one of the men places his foot on a step, and William H. Whyte now predicts that the other man will do the same and copy his friend. Seconds after, the second guy also places one of his feet to rest on the step. It is almost the same situation with public chairs, people act in the same way, all though their actions make more or less sense. Even if a public chair is positioned perfectly by its former user, e.g. it could be faced directly towards the sun or perhaps in the shadow under a tree, it is registered how the new users of a public chair moves it, just a little bit, could be a matter of centimetres or even millimetres, but moves it, as a way of claiming the territory and the (temporary) ownership of the chair.

The main conclusion regarding peoples' behaviour in the urban spaces is that people like watching other people. This is main activity by the citizens and is done at various scenarios.

Beside documenting and predicting peoples' behaviour in North American urban spaces, William H. Whyte also comes with suggestions, based on his findings, of seven elements useful for creating or having an attractive urban space, where people will come and live their life. These seven elements are 'seating spaces', 'street', 'sun', 'water', 'trees', 'food' and 'triangulations', which are all described in the following section.

SEATING SPACES

One of the key elements of having a successful urban space is the possibility of seating. Not only specifically designed elements for seating such as chairs and benches, but even the edge of a water fountain or the steps of a stair work tremendously as seating spaces as long as the dimension is correct. William H. Whyte mentions one linear foot per 30 square feet as a good dimension and if a seating space is doubled in depth, more people are likely to use it at the same time as both sides of the seating can hereby be used.

STREET

The connection between a place and the street is of importance in order to facilitate urban activity. If a place is well connected with the streets, it is more likely that people will access the place and use it.

In relation to the use of places, it is mentioned in the film that the capacity of how many people or the amount of activity an urban space can handle is self levelling. Even if a space can handle more people, they are not necessary using the space, as the people naturally feel that the space has reached its maximum capacity in order for it to be enjoyable used.

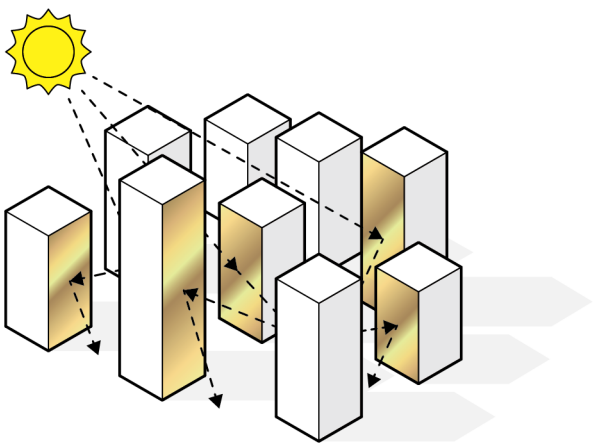
SUN
As shown in the very beginning of the film, the sun is affecting our behaviour. A time-lapse camera overlooking the plaza in front of the Seagram Building in New York, designed by the great German architect Mies van der Rohe in 1954-1958 (Leoni, 2008), captures how people sits where the sun is shinning. This behaviour was expected by William H. Whyte and his team, but it turns out to be a misleading observation. Even places with indirect sunlight, where the sunlight is reflected by the surrounding building facades, has a pleasant effect and in some occasions is better and more preferable than places with direct sunlight.

WATER
Cooling the feet on a hot summer day or entertainment for children, water has an almost magnetic effect on people, no matter age or gender. Beside the physical qualities of water, the sound of it also has a positive impact on humans. Even if the sound from a water fountain or artificial waterfall can be quite loud, the present of it is not necessarily negative as this type of sound is categorized as white noise, which can help providing reduction of unpleasant noise from traffic jam etc.

TREES
The presence of trees within a city is much appreciated as the trees has numerous of great qualities which the urban life can benefit from. First of all, trees are positive in regards of the microclimate and the respiration. They provide shade and cooling, much appreciated when the air temperatures rises. Furthermore, there is also the aesthetic value of trees, as people find them beautiful and where they can help making a space look and become more appealing.

FOOD
It is essential to eat in order to survive and businesses providing food serves a function that people not only want, but also need. In the film, it is also seen how a small street kitchen can function as a gossip central, as people will come here to meet and eat while they tell each other stories.

TRIANGULATIONS
This is a more widespread element, which can take shape of many things and is usually an external stimulus that brings people together. One example could be street musicians or actors who starts performing on a street corner, where as another example could be art installations. A sculpture which people reacts to and starts talking about, allowing people not only to watch the art piece, but also to touch it, feel it, and even use it. Perhaps a certain sculpture functions as a great seating space?



ill. 46 - Sunlight reflecting facades

GLOBAL AND LOCAL URBANIZATION

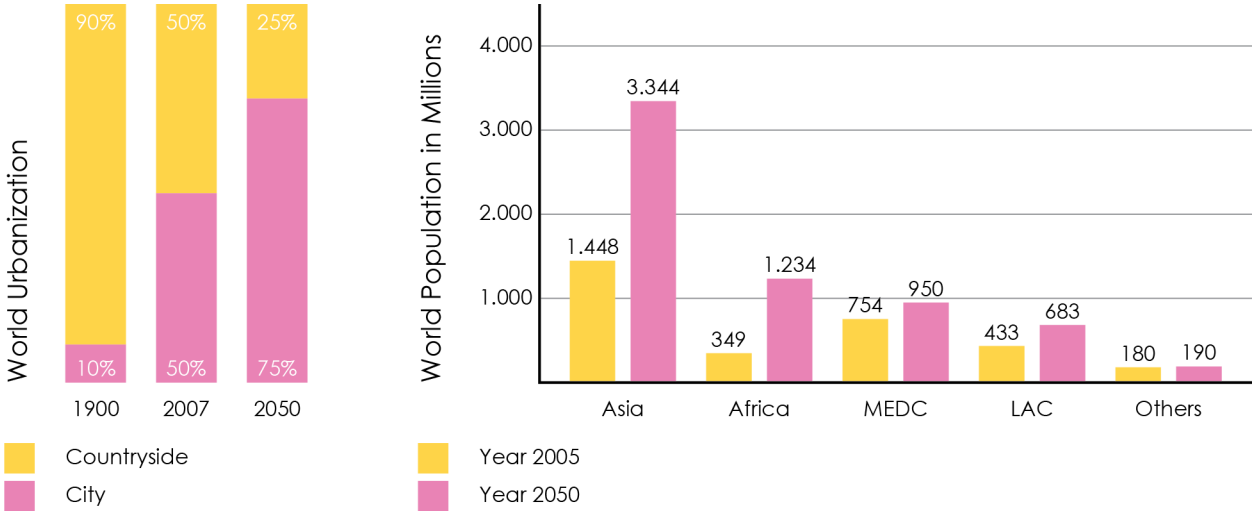
2007 was a milestone in regards of urbanization. This was the year when 50% of the global population had moved from the countryside and now lived in a city (Gehl, 2010). A dramatic evolution that hat happened in about a century's time (Urbanized, 2011) and which is assumed to continue in the future, where it is estimated that 75% of the world population will live in cities in 2050 (Gehl, 2010).

Not only is the world becoming more urbanized, the human population is also increasing drastically in the next decades to come according to the statistics (see ill. 47 below). Especially the regions of Asia and Africa will become more populated in the future years, where as the more developed countries will face a less dramatic increase of the number of inhabitants.

Looking at urbanization from a more local perspective and the statistics from the municipality of Lyngby-Taarbæk Kommune, it is the same trend found here. The population within the area of the municipality has grown over the years. Back in January 2014, Lyngby-Taarbæk Kommune had 54.237 inhabitants, where as the new numbers shows that by January 2017, this number has increased to 55.240 inhabitants (Lyngby – Taarbæk Kommune, 2017c).

In regards of the future prospects for the population in Lyngby-Taarbæk Kommune, the municipality's prognoses from 2016, shows that 56.831 people are expected to live in the area in 2020. In 2025, this number has further increased to reach 58.058 inhabitants and according to the prognosis, there will live 59.386 people in Lyngby-Taarbæk Kommune in 2030 (Lyngby – Taarbæk Kommune, 2017c).

These statistics from the municipality of Lyngby-Taarbæk hereby corresponds to the forecast of an increased global population in the future, where more and more people will residence in an urban setting, although the numbers and prognoses from Lyngby-Taarbæk Kommune are on a much smaller scale compared to the numbers regarding world urbanization.



ill. 47 - World Urbanization (Data: Gehl, 2010)

PROBLEM STATEMENT & DESIGN PARAMETERS

PROBLEM STATEMENT

The project site shall be developed into a new urban area that embraces the green values of today's site and will inspire future users and residents of the area to meet and interact with each other in the new urban environment, creating a vibrant atmosphere throughout the day.

DESIGN PARAMETERS

IMPLEMENTATION OF GREENERY

BUILDING HEIGHTS

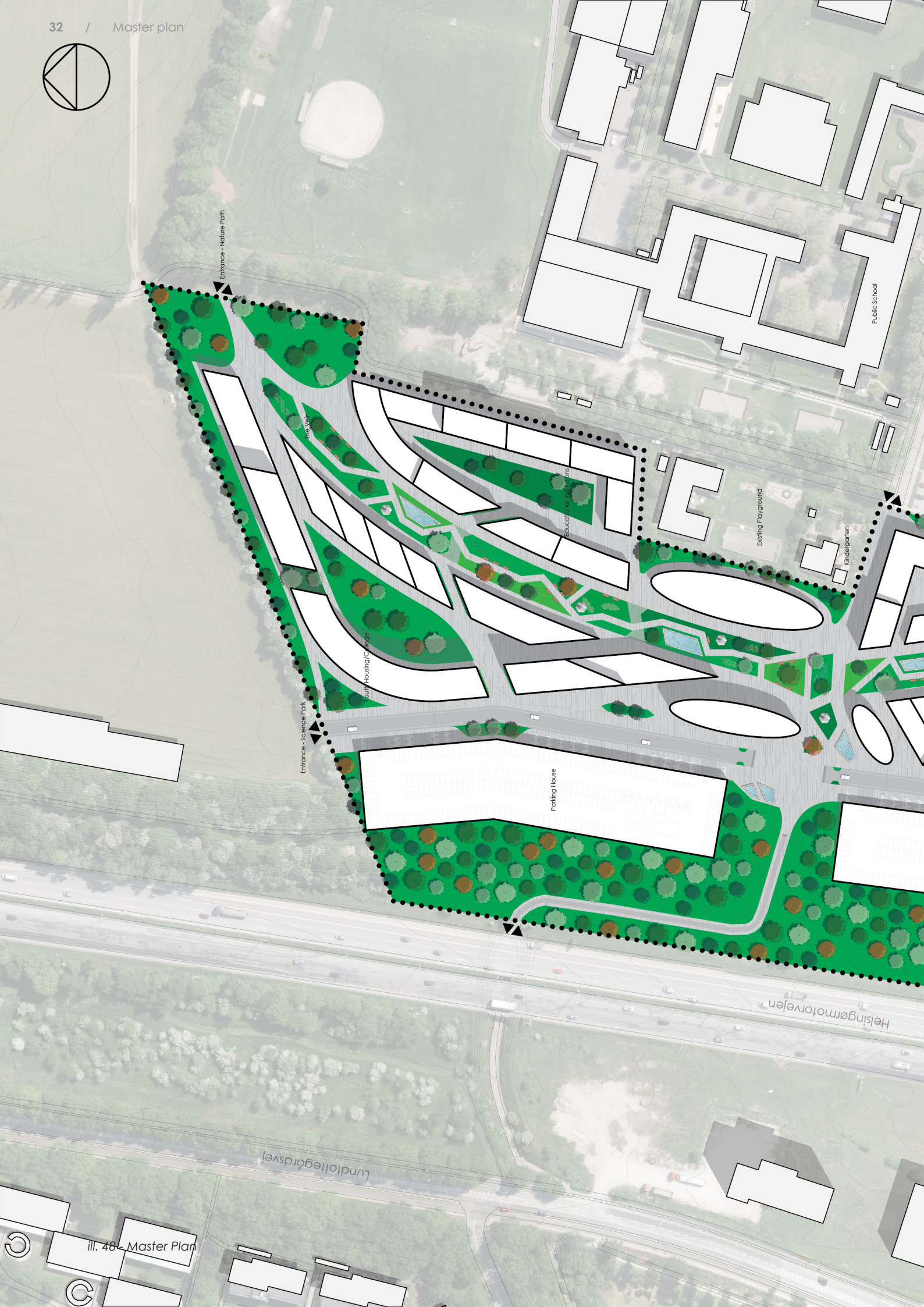
WIND CONDITIONS

PRIORITICED STREETS

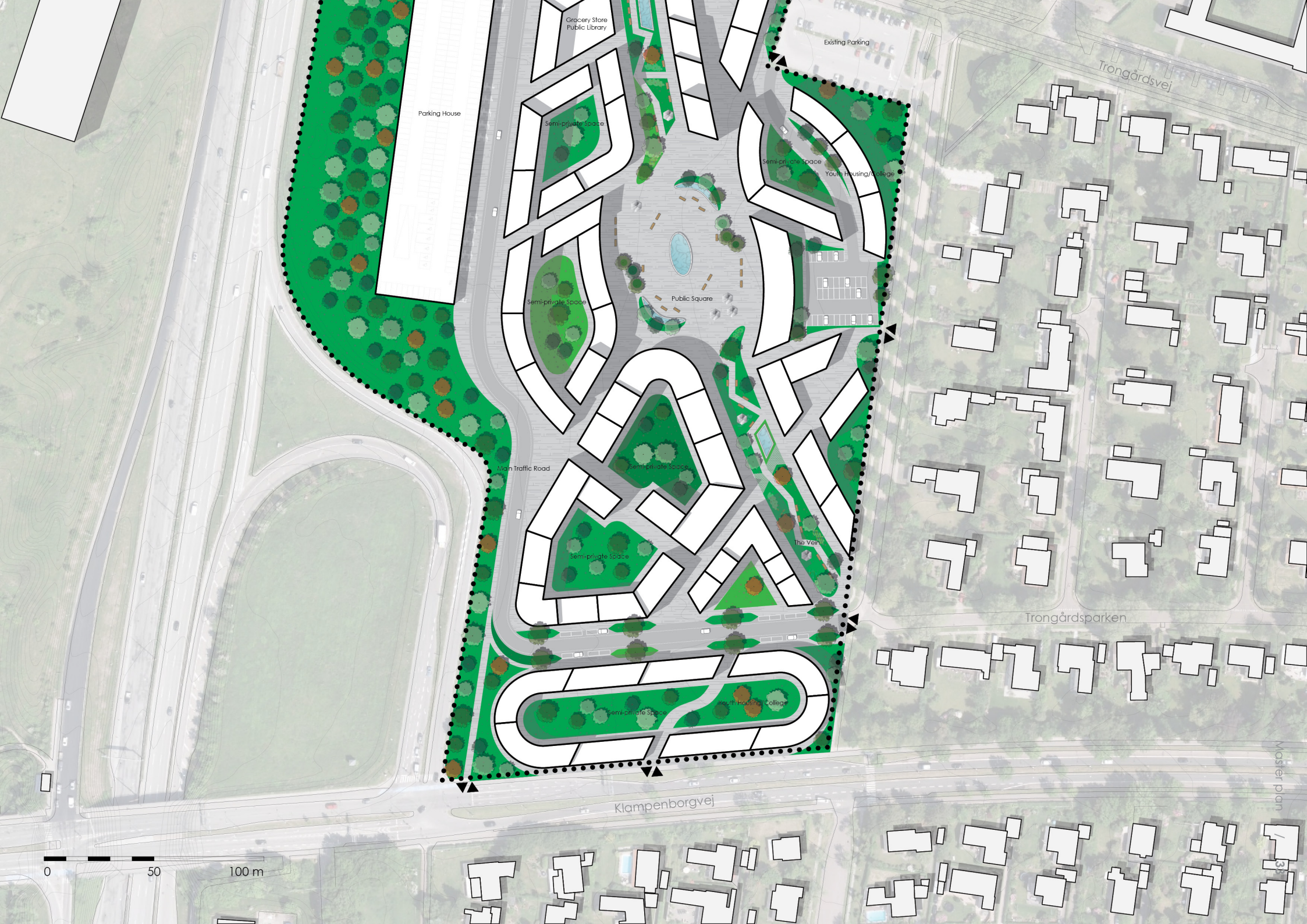
CONCEPT - GREEN VEIN

Opposite the slightly popular term ‘wedge’ that is used when a certain function or program is developed to run through a site, a great example is Superkilen, directly translated The Super Wedge, by Bjarke Ingels Group, where a long strip runs through a neighborhood in Copenhagen, Denmark, offering various activities for pedestrians and cyclist, without interfering of car traffic, the actually function of a wedge is to divide and split, not unite.

