MONKEY TECTURE

HEALTHIFYING THE INFORMATION AGE

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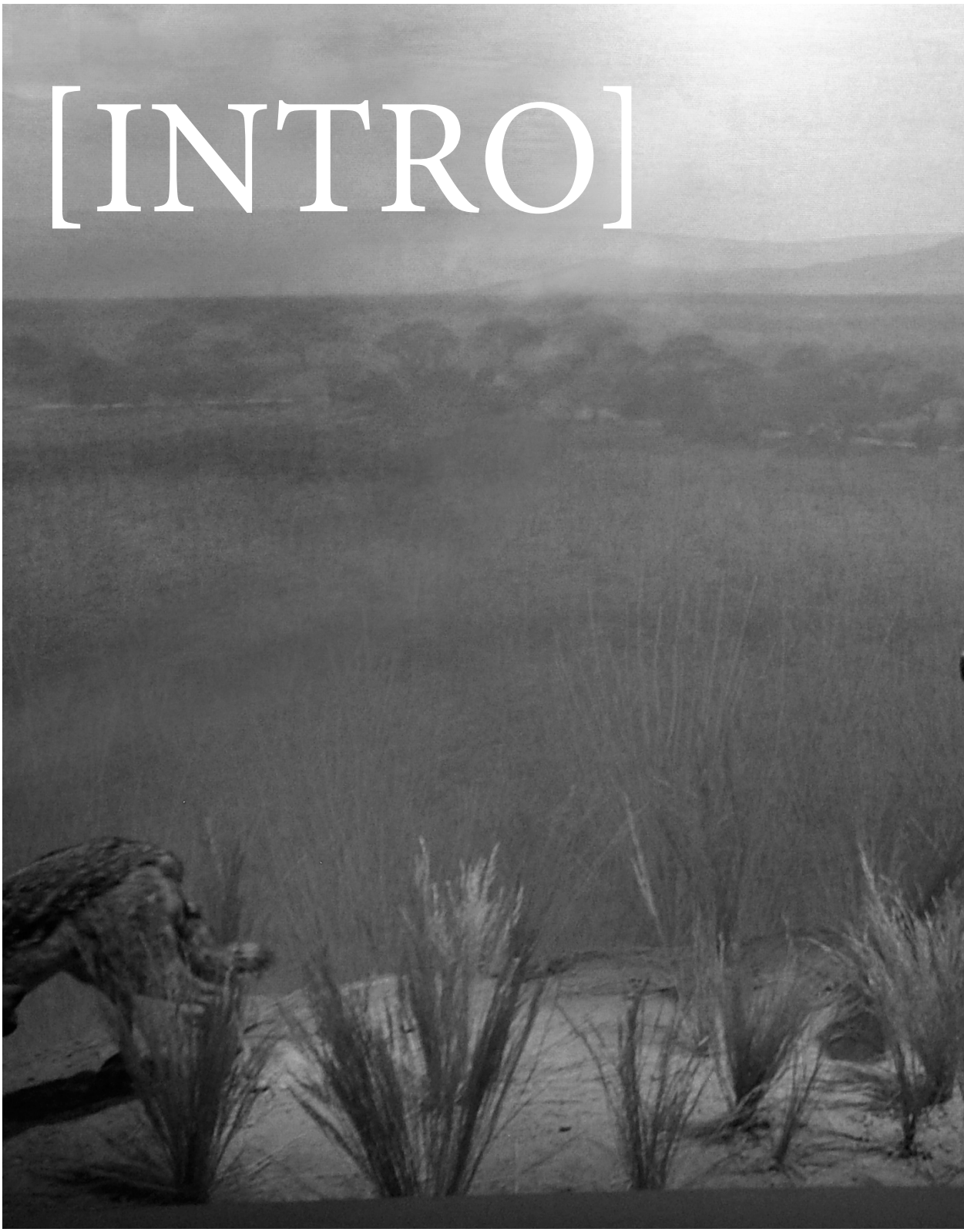
[INTRO]



[SYNOPSIS]

The aim of this master thesis is to design a high rise office building in a dense urban environment that meets the comprehensive needs of future knowledge workers. The scheme for the final proposal will be generated by challenging the traditional ways of designing office buildings, with a fundamental and holistic research into basic physiological needs and the future of information based workspaces.

The architectural focus, given the economic incentives in projects of this scale, will be on creating an efficient prime estate in a location where such an investment would have justifiable urban- and societal benefits. The building should make a profound contribution to the existing skyline and seek to resolve the challenges and negative impact large scale buildings often have on their adjacent street-level urban environment in terms of shadows, wind turbulence and scale.

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[INTRO]

[PROGRAM]

[CONCEPT]

[PRESENTATION]

[EPILOGUE]

[MOTIVATION]

The human body wasn't built for ten hours of sedentary work each day, yet this is the norm for the majority of people working in the urban areas of the information age.

Having experienced firsthand how high levels of inactivity and poor working environments can affect your body and mind and your ability to focus, I understand the issue that many people are facing each day.

Sedentary work is literally killing people and causing many and severe life-style diseases. Even when people with predominantly sedentary work put in an effort to stay healthy by exercising several hours a week, it has little to no effect if they are inactive throughout the majority of the day. (Ferro, 2013)

Sedentary work is literally killing people and causing many and severe life-style diseases. Even when people with predominantly sedentary work put in an effort to stay healthy..

Apart from the physiological risks of sedentary work, a huge boost to well-being, creativity and productivity levels are lost due to mental fatigue caused by the high levels of inactivity that knowledge workers are currently experiencing in the information age. (Hoffmann, 2015)

The driving force of the current economy of the Information Age is created through knowledge based work in diverse range of sectors, but common to most is the sedentary work style and the drawbacks that it has. Despite the importance of this branch of our society, little to no innovation has been made in the field of office design for many decades.