Instead of using wedge as a term regarding the action of having a main path with vegetation that runs through the site, a nicer and more inviting reference would be a red carpet that turns green. This carpet would furthermore develop branches that spreads and runs out from it, resulting in an enhanced amount of vegetation throughout the project site, turning the red carpet into a green vein that pumps life and vegetation out to the entire area.



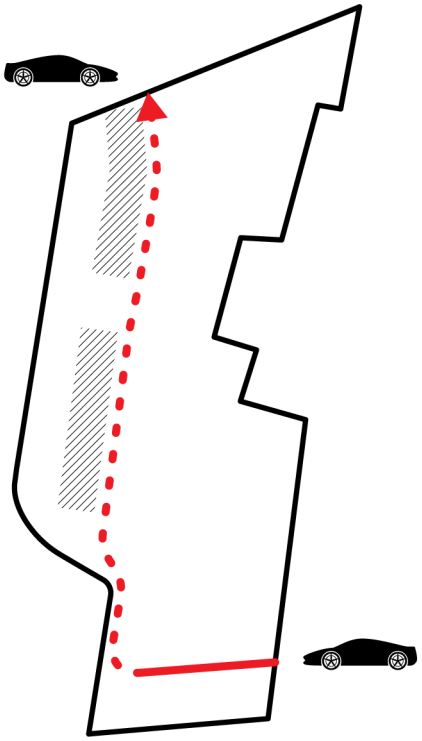
ill. 48 - Master Plan


Grocery Store
Public Library
Existing Parking
Trongårdsvej
Parking House
Semi-private Space
Semi-private Space
Youth Housing/College
Public Square
Semi-private Space
Main Traffic Road
Semi-private Space
The Vein
Semi-private Space
Trongårdsparken
Semi-private Space
Youth Housing/College
Klampenborgvej
0
50
100 m
Master plan

DESIGN ACTIONS

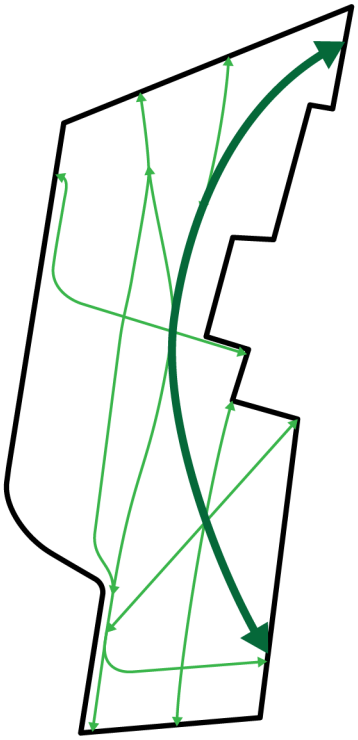
HEAVY TRAFFIC AT THE BORDERS

Based on the Venice model where the means of transportation is parked by the borders of the city (Gehl, 2010), the same principal have been used for this project, in order to have an active urban space suitable for pedestrians and soft traffic with a speed of 5 km/h, undisturbed by heavy traffic such as cars, trucks etc. By extending the dead end road (Trongårdsparken) at the southern part of the project site and let it continue along the sound barrier hills at the western part of the area and all the way up to the future Novozymes science park, which will give these two areas en easy accessible connection, heavy traffic is hereby able to access the area of the project site from two directions, but without interfering with the city life in the central urban spaces of the site. Along this route, parking houses are established and partly integrated in the sound barrier hills.



FACILITATING NATURAL FLOWS AND ESTABLISHMENT OF THE GREEN VEIN

With the knowledge of the future development plans for Dyrehavegårds Jorder and the existing infrastructure conditions, natural flows within the project site was created. These flow lines were further ordered in a hierarchy of which of them would facilitate the greatest amount of traffic and activity, which led to the placement of the Green Vein. A boulevard of life and greenery, running through the entire site from the southeastern part of it, to the northeastern corner and hereby attached to the future nature path that will continue north of the area of Dyrehavegårds Jorder. Due to the central placement of the Green Vein, the secondary streets would hereby easily distribute flows to and from it.



TOP *ill. 49 - Heavy traffic*, BOTTOM *ill. 50 - Flows*

THE GREAT PLAZA

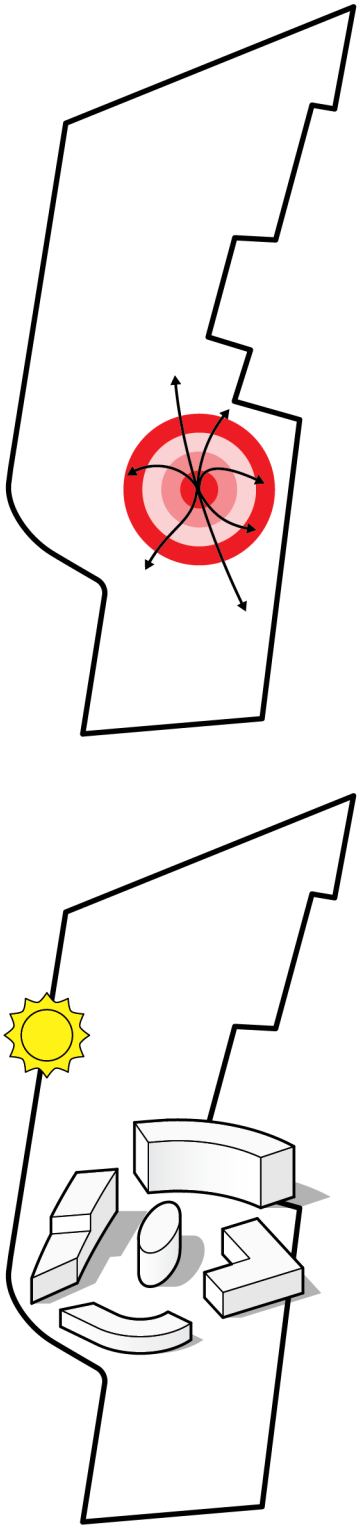
Like a nuclear reaction when particles collide, the great plaza in the central part of the southern area of the project site, is founded on the same principles. Instead of atoms creating an exploding reaction, it is the crossing point of main flows that creates this great plaza, becoming the activity center of the small universe of the project area.

SHAPING THE PHYSICAL ELEMENTS

As suggested by Jan Gehl (Gehl, 2010), the flows and pathways where people are intended to travel, makes the foundation of the further development of the area. With these flows settled, building shapes and functions within the project site could hereby be determined.

With the notions regarding architecture and wind conditions (Bjerg, 2012), building shapes creating shelter and reduction of turbulence was developed, often concave and with rounded corners. Besides these shapes' affordances regarding wind conditions of an outdoor space, some of these more curvy and organic shapes draws also references to some of the architecture found in the nearby regional area, such as the local town hall of Lyngby-Taarbæk Kommune and the Bellavista building complex in Klampenborg designed by Arne Jacobsen.

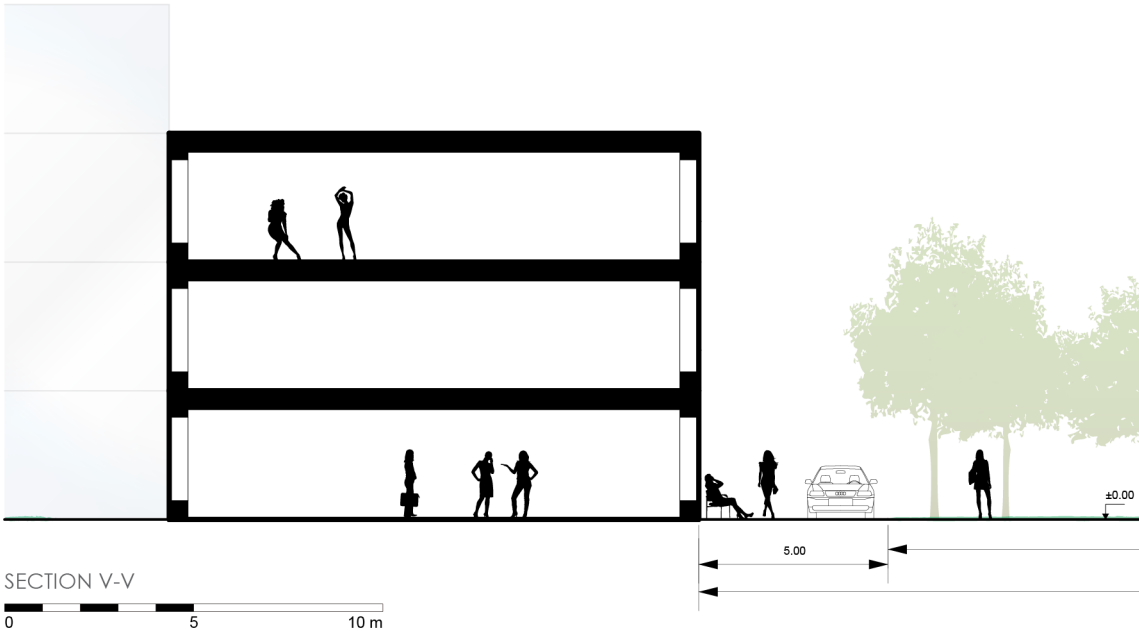
Sun conditions and human scale in relation to the building restriction caused by Eremitageslottet, further influenced the building heights within the project site, with heights terracing upwards from the southeastern corner next to the residential area at Trongårdsparken.



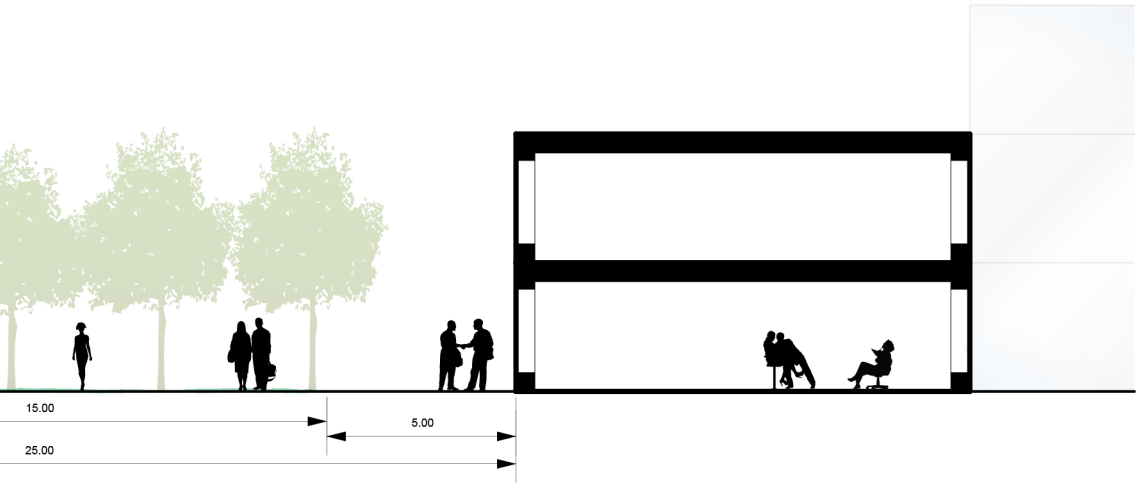
TOP *ill. 51 - Plaza*, BOTTOM *ill. 52 - Building shapes*

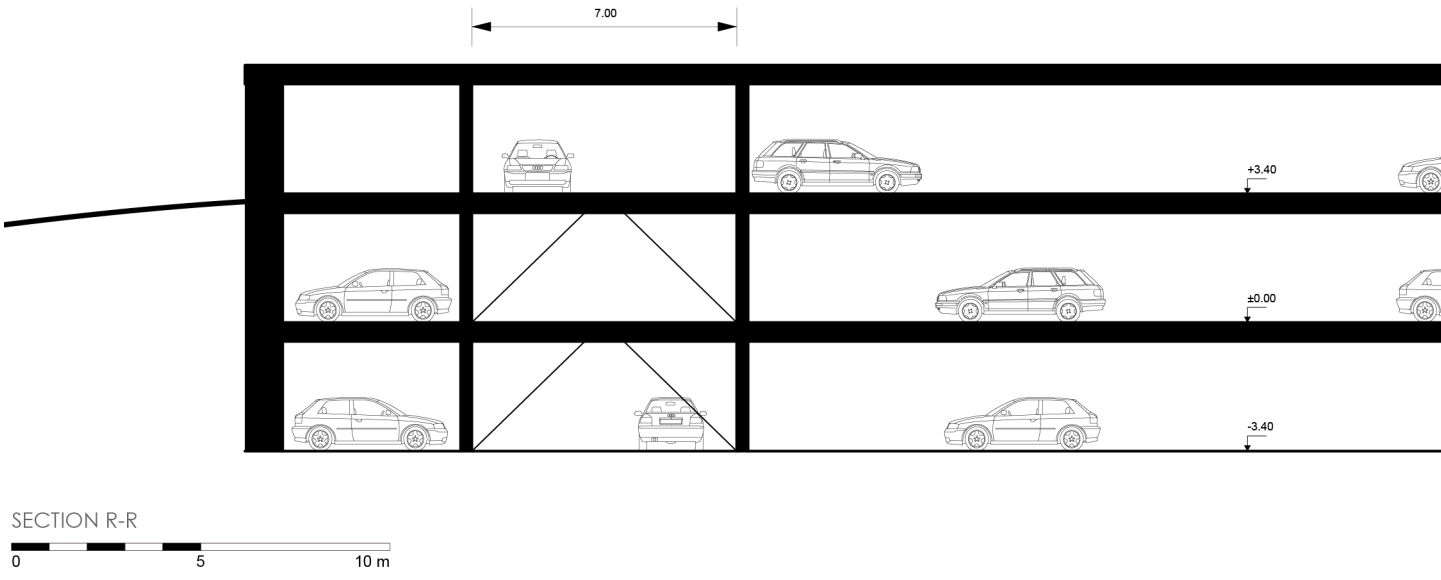
ill. 53 - Green Vein

ROAD SECTIONS

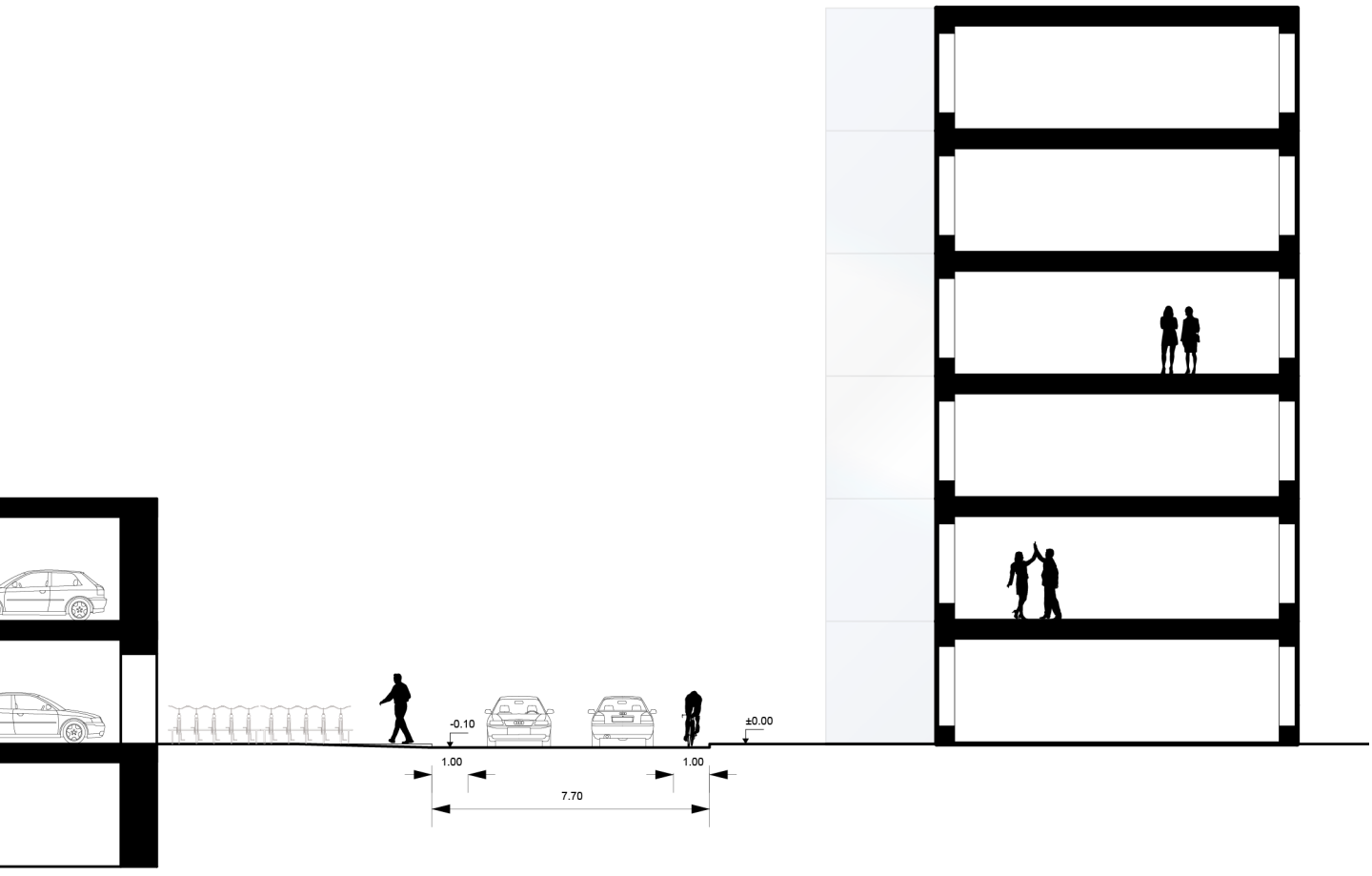


TOP *ill. 54 - Section lines*, BOTTOM *ill. 55 - Vein section*


15.00
5.00
25.00



ill. 56 - Traffic road section

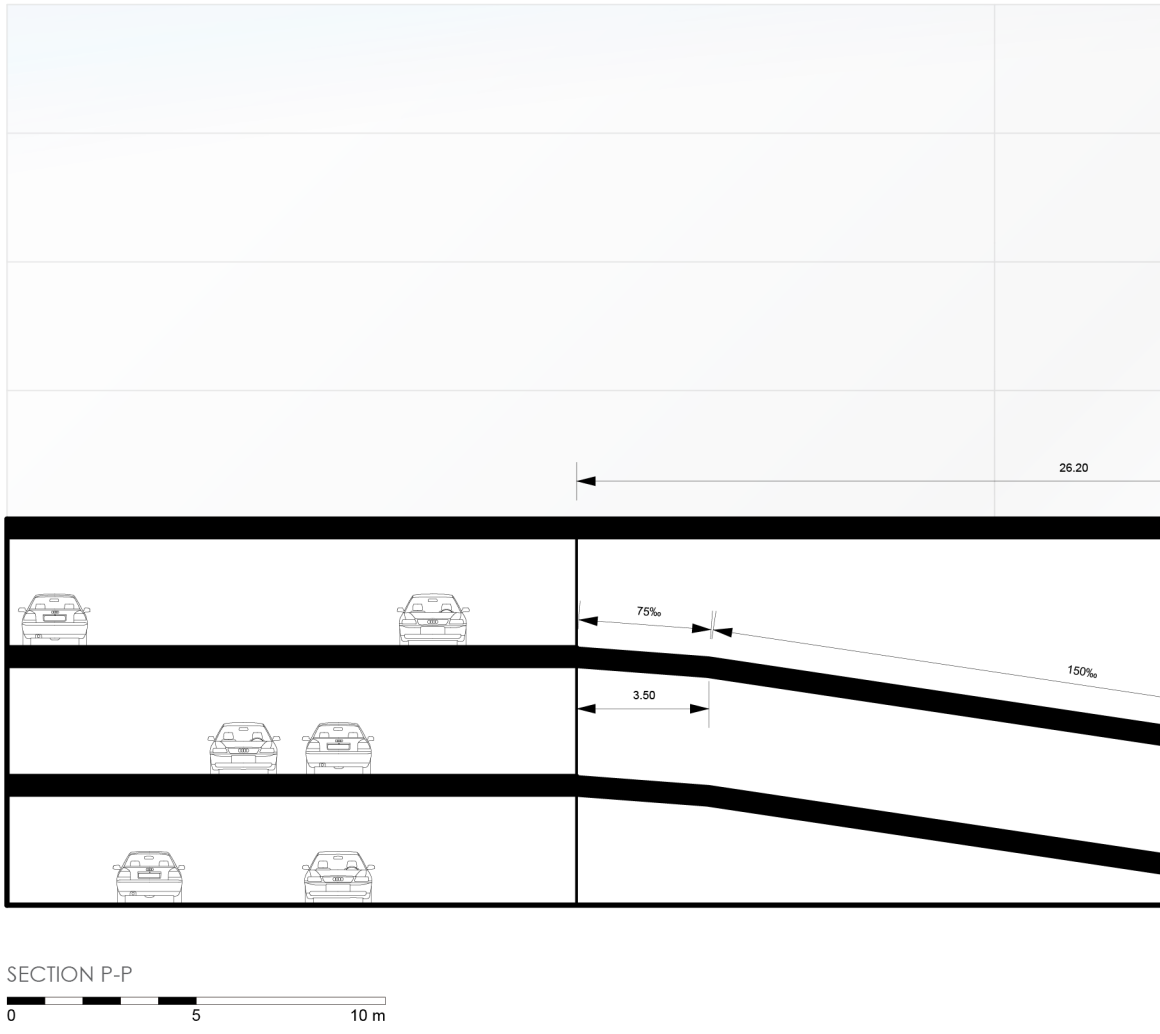

-0.10
±0.00
1.00
1.00
7.70

PARKING HOUSE SECTION

By extending the principal solution from the Novozymes Science Park development (Lyngby – Taarbæk Kommune, 2016a, p. 7) and down in to the project site, car parking is supposed to be facilitated by parking houses that are build in to the existing noise barrier hill that runs along the western part of Dyrehavegårds Jorder. Two parking houses in three levels; basement, ground level and first floor, consisting of four rows of 90° parking lots with two parking streets that both has a maneuver area of 7 meter (Byggecentrum, 2016).

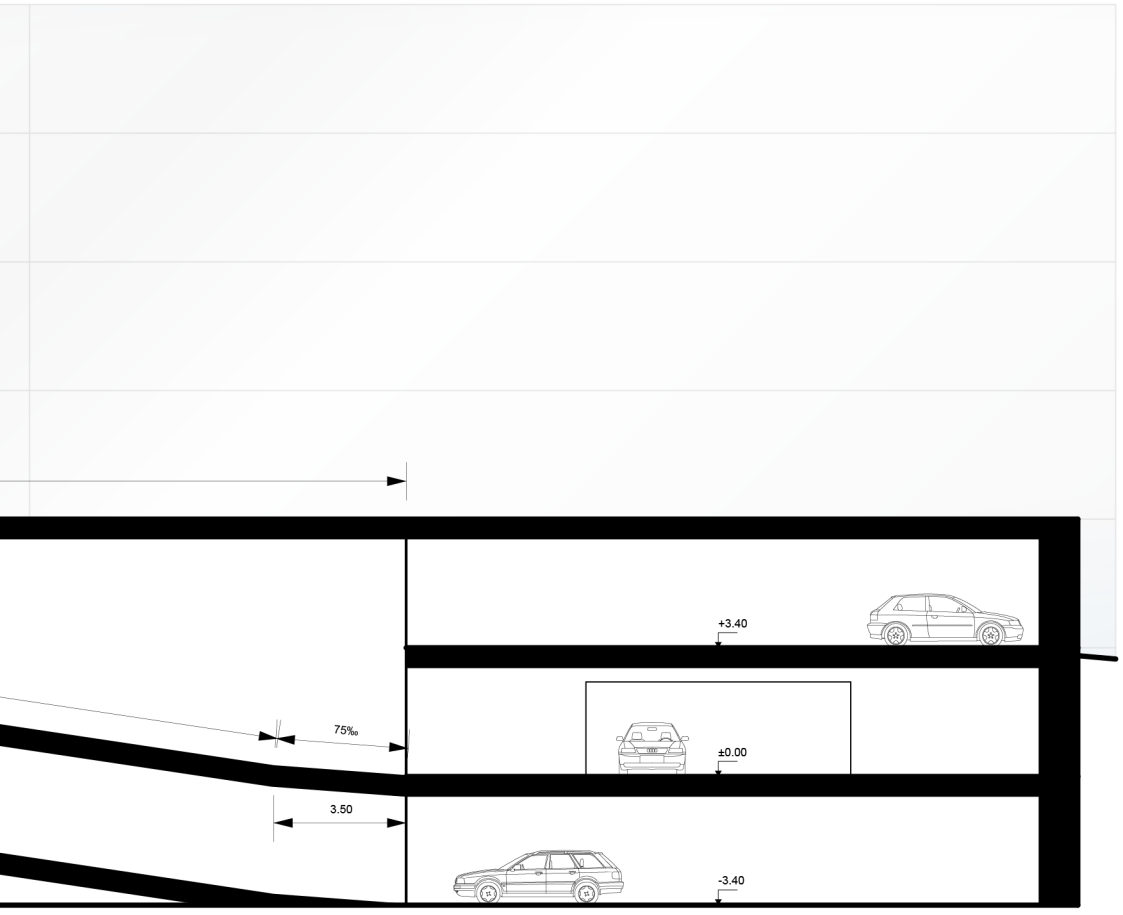
The two parking houses are estimated to have a total amount of 1.293 parking lots.

Length = Height * 1000 / ‰
Height = ‰ * Length / 1000
Inclination (‰) = Height * 1000 / Length



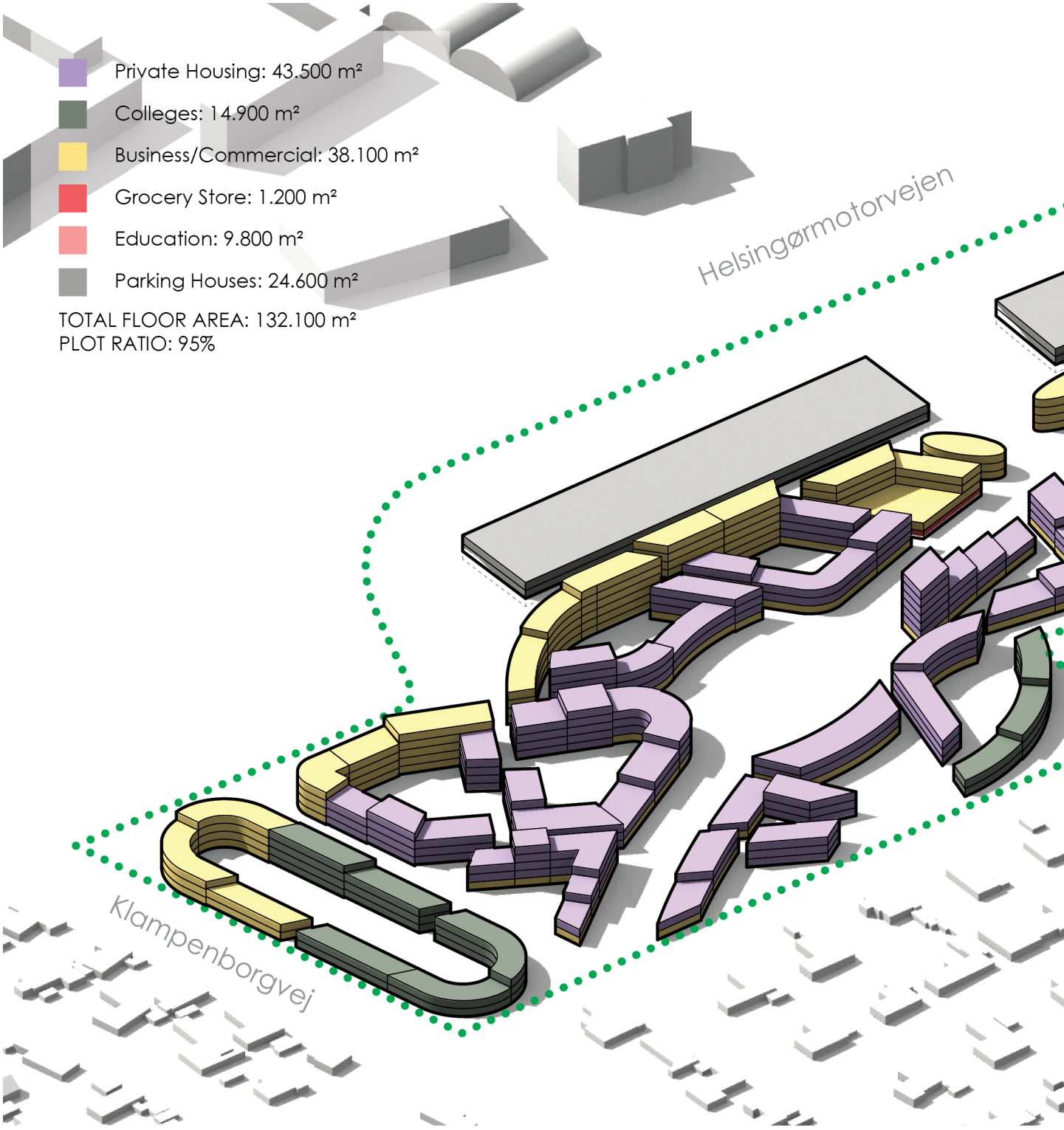
ill. 57 - Parking house section

For indoor parking house ramps, the inclination is not allowed to exceed 150‰ (Byggecentrum, 2016). Furthermore, based on the vehicle type that is supposed to use the parking house and hereby the ramp, the first and last part of the ramp has to have an inclination of half of the total inclination of the ramp (inclination / 2), based on the minimum length of the vehicle typology (Byggecentrum, 2016). In this particular case, the designed parking houses within the project site are created for private car use, which has a minimum length of 3,5 meter. If the main inclination of the ramps are set to the maximum of 150‰, the first and last 3,5 meters of the ramps should hereby have an inclination of 75‰. From these numbers, it is further possible to determine the total length of the ramps. With a total height of 3,4 meter between the levels of the parking decks, the total length of the indoor parking ramps is around 26,2 meter.

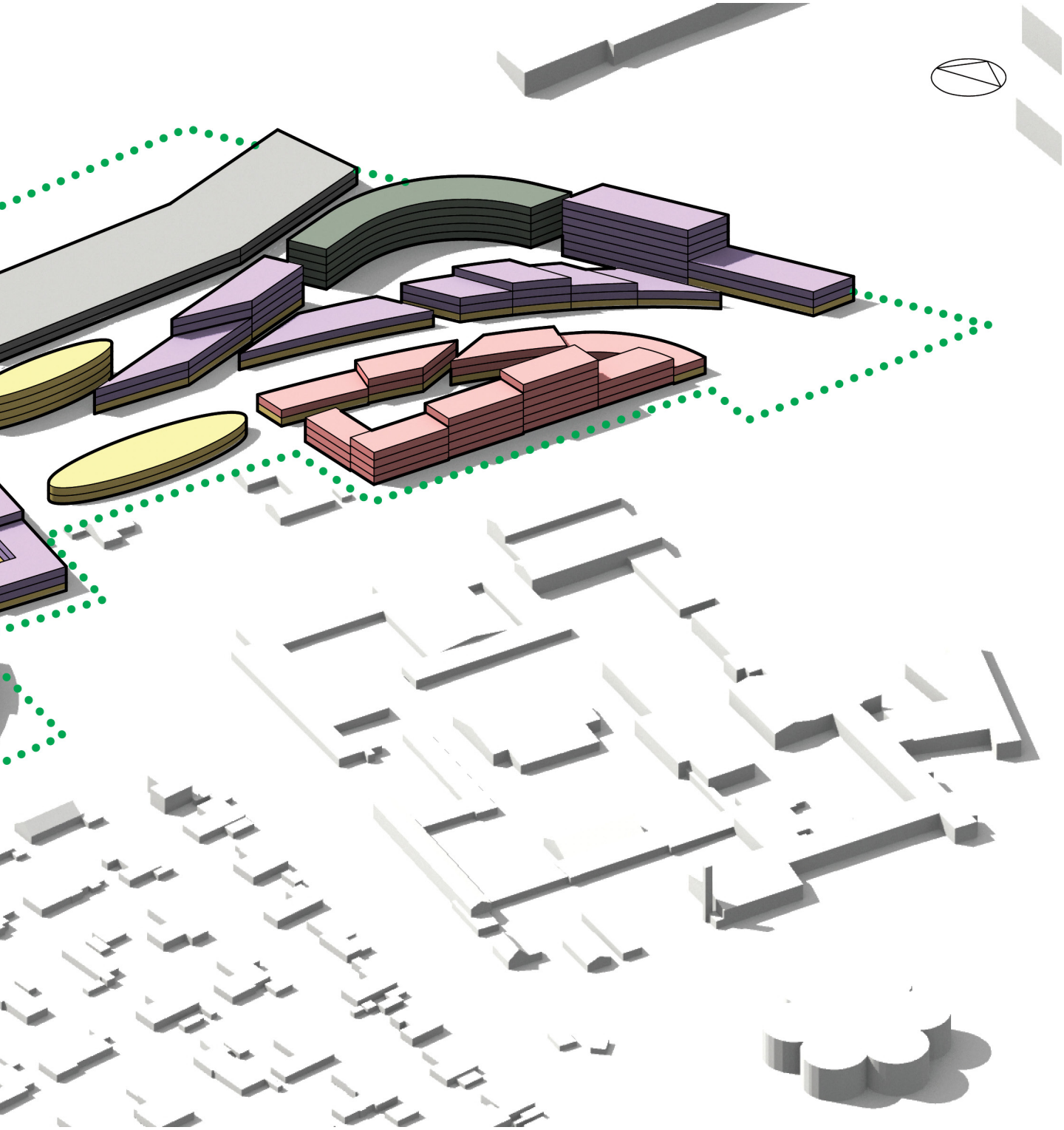


ill. 58 - Plaza

FLOOR AREAS



ill. 59 - Floor Areas



REFERENCE PROJECTS - ARCHITECTURE

Haldor Topsøe, Ravnholm – Denmark
2,5 km north of the project site, in what was IBM's former office space, Haldor Topsøe has now its headquarter in these buildings at Ravnholm, where the half circular one in particular stands out from the rest of the building complex. It was added to the existing buildings in 1991 and designed by PLH Arkitekter (Arkark.dk, 2011). The half circle's inner façade consist of mirrored glass that reflects the surrounding environment, but at the same time prevent people from the outside to look and see what is happening inside the building. In the center of the half circle stands a group of trees, and while observing the entire setting from behind the group of trees, watching into the reflecting half circular building, it could remind of an ancient Greek theater.

Einstein Tower, Potsdam – Germany
(Erich Mendelsohn)
Build between 1920 and 1924; Erich Mendelsohn managed with the Einstein Tower to create an architectural icon of impressionism, which at the same time was the German architect's first significant project. The building with all its concave and convex surfaces which gives it sculptural values, was supposed to be developed in reinforced concrete, but ended up being build more traditional with a brick construction above the socket and finished with a plaster layer as surface, due to difficulties with the building techniques. The buildings purpose is demonstrated in a symbolic way with the socket and tower rising up towards the sky, creating a connection between heaven and earth. It consists of a telescope in the tower, an underground laboratory, an office/study at ground floor as well as accommodation facilities (Tietz, 2008, p. 26).

TOP ill. 60 - Haldor Topsøe, BOTTOM ill. 61 - Einstein Tower

Lyngby Town Hall, Kgs. Lyngby – Denmark
As the population in Lyngby-Taarbæk grew rapidly in the first half of the 20th Century, the plans regarding a new town hall for the municipality of Lyngby-Taarbæk changed throughout the years and more than one architecture competition regarding the design of it were held in order to meet the new needs of that time. The final competition was held in 1938 and the construction of the winning proposal started in 1939 and was realized in 1941. It was the architects Hans Erling Langkilde and Ib Martin Jensen who won the competition with a six story concave building design covered the marble from Greenland. The top floor is drawn slightly back from the rest of the façade and is instead covered with copper. One of the significant factors that made Langkilde & Jensen win with their proposal was that they managed to create a meeting hall with a height of two floors, whereas it was initially expected that the first floor would just have been higher compared with the others (Lyngby – Taarbæk Kommune, 2014).

Vitra Design Museum, Weil-Am-Rhein – Germany (Frank O. Gehry)
Where architecture and design is united. Some of the history's most iconic designer furniture is displayed inside the stunning Vitra Design Museum, which were the first major commission in Europe for the renowned North American architect Frank O. Gehry. The expression of the building is typical for Gehry, showing the eccentricity which the architect is famed for; fragmented facades, sweeping curves and unusual angles (Neal, 2002), a classic Frank O. Gehry look.

TOP *ill. 62 - Lyngby Town Hall*, BOTTOM *ill. 63 - Vitra Design Museum*

REFERENCE PROJECTS - LANDSCAPE ARCHITECTURE

Sønder Boulevard, Copenhagen – Denmark (SLA)

"Sønder Boulevard cuts through the inner city of Copenhagen like a fragment of the 19th Century's dream of the great metropolis" (SLA, 2017). In 2006, the Danish landscape architecture practice SLA transformed Sønder Boulevard from being an arterial thoroughfare, to a new enjoyable urban space with numerous possibilities for activity in a green setting. Installations of seating, meetings spots to hang out at, basketball courts for the active users and small garden areas for a more peaceful use of Sønder Boulevard are just some of the interventions made here. Furthermore, the locals of Vesterbro (as well as tourists and other visitors) have with the new design of Sønder Boulevard become better connected with the city center of Copenhagen, the Central Train Station and the new urban neighborhood at the Carlsberg Area (SLA, 2017).

Musée du Quai Branly, Paris – France (Jean Nouvel)

Through paths in a miniature hill landscape in the heart of Paris, visitors of the Musée du Quai Branly are guided to the gallery raised above the landscape, mainly supported by pillars. Its irregular shape with a slightly curved base structure covered with wood panels, is 220 meters long and on the northern façade, various cubes pops out in vibrant colors, creating small chambers inside the museum (Fischer, 2008). It was designed by French architect Jean Nouvel, and in 2006 the Musée du Quai Branly opened its doors (Musée du Quai Branly, 2017).

TOP *ill. 64 - Sønder Boulevard*, BOTTOM *ill. 65 - Musée du Quai Branly*

VEGETATION

In order to create a diverse expression of the green vein that transforms throughout the seasons of the year, the vegetation strategy includes evergreen trees such as Boxwood, Cypress, Holly and Pine trees, and deciduous trees that loses its leafs in the winter time e.g. Birch, Copper Beech and Platan trees. This strategy will give the green vein identity and character.






TOP ROW FROM LEFT, *ill. 66 - Holly tree*, *ill. 67 - Boxwood* and *ill. 68 - Skotch Pine tree*. BOTTOM ROW FROM LEFT, *ill. 69 - Birch trees*, *ill. 70 - Platan tree* and *ill. 71 - Copper Beech leafs*

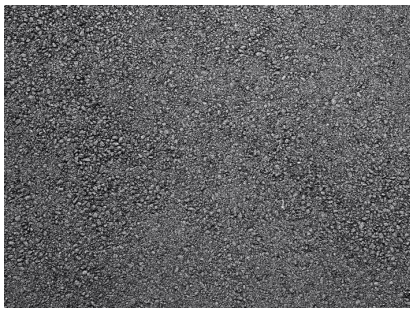
MATERIALITY AND ILLUMINATION

MATERIALITY

Within the urban area where city life is taking place and movements happens at a pace of 5 km/h, the pavement consist of differentiated tiles, creating a dynamic yet homogeneous expression of the surface. A pavement that also continues and serves as the pathway that runs through the green vein.

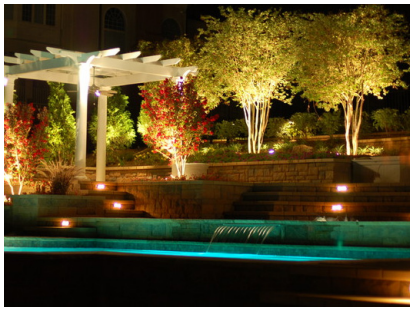
The street that handles the main flow of heavy means of transportation at the sound barrier hills in west and the secondary street connecting the minor parking space in east with the existing parking area next to the kindergarten and Trongårdsskolen, will have asphalt as pavement.

The green semi-private courtyards and the green vein will consist of a grass base, where flowers can spire both controlled and uncontrolled throughout parts of these grass areas.

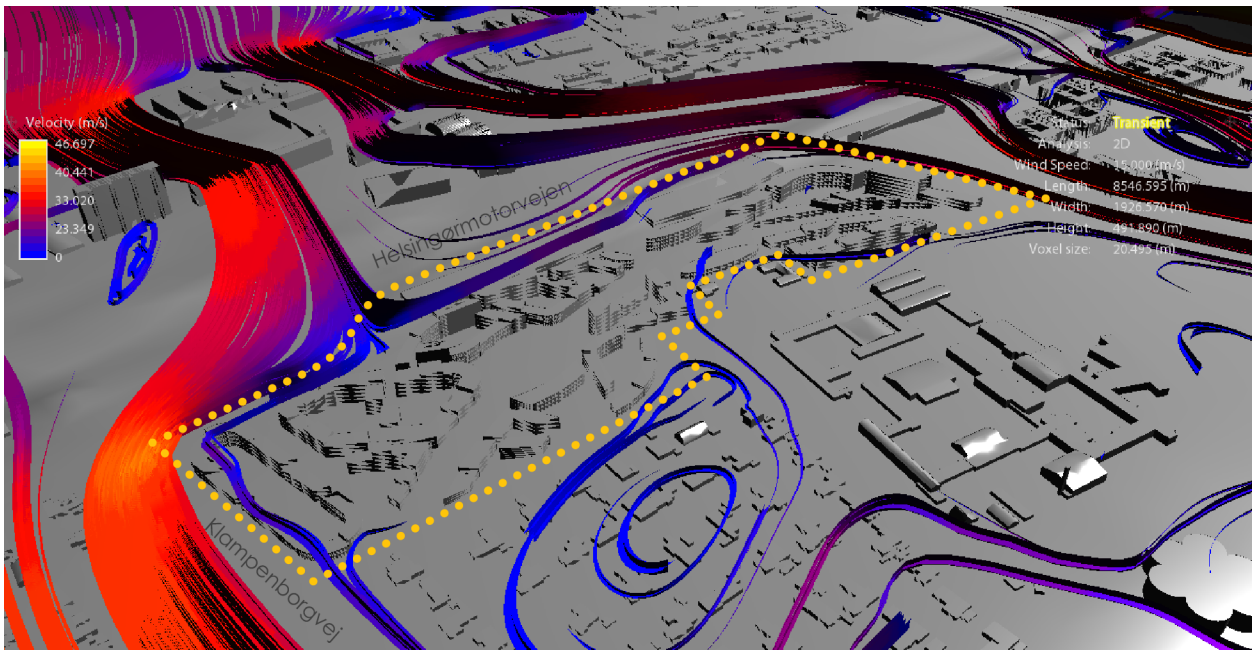

ILLUMINATION

In regards of illumination within the project, this subject can be divided in to three categories: function illumination, atmosphere illumination and decorative light projection. The function illumination will serve a more practical cause, by illuminating streets and public spaces at night, allowing people to navigate safely throughout the site after sunset, whereas the atmosphere illumination will have a more psychological purpose with its softer light creating moods within the area. The decorative light projection is in relation to triangulation mentioned by William H. Whyte (Whyte, 1988), an artistic and modern use of artificial light, displaying interactive and dynamic art.


TOP ROW FROM LEFT, *ill. 72 - Tiles*, *ill. 73 - Asphalt* and *ill. 74 - Grass base*. BOTTOM ROW FROM LEFT, *ill. 75 - Function illumination*, *ill. 76 - Atmosphere illumination* and *ill. 77 - Light projection on Ponte Vecchio*

WIND ANALYSIS

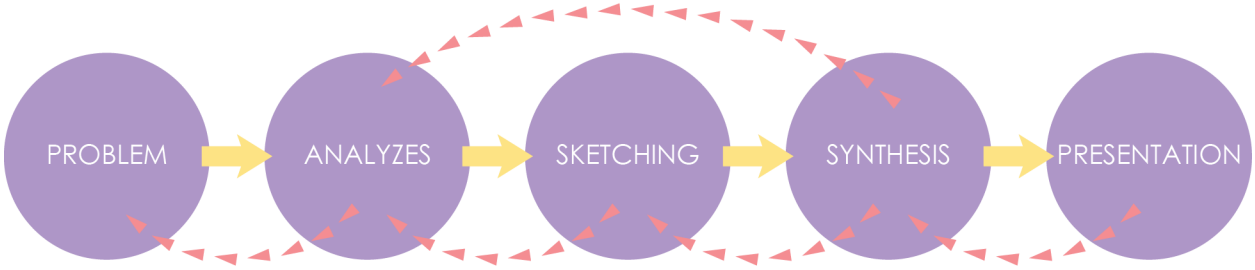


By importing a 3D computer generated model of the design and the surrounding environment, it has been possible to simulate the wind conditions of the area and how the wind will react and affect the design. The results from these wind simulations show that the design is blocking the western wind, forcing the wind streams around the site, which hereby indicates that the outdoor urban spaces within the designed area is sheltered and turbulence is unlikely to be a major issue.

Even the great plaza shows no sign of wind turbulence despite its size, which is a positive result in regards of having an active public space where it is not the wind conditions that determines if the space is used or not.

ill. 78 - Wind simulation

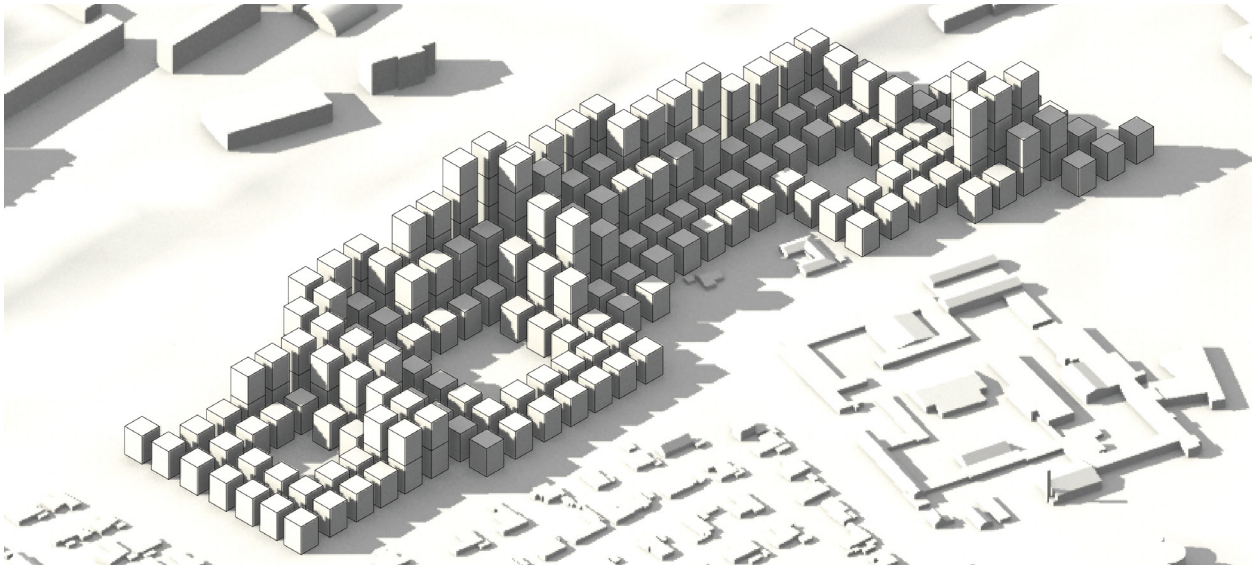
METHODOLOGY AND DESIGN PROCESS

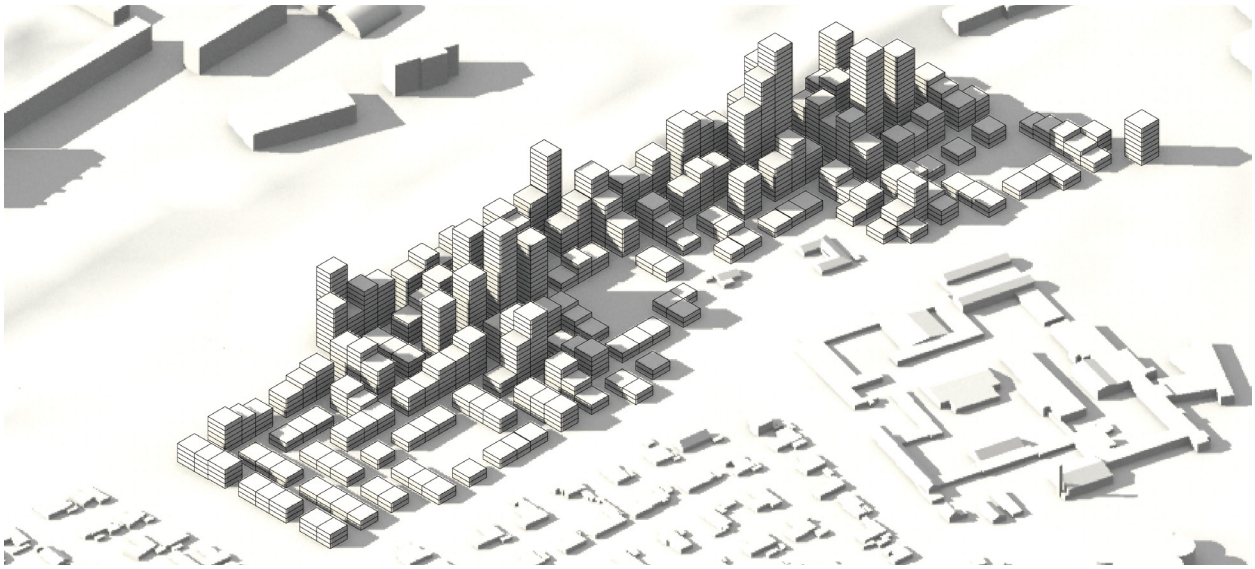


ill. 79 - Integrated Design Process

GRID AND HIGH RISES

With the initial idea of developing a project that would be very dense, consisting of high rises that would give some extraordinary views of the landscape such as Lyngby city center west of the site and Dyrehaven east of it, perhaps even the sea Øresund, which is most likely the major attraction regarding external elements concerning housing facilities in North Zealand, grid systems inspired by the city plan of Manhattan, New York, were sketched in 3D. The building typology of high rises would furthermore increase the amount of people within the area, which should lead to more unexpected meetings where knowledge should be exchanged and inspire new creativity.





TOP *ill. 80 - Grid V1,* BOTTOM, *ill. 81 - Grid V2*

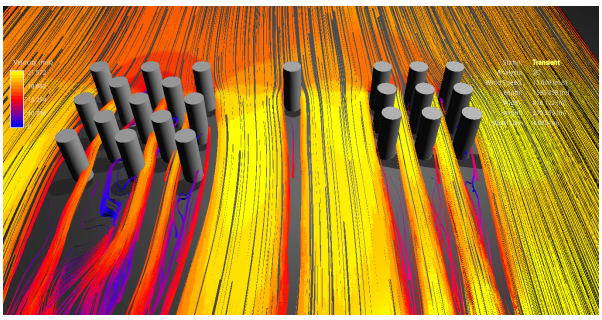
WIND ANALYZES

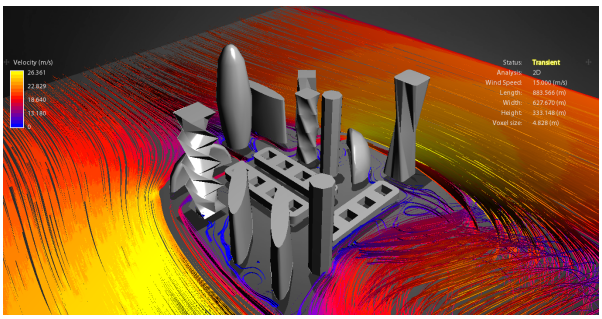
From an early phase of the process, numerous wind simulations were conducted of various building shapes and layouts of the project site, with height as a common parameter, due to the wish of developing high rises at this early stage of the project.

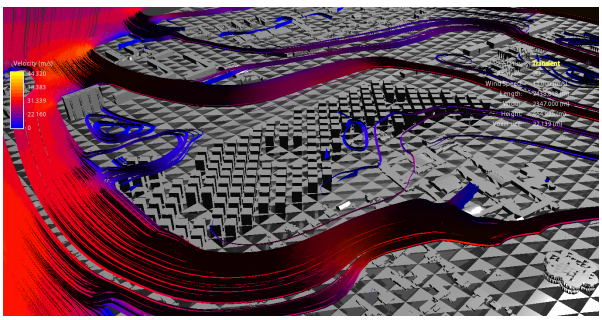
Based on theoretical background knowledge from 'Vindmiljø i arkitekturen' (Bjerg, 2012), various computer generated 3D models were developed and tested with a wind simulation software. Some 3D models were made as the project site with a topography surface to illustrate the landscape and placement of existing buildings where done to give an even more realistic simulation due to these existing buildings possible effect on the wind conditions. Tests of various arrangements of mixed building heights was carried out, where it was hereby possible to simulate and analyze the sites wind conditions in relation to the proposed building arrangement.

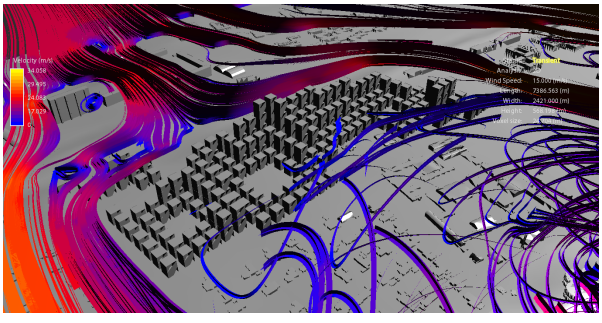
Individual high rises of different shapes were furthermore tested and analyzed with the wind simulation software in order to see how the wind streams reacts to these different building forms and which shapes would be best in regards of decreasing the amount of turbulence around it.

In general, when the 3D models of the entire site with various arrangements of high rises were tested with the wind simulation software, none or very little turbulence between the buildings within the project site was discovered. It was the same situation regarding the final project design, where the outdoor spaces within the design was sheltered and the wind streams were running around the site.









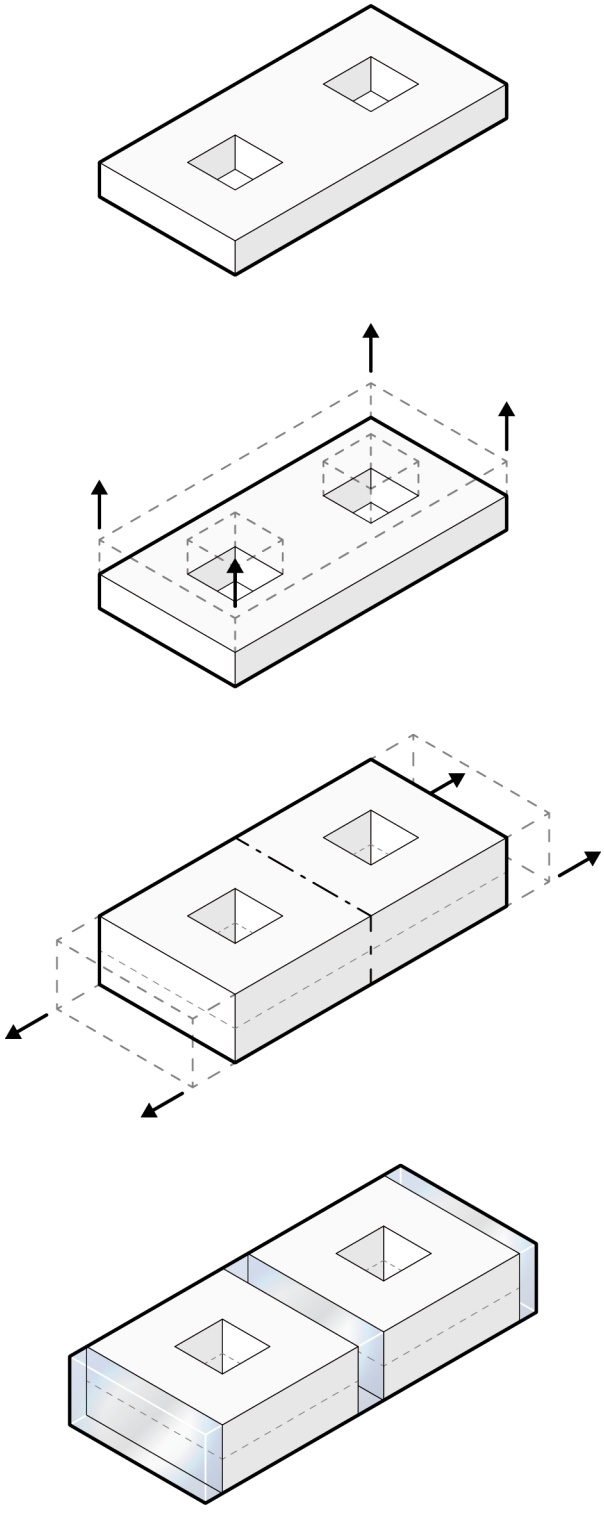
ill. 82-85

DOMUS YOUTH

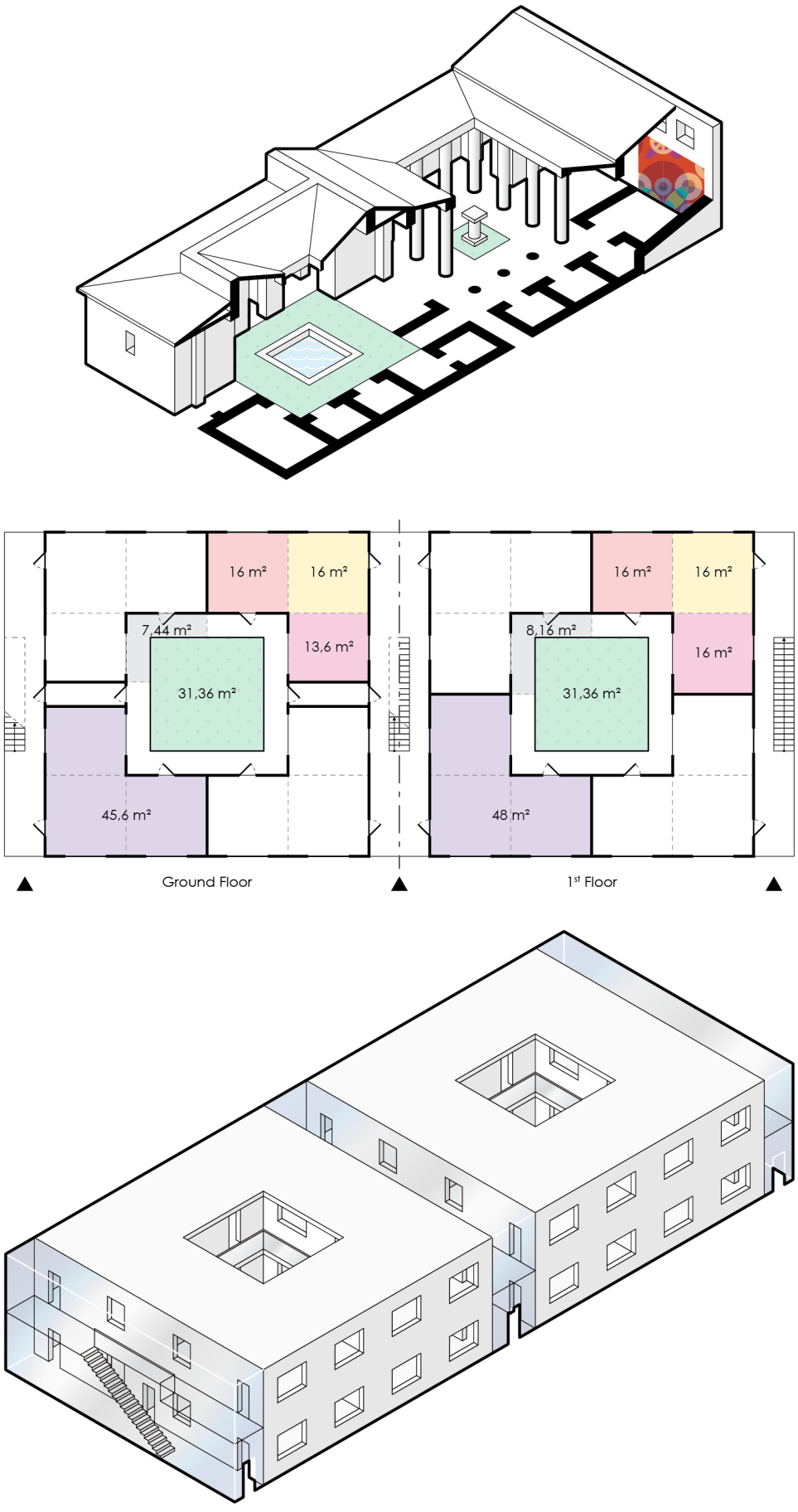
During the design process, concerns regarding student housing and colleges let to the design of a new plan solution for this typology of housing. With experiences from Aalborg, where completely new build colleges are taken badly care of by the young residents, the idea of develop a housing typology for this user group that would force each of the residents to take a larger responsibility of the dwelling arose.

Inspired by the old roman housing typology Domus (Chiappinelli, 2001), the designed colleges would create awareness of the neighbours, privacy and shared outdoor spaces, which should help the residents in collaboration to take more responsibility of their shared housing complex. By entering a centred entrance hall, four apartments, two on each side of the hallway, a small neighbour community is hereby established within this hallway. The two apartments located on the same side of the hallway will now share a common outdoor space with two of the apartments from the neighbouring entrance hall. In this way, the residents have to develop a good relation to a larger amount of the neighbours living in the Domus Youth complex.

The Domus Youth housing concept was unfortunately later omitted in the further process.



Il. 86 - Domus Youth concept evolution



ill. 87 - Domus Youth principles

CONCLUSSION

With the green vein that not only embraces the nature and vegetation surrounding the project area, it furthermore integrates and distributes the green elements to the entire site, giving the designed urban environment a green profile. With its central flow across the site, the green vein invites people from the secondary roads to enter this strip, where users are presented various pleasures such as recreational elements, art, culture and gastronomy.

Due to the mix of residents, businesses and educational facilities, an interesting vibrant city life is expected to take place here during the time span of an entire day. The school kids taking a brake and joking about an art sculpture further down the green vein, passed by a CEO on his way to the local café to get one of his daily doses espresso, who get inspired from the kids' conversation and pitch a new business idea to his colleagues later on that same day. This could be one of many inspiring scenarios found within the site.

With good sunlight conditions and shelter from the western wind, combined with the greenery distributed by the green vein and the activities at street level, the project site surely invites people to take part of the urban life within Project GV.

DISCUSSION AND REFLECTION

RESIDENTIAL AREA

During the process of the thesis, Lyngby-Taarbæk Kommune listed the majority of the southern area of the project site, with the intention of being developed in to a new residential area, mainly consisting of low and dense housing typologies such as row houses of two stories. Last day for submission regarding offers on the site, was May 17, 2017.

Looking at the municipality's plan for the site and the design by the student, two quite different visions of the area occurs. It is interesting why the municipality aims for yet another residential area that perhaps could be a bit similar to the one of Trongårdsparken east of the site, as the municipality is part of the Lyngby-Taarbæk City of Knowledge association, with a vision of developing a new innovation district, unique for Denmark, with the neighboring area of DTU as driver. How is this vision in relation to the municipality's plan of a residential area?

The thesis project on the other hand, meets both the idea of an innovation district as well as a solution for housing, creating what must be expected, a much more diverse urban space compared to the residential area the municipality is looking for.

PARKING

Comparing the amount of parking space with the floor area ratio, and then looking at the recommended parking standards (Byggecentrum, 2016) regarding how much parking various functions need e.g. private housing, office space, restaurants etc., it becomes evident based on roughly calculations that the parking solution of the project corresponds very well with these standard recommendations. It must although be stated, that the design of the two great parking houses is conceptual, where a more technical construction drawing could influence the number of parking lots.

Construction of parking houses are often not very appreciated by developers, as they find the financial and aesthetics aspect of parking houses unattractive. In this particular case, it could also be discussed whether the construction and placement of the two parking houses are the best solution. How is the areas along these large constructions perceived by the users of the site, can the parking houses add more value to the area besides the practical function? By placing the parking houses as done, an easily accessible route from car to purpose within the site is established, but it will of course give architects a great challenge to develop a parking house design that can do more than just store cars, indicating that the facades must become interesting.

HEIGHT RESTRICTION

Not only was the height restriction of buildings influencing and damaging the initial ideas of this project, it will also impact real life development of the area. The idea of an unspoiled view of Eremitagesletten seen from Eremitageslottet is maybe beautiful, but is it reasonable? The castle is reserved the royal Danish family, who only use it occasionally. The highest step on the staircase where the restricted view line is measured 152 cm above, is not accessible for the public, as the castle is fenced, preventing people from getting too close to it. This means that there is only a small group of privileged people to whom this height restriction is suited for.

By visiting Dyrehaven, standing in front of Eremitageslottet on the ground and looking in the direction of the project site, one will today be exposed to the view of a high industrial chimney in that background of the forest. It is therefore arguable why properties are not allowed to be the same height then. A penthouse view of Dyrehaven and Eremitageslottet would unmistakably be much desirable among the public.

THE REALITY

As a final remark, one could ask if the green vein with its facilities based on theoretical thoughts, in reality would inspire to use the outdoor space of the urban environment, where unexpected meetings are supposed to take place and knowledge is shared between people, leading to new ideas and creativity. A place that will ensure the continued progression and development of our future lives.

BIBLIOGRAPHY

ArchDaily, 2015. The Interlace / OMA / Ole Scheeren | ArchDaily. [online] Available at: <http://www.archdaily.com/627887/the-interlace-oma-2> [Accessed 07 May 2017].

Arkark.dk, 2011. IBM Danmark, Lundtofte. [online] Available at: <http://www.arkark.dk/building.aspx?buildingid=3043> [Accessed 01 May 2017].

Arkitektforeningen, 2013. Jan Gehl om De Bynære Havnearealer i Aarhus: Tænk jer om! | Arkitektforeningen. [online] Available at: <https://arkitektforeningen.dk/artikel/nyheder/jan-gehl-om-de-bynaere-havnearealer-i-aarhus-taenk-jer-om> [Accessed 16 February 2017].

Bjerg, S. N., 2012. Vindmiljø i arkitekturen. _: Arkitektskolens Forlag.

Brookings, 2017. Innovation Districts | Brookings Institution. [online] Available at: <https://www.brookings.edu/innovation-districts/> [Accessed 22 April 2017].

Byggecentrum, 2016. 14_Parkeringsarealer. [pdf] Byggecentrum. Available at: <http://www.hfb.dk/fileadmin/templates/hfb/dokumenter/rum-pdf/14_Parkeringsarealer.pdf> [Accessed 22 March 2017].

Chiappinelli, M. G., 2001. Architettura Riconoscere Gli Stili. 3rd ed. Prato: Giunti.

DMI, 1999. Technical Report 99-13. [pdf] Available at: <http://www.dmi.dk/fileadmin/user_upload/Rapporter/TR/1999/tr99-13.pdf> [Accessed 17 February 2017].

Faber, K., 2010. Arkitekt: Derfor er det gået galt i Ørestaden. Politiken. [online] 22 May. Available at: <http://politiken.dk/kultur/art5606608/Arkitekt-Derfor-er-det-g%C3%A5et-galt-i-%C3%98restaden> [Accessed 16 February 2017].

Fischer, J., 2008. Design Destinations Worldwide. _: h.f.ullmann.

Frearson, A., 2015. Zaha Hadid plans apartment complex for first project in Mexico. Dezeen. [online] 14 May. Available at: <https://www.dezeen.com/2015/05/14/zaha-hadid-apartment-complex-esfera-city-center-first-project-mexico-monterrey/> [Accessed 24 April].

Gehl, J., 2010. Byer for mennesker. _: Bogværket.

Hobson, B., 2013. Movie with Colin Seah on Singapore housing | architecture | Dezeen. Dezeen. [online] 17 October. Available at: <https://www.dezeen.com/2013/10/17/movie-colin-seah-ministry-of-design-singapore-housing-public-spaces/> [Accessed 24 April].

Hovedstadens Letbane, 2017a. Fakta | Hovedstadens Letbane. [online] Available at: <http://www.dinletbane.dk/se-visionerne/fakta/> [Accessed 28 April 2017].

Hovedstadens Letbane, 2017b. Se visionerne | Hovedstadens Letbane. [online] Available at: <http://www.dinletbane.dk/se-visionerne/> [Accessed 28 April 2017].

Jonassen, O., 2014. Ørestaden forbliver en spøgelsesby. NetAvisen. [online] 17 March. Available at: <http://navisen.dk/blog/orestaden-forbliver-en-spogelsesby/> [Accessed 16 February 2017].

Kjeldtoft, S. S., 2016. 'Jeg har svært ved at pege på én vellykket ny bydel i København'. Information. [online] 19 July. Available at: <https://www.information.dk/indland/2016/07/svaert-ved-pege-paa-vellykket-ny-bydel-koebenhavn> [Accessed 16 February 2017].

Leoni, G., 2008. Mies van der Rohe. Foligno: 24 ORE Motta Cultura.

Lyngby – Taarbæk Kommune, 2014. Rådhusets historie | Lyngby Taarbæk Kommune. [online] Lyngby – Taarbæk Kommune. Available at: <http://www.ltk.dk/raadhusets-historie> [Accessed 06 May 2017].

Lyngby – Taarbæk Kommune, 2015a. Kommuneplantillæg 11A/2013 for Dyrehavegårds Jorder. [pdf] Lyngby – Taarbæk Kommune. Available at: <http://kommuneplan.ltk.dk/download/tillaeg/tillaeg_11a_endelig_vedtagelse.pdf> [Accessed 19 February 2017].

Lyngby – Taarbæk Kommune, 2015b. Jægersborg Dyrehave | Lyngby Taarbæk Kommune. [online] Available at: <http://www.ltk.dk/jaegersborg-dyrehave> [Accessed 25 April 2017]

Lyngby – Taarbæk Kommune, 2016a. Lokalplan 264 – Et erhvervsområde på Dyrehavegårds jorder. [pdf] Lyngby – Taarbæk Kommune. Available at: <http://soap.plansystem.dk/pdfarchive/20_3107618_1466493342144.pdf> [Accessed 17 February 2017].

Lyngby – Taarbæk Kommune, 2016b. Lokalplan 265 – for et område i Tracéet Syd. [pdf] Lyngby – Taarbæk Kommune. Available at: <http://soap.plansystem.dk/pdfarchive/20_3127608_1466600004763.pdf> [Accessed 17 February 2017].

Lyngby – Taarbæk Kommune, 2017a. Boligbyggegrunde i Trongårdens byområde sælges - Budfrist 17. maj 2017 | Lyngby Taarbæk Kommune. [online] Available at: <http://www.ltk.dk/boligbyggegrunde-i-trongaardens-byomraade-saelges> [Accessed 19 February 2017].

Lyngby – Taarbæk Kommune, 2017b. Aktuelle arbejder - Dyrehavegårds Jorder og Tracéet langs Helsingørmotorvejen | Lyngby Taarbæk Kommune. [online] Available at: <http://www.ltk.dk/aktuelle-arbejder-dyrehavegaards-jorder-og-traceet-langs-helsingoermotorvejen> [Accessed 22 April 2017].

Lyngby – Taarbæk Kommune, 2017c. Information om Lyngby-Taarbæk Kommune - KommuneGuiden. [online] Available at: <http://ltk.kommuneguiden.dk/app/fakta_ntal.asp?hkat=12&knr=173&foldud_id=300> [Accessed 26 April 2017].

Mondadori, 2017. Innovation Design District Porta Nuova - Porta Volta | Mondadori. [online] Available at: <http://www.mondadori.com/media-room/news-and-press-releases/year-2017/innovation-design-district-porta-nuova-porta-volta> [Accessed 04 May 2017].

Miljø- og Fødevareministeriet, 2017. Miljøgis. [online] Available at: <http://miljoegis.mim.dk/spatialmap?&profile=noise> [Accessed 05 March 2017].

Musée du Quai Branly, 2017. musée du quai Branly - Jacques Chirac - An architecture for a dream. [online] Available at: <http://www.quaibranly.fr/en/public-areas/an-architecture-for-a-dream/> [Accessed 06 May 2017].

Naturstyrelsen, 2017. Seværdigheder i Dyrehaven. [online] Available at: <http://naturstyrelsen.dk/naturoplevelser/natur-guider/jaegersborg-dyrehave/sevaerdigheder/> [Accessed 22 April 2017].

Neal, J., 2002. Architecture – A Visual History. 2nd ed. _: PRC Publishing.

Sandqvist, P. M., 2016. The Network City, More than A to B. [report] Aalborg University.

Sandqvist, P. M., 2017. Life at Night by Colourful Light. [report] Aalborg University.

Senate Department for Urban Development and Housing, 2017. 04.03 Near Ground Wind Speeds. [online] Available at: <http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/ed403_01.htm> [Accessed 24 March 2017].

SLA, 2017. Sla :: Sønder Boulevard. [online] Available at: <http://sla.dk/dk/projects/sonderboulevard/> [Accessed 05 May 2017].

Tietz, J., 2008. Den moderne arkitekturs historie. _: h.f.ullmann.

Tvede, L., 2014. Det kreative samfund: Hvordan Vesten vinder fremtiden. _: Gyldendal Business.

Urbanized, 2011. [Film] Directed by Gary Hustwit. USA: Swiss Dots.

Vejrdirektoratet, 2011. Anlæg for parkering og standsning i byer. [online] Available at: <http://vejregler.lovportaler.dk/showdoc.aspx?q=F%c3%a6rdselsarealer+for+alle%2c+H%c3%a5ndbog+i+tilg%c3%a6ngelighed&docId=vd-anlaeg-parkering9-full> [Accessed 09 May 2017].

Vejdirektoratet, 2012. Grundlag for udformning af trafikarealer. [pdf] Available at: <http://www.vejdirektoratet.dk/DA/vejsektor/vejregler-og-tilladelser/vejregler/h%C3%B8ringer/Documents/H%C3%B8ring%20-%20%C3%85bent%20land/Grundlag%20for%20udformning%20af%20trafikarealer.pdf> [Accessed 13 April 2017].

Vejrdirektoratet, 2016. Tværprofiler i byer. [online] Available at: <http://vejregler.lovportaler.dk/ShowDoc.aspx?q=parkering&docId=vd-2016-0053-full> [Accessed 09 May 2017].

Vidensby, 2017a. Om Vidensby - Vidensby. [online] Available at: <http://vidensby.dk/om-vidensby/> [Accessed 19 February 2017].

Vidensby, 2017b. Greater Copenhagen - Science Cities - Vidensby. [online] Available at: <http://vidensby.dk/projekt/greater-copenhagen-udvikling-af-vidensmiljoeer/> [Accessed 22 April 2017].

Whyte, W. H., 1988. The Social Life of Small Urban Spaces. [video online] Available at: <https://archive.org/details/SmallUrbanSpaces> [Accessed 6 March 2017].

Windfinder, 2017. Wind & weather statistics Jægersborg – Windfinder. [online] Available at: <https://www.windfinder.com/windstatistics/jaegersborg> [Accessed 17 February 2017].

ILLUSTRATIONS

ill. 01-03 - Own illustration

ill. 04 - https://www.bing.com/maps

ill. 05-21 - Own illustration

ill. 22 - http://www.dinletbane.dk/se-visionerne/linje-og-stationer/

ill. 23 - http://kommuneplan.ltk.dk/dk/byudvikling/letbane/

ill. 24 - http://www.residenzeportanuova.com/public/background/home/homepage_03.jpg

ill. 25 - http://images.adsttc.com/media/images/5549/8765/e58e/ce42/3b00/001d/large_jpg/The_Interlace_by_OMA_Ole_Scheeren_photo_--%C2%BC_Iwan_Baan_04.jpg?1430882140

ill. 26 - http://images.adsttc.com/media/images/5554/c408/e58e/ce16/aa00/0135/large_jpg/Esfera_City_Center_(5).jpg?1431618550

ill. 27-60 - Own illustration

ill. 61 - https://farm8.staticflickr.com/7372/9616566364_0c612a3dff_c.jpg

ill. 62 - http://bygningskulturenshus.dk/wp-content/uploads/2013/08/LT_Laura-Boelskifte_01.jpg

ill. 63 - http://www.design-museum.de/fileadmin/user_upload/Bilder/Vitra%20Campus/Vitra_Design_Museum_77300_preview_cropped.jpg

ill. 64 - http://arkfo.dk/sites/default/files/styles/slide-with-statement/public/feature/la_2_sdr_boulevard_foto-camillahedegaardmoeller_0.jpg

ill. 65 - http://www.jeannouvel.com/images/made/images/remote/http_www.jeannouvel.com/mobile/projets/483_parisbranly/images/AJN_Paris_MQB_Roland-Halbe_prodrh0008_600_801_80.jpg

ill. 66 - http://www.fanonatur.dk/Files/Billeder/januar%202014/kristtorn-140110-svf_1470.jpg

ill. 67 - https://www.bolius.dk/fileadmin/_processed_/2/f/csm_03-buksbom-planten-der-kan-klippes-som-dyr_a6162b2547.jpg

ill. 68 - http://www.naturplan.dk/foto/upload/s-dsc_1490-skovfyr.jpg

ill. 69 - http://eskipaper.com/images/birch-tree-1.jpg

ill. 70 - http://flfoto.dk/galleri/albums/Rejse/Frankrig/Sete/IMG_3441fl.jpg

ill. 71 - https://s-media-cache-ak0.pinimg.com/originals/ea/4b/a0/ea4ba00545063de7466250b6561c28f7.jpg

ill. 72 - https://s-media-cache-ak0.pinimg.com/originals/0b/1d/eb/0b1debdb5960249772909dc71d51de65.jpg

ill. 73 - https://s-media-cache-ak0.pinimg.com/736x/e7/ea/7d/e7ea7d9d1fdef1ec62081d4e74cd3038.jpg

ill. 74 - http://s1.1zoom.me/big7/687/Ranunculus_Poppies_443013.jpg

ill. 75 - http://carmanah.com/sites/all/themes/carmanah_omega/fps/fpss/slideshows/carmanah-frontpage/images/outdoor-lighting.jpg

ill. 76 - http://st.hzcdn.com/simgs/4eb16fd40d52c310_4-9958/traditional-pool.jpg

ill. 77 - http://www.flightfirenze.it/file/foto/big/v86zesan-6553.jpg

ill. 78-112 - Own illustration

12 QUALITY CRITERIA FOR PUBLIC SPACES

Protection

PROTECTION AGAINST TRAFFIC AND ACCIDENTS - FEELING SAFE

- Protection for pedestrians.
- Eliminating fear of traffic.

PROTECTION AGAINST CRIME AND VIOLENCE - FEELING SECURE

- Lively public realm.
- Eyes on the street.
- Overlapping functions day and night.
- Good lighting.

PROTECTION AGAINST UNPLEASANT SENSORY EXPERIENCES

- Wind/drag.
- Rain/snow.
- Cold/heat.
- Pollution.
- Dust, glare and noise.

Comfort

OPPORTUNITIES TO WALK

- Room for walking.
- No obstacles.
- Interesting facades.
- Accessibility for everyone.
- Good surfaces.

OPPORTUNITIES TO STAY/STAND

- Edge effect / attractive areas for standing/staying.
- Supports for standing.

OPPORTUNITIES TO SIT

- Zones for sitting.
- Utilizing advantages: view, sun, people etc.
- Good places to sit.
- Benches for resting.

OPPORTUNITIES TO SEE

- Reasonable viewing distances.
- Unhindered sightlines.
- Interesting views.
- Lighting (evening/night).

OPPORTUNITIES TO TALK AND LISTEN

- Low noise levels.
- Street furniture that provides "talkscapes".

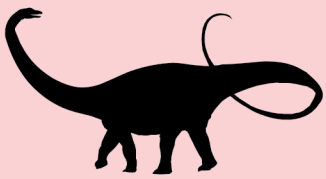
OPPORTUNITIES FOR PLAY AND EXERCISE

- Invitations for creativity, physical activity, exercise and play.
- By day and night.
- In summer and winter.

Delight

SCALE

- Buildings and spaces designed to human scale.



OPPORTUNITIES TO ENJOY THE POSITIVE ASPECTS OF CLIMATE

- Sun/shade.
- Heat/coolness.
- Breeze.

POSITIVE SENSORY EXPERIENCES

- Good design and detailing.
- Good materials.
- Fine views.
- Trees, plants and water.

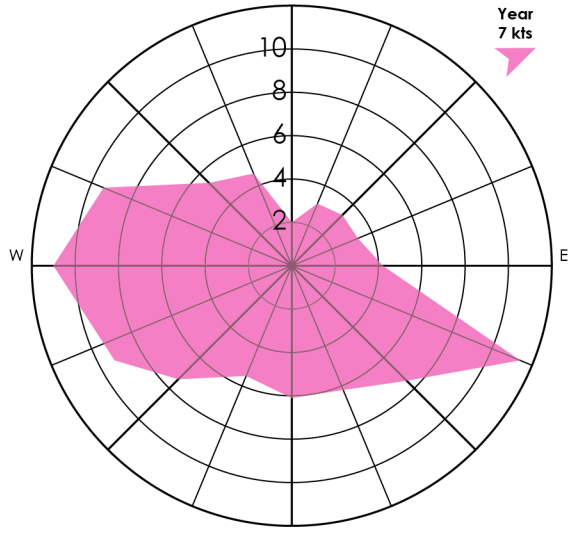
ill. 88 - 12 quality criteria for public spaces (Data: Gehl, 2010)

WIND ROSE ANALYZES

JÆGERSBORG / Jægersborg

Daily observations from 7 am to 7 pm local time, between 05/2010 - 01/2017.

Wind direction distribution in (%%)

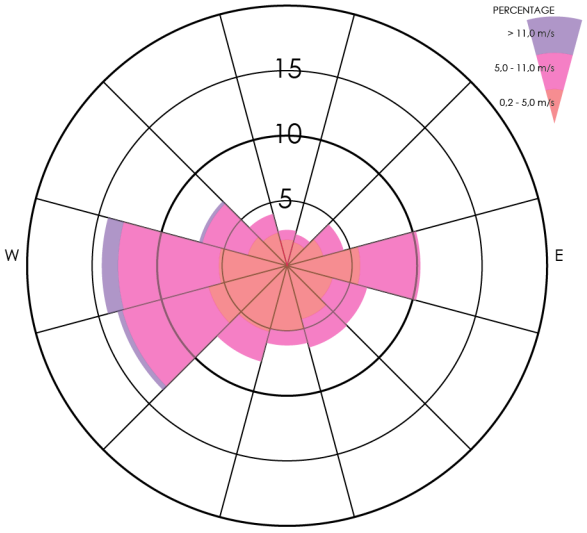


Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
8 kts	8 kts	8 kts	8 kts	8 kts	8 kts	7 kts	7 kts	7 kts	7 kts	7 kts	8 kts

VÆRLØSE / Flyvestation Værløse

29140 observations during the period between January 1st1989 and December 31st 1998.

Wind direction distribution in (%%)

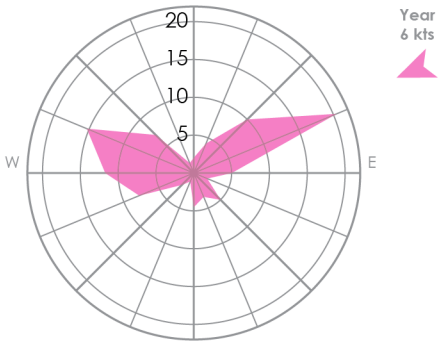


N	30°	60°	Ø	120°	150°	S	210°	240°	V	300°	330°
3,7 m/s	3,6 m/s	4,2 m/s	4,8 m/s	4,7 m/s	4,3 m/s	3,5 m/s	4,1 m/s	5,4 m/s	6,3 m/s	5,6 m/s	4,5 m/s

NEW YORK CITY / Central Park

Daily observations from 7 am to 7 pm local time, between 02/2012 - 01/2017.

Wind direction distribution in (%%)

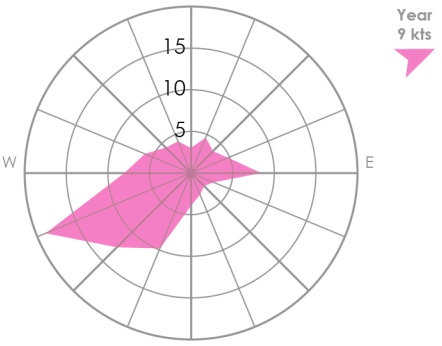


Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
7 kts	8 kts	7 kts	7 kts	6 kts	5 kts	5 kts	5 kts	5 kts	6 kts	6 kts	7 kts

LONDON / London City Airport

Daily observations from 7 am to 7 pm local time, between 09/2009 - 01/2017.

Wind direction distribution in (%%)



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9 kts	10kts	9 kts	9 kts	10kts	9 kts	9 kts	9 kts	9 kts	9 kts	9 kts	10kts

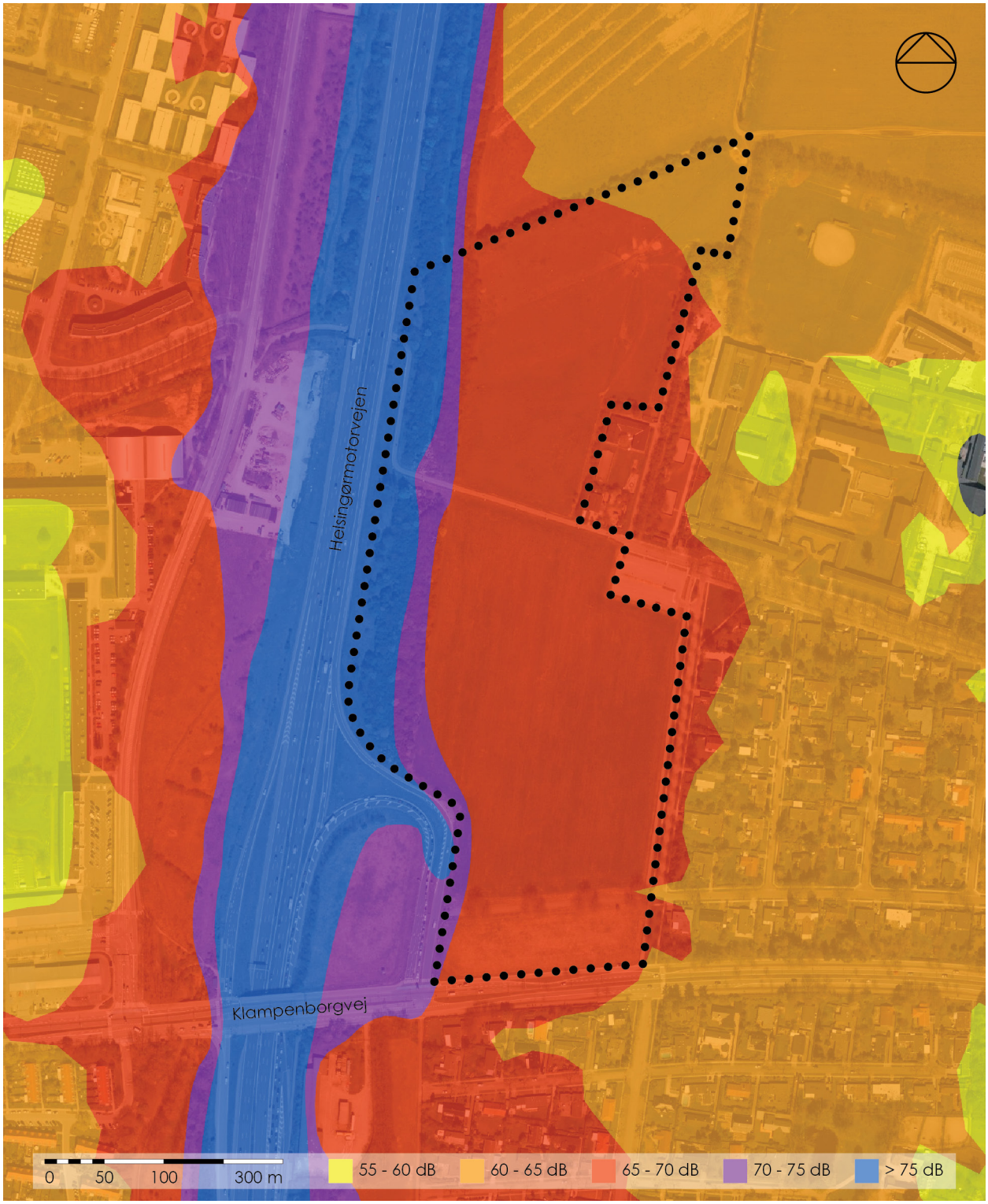
TOP LEFT *ill. 89 - Jægersborg Wind Rose (Data: Windfinder)*, TOP RIGHT *ill. 90 - Værløse Wind Rose (Data: DMI)*, BOTTOM LEFT *ill. 91 - New York Wind Rose (Data: Windfinder)*, BOTTOM RIGHT *ill. 92 - London Wind Rose (Data: Windfinder)*

BEAUFORT WIND FORCE SCALE

Beaufort	m/s	Knob	km/t	Designation	Observations - land	Observations - sea
12	>32	>63	118-	Hurricane	Severe damages.	The air is filled with foam, impairing the sight significantly.
11	29-32	56-63	103-117	Violent Storm	Numerous damages.	Immensely high waves, the sea is covered with white foam flakes and sight impaired.
10	25-28	48-55	89-102	Storm	Trees are uprooted, significant damage to homes.	Very high waves, nearly white surface and sea spray affect the sight.
9	21-24	41-47	75-88	Strong Gale	Large branches breaks, roof tiles are blown away.	High waves with tumbling tops, sea spray can affect the sight.
8	17-20	34-40	62-74	Gale	Twigs and branches breaks, difficult to walk towards the wind direction.	Fairly high and long waves, wave crest turns into sea spray.
7	14-16	28-33	50-61	Near Gale	Larger trees are moving, tedious to walk towards the wind direction.	White foam from breaking waves carried in lines by the wind direction.
6	11-13	22-27	39-49	Strong Breeze	Large branches move.	Big waves, whitecaps everywhere.
5	8-10	17-21	29-38	Fresh Breeze	Small deciduous trees swaying slightly.	Medium size and longish waves with many whitecaps, possibly sea spray.
4	6-7	11-16	20-28	Moderate Breeze	Dust and paper lifts, twigs and smaller branches moves.	Smaller waves with frequent whitecaps.
3	4-5	7-10	12-19	Gentle Breeze	Leaves and small twigs moves, pennants lifts.	Small waves where crests break, glassy foam.
2	2-3	4-6	6-11	Light Breeze	Small leaves moves.	Quite short wavelets that is not broken.
1	1	1-3	1-5	Light Air	Smoke just shows the wind direction.	Small ripples without foam.
0	0	0	<1	Calm	Smoke rises straight up into the air.	Sea like a mirror.

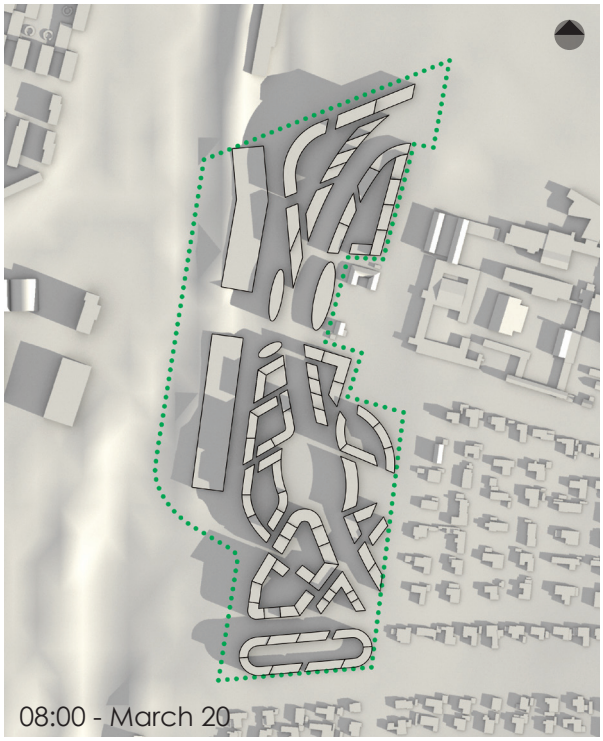
Table describing the wind forces effect (Bjerg, 2012, p. 43)

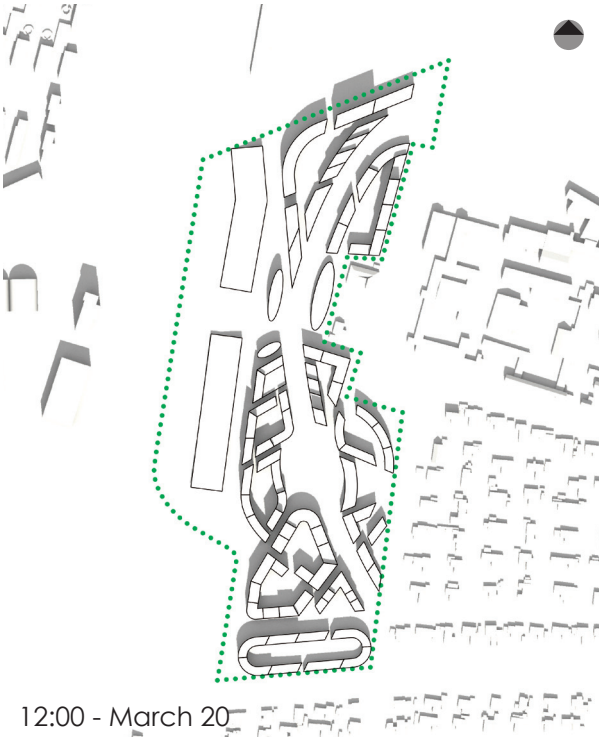
NOISE MAP

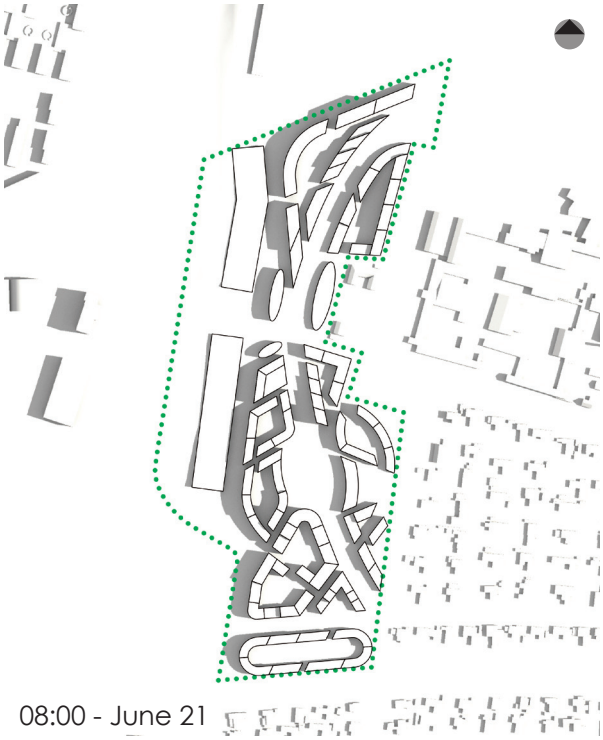


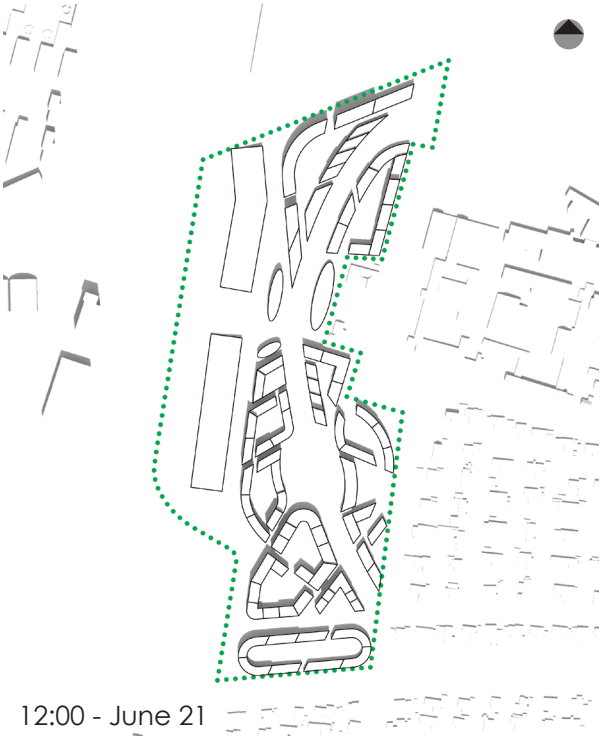
ill. 93 - Noise from larger roads during daytime measured 1,5 m above ground (Data: Miljøstyrelsen)

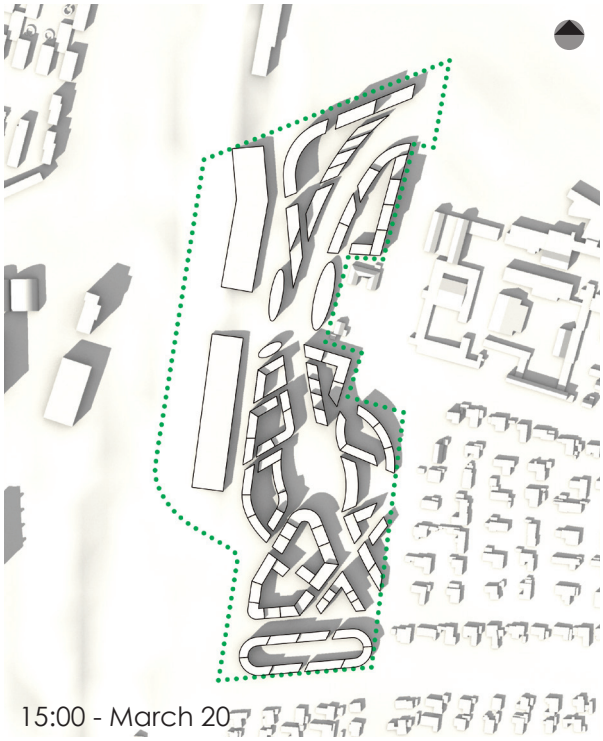
SUN ANALYZES







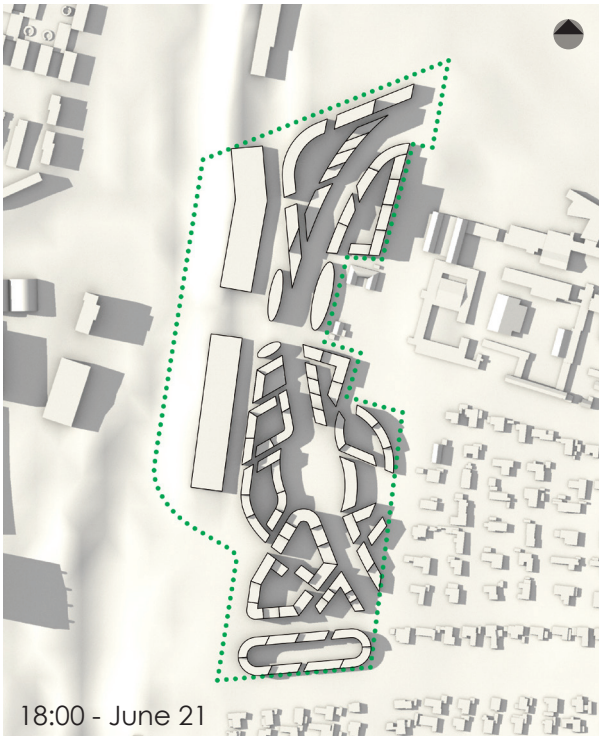




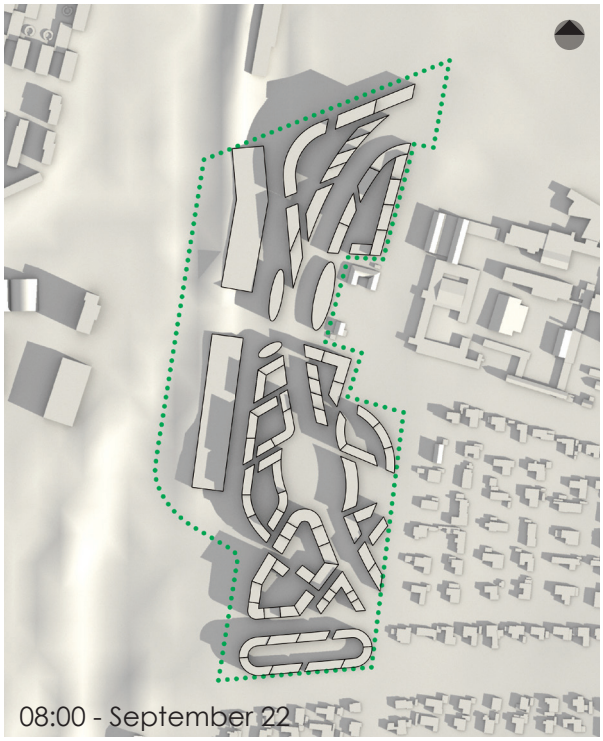
15:00 - March 20

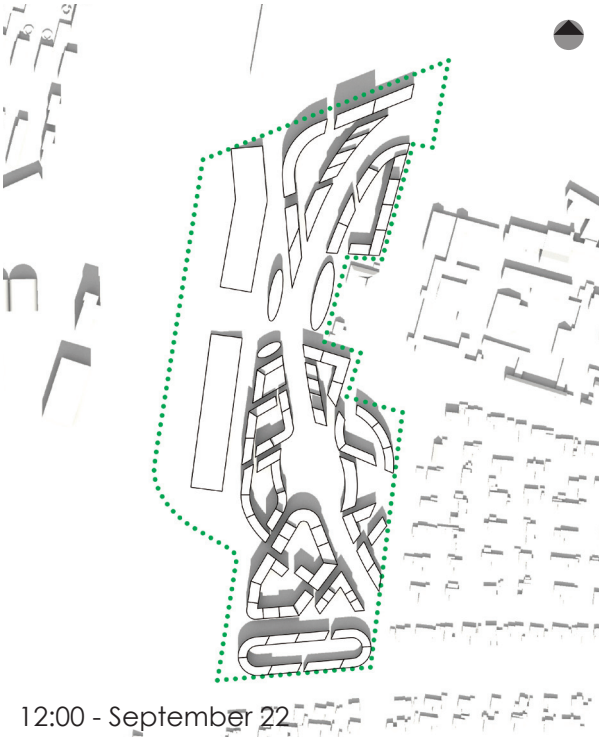
18:00 - March 20

15:00 - June 21

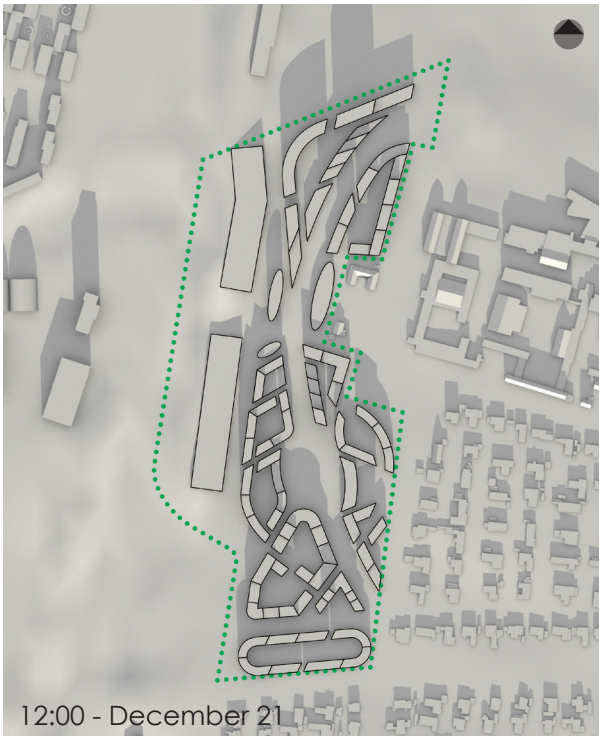


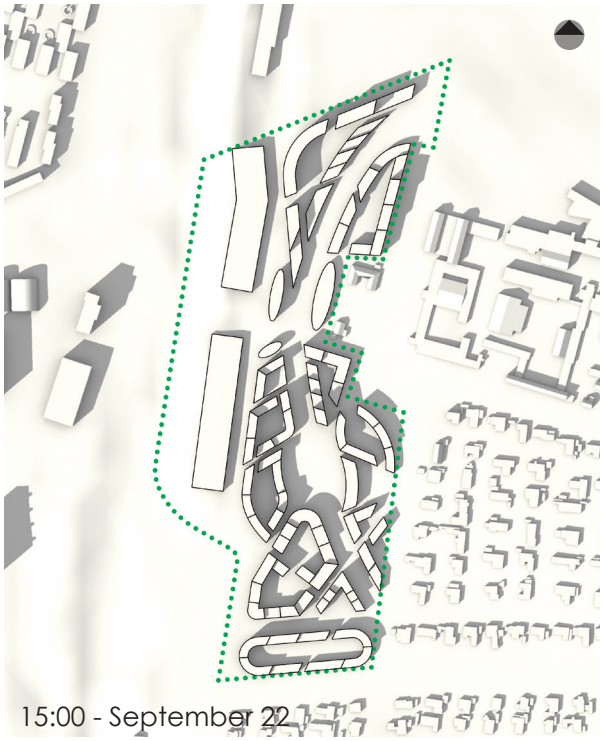
18:00 - June 21


08:00 - September 22

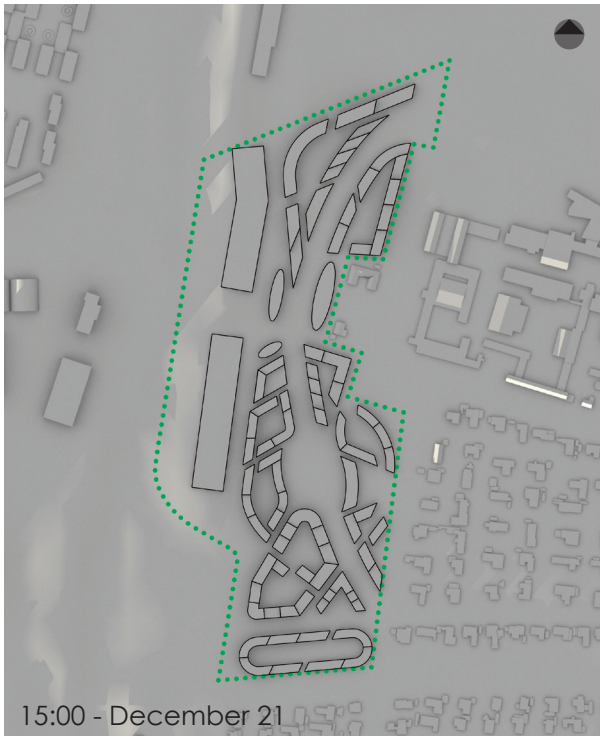

12:00 - September 22


08:00 - December 21


12:00 - December 21


15:00 - September 22


18:00 - September 22


15:00 - December 21


18:00 - December 21