Combining this untapped potential with new and emerging trends in communication technology and advancements in work style and workspace research have intrigue me to choose this subject for my thesis.

[MONKEYTECTURE]

The objective of this project is to create a more coherent synergy between our ancient physiological needs and the modern office environment in which many of us operates throughout the majority of the day. Although we are gradually starting to adapt the office architecture on some parameters like of our physiological needs, such as our need for sufficient daylight, there is still a huge gap between our needs and the opportunities of the environment in which we work.

The title Monkeytecture was chosen to emphasize the fact that we are basically a species of monkeys with brains and bodies that haven't evolved much in the past 50.000 years. (McAuliffe, 2009) But we live in a highly complex world managing complex tasks and collaborating in groups of unprecedented size, while we are physical inactive throughout most of our lives.

Addressing these issues will lay the foundation for the Monkeytecture project. By proposing a novel approach for a future architecture in a dense urban environment, that takes inspiration in basic human needs, this project will seek to resolve a comprehensive and relevant problem.

Logical deductions on afore mentioned issues will be carried out in parallel with an investigation into computational tools, and their applications in solving complex design matters, throughout the design process. The use of advanced digital tools will be incorporated to validate and optimize the intentions of the logical deductions in an ongoing information based design process.

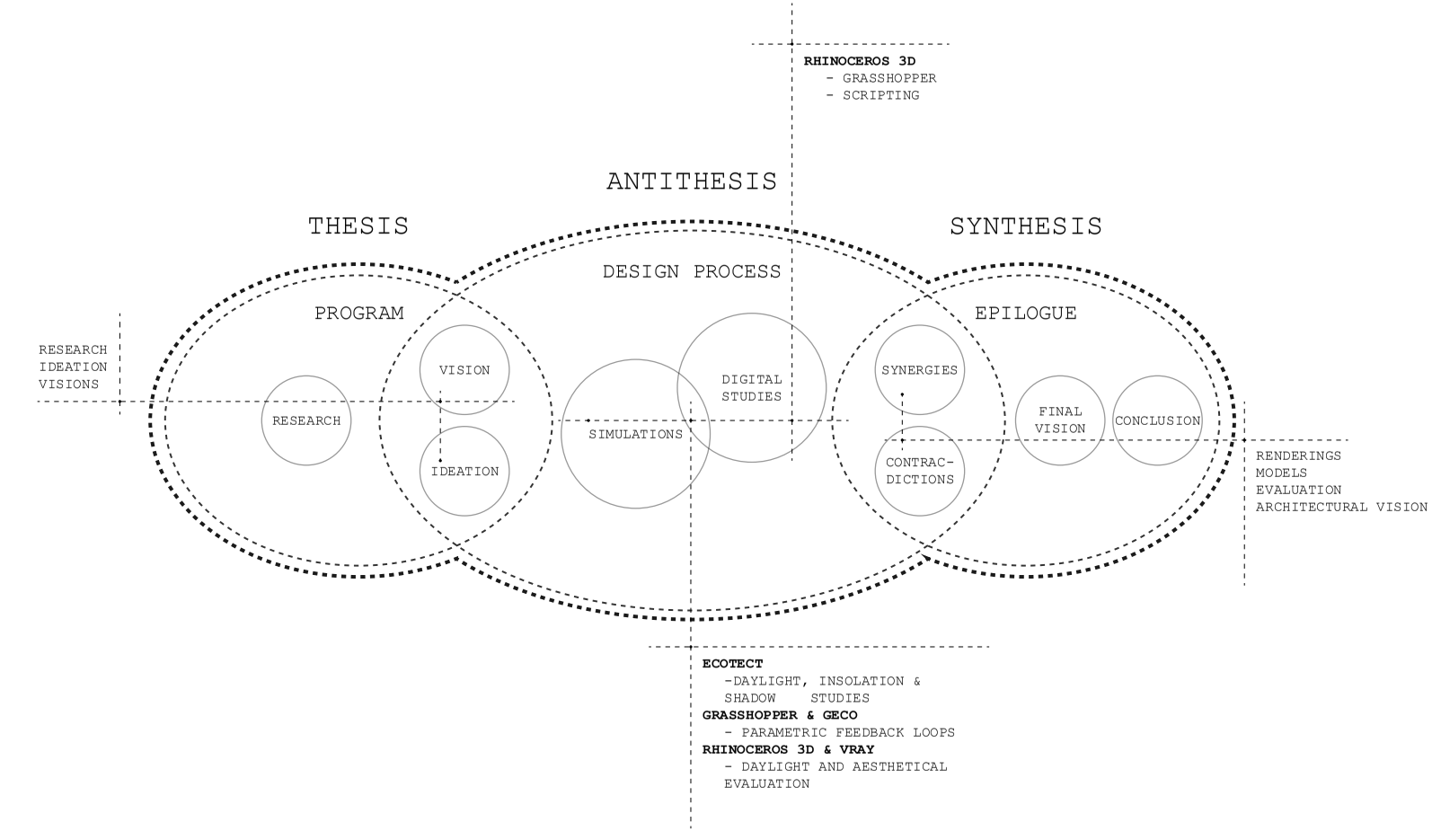
[METHOD]

The following methodology consisting of three overlapping phases will be used to achieve the afore mentioned objectives of the project.

Thesis: In the program an initial thesis will take shape. An intellectual proposition based on an in-depth research of the challenges, the potential and the contextual settings will generate the preliminary ideas and vision for the project.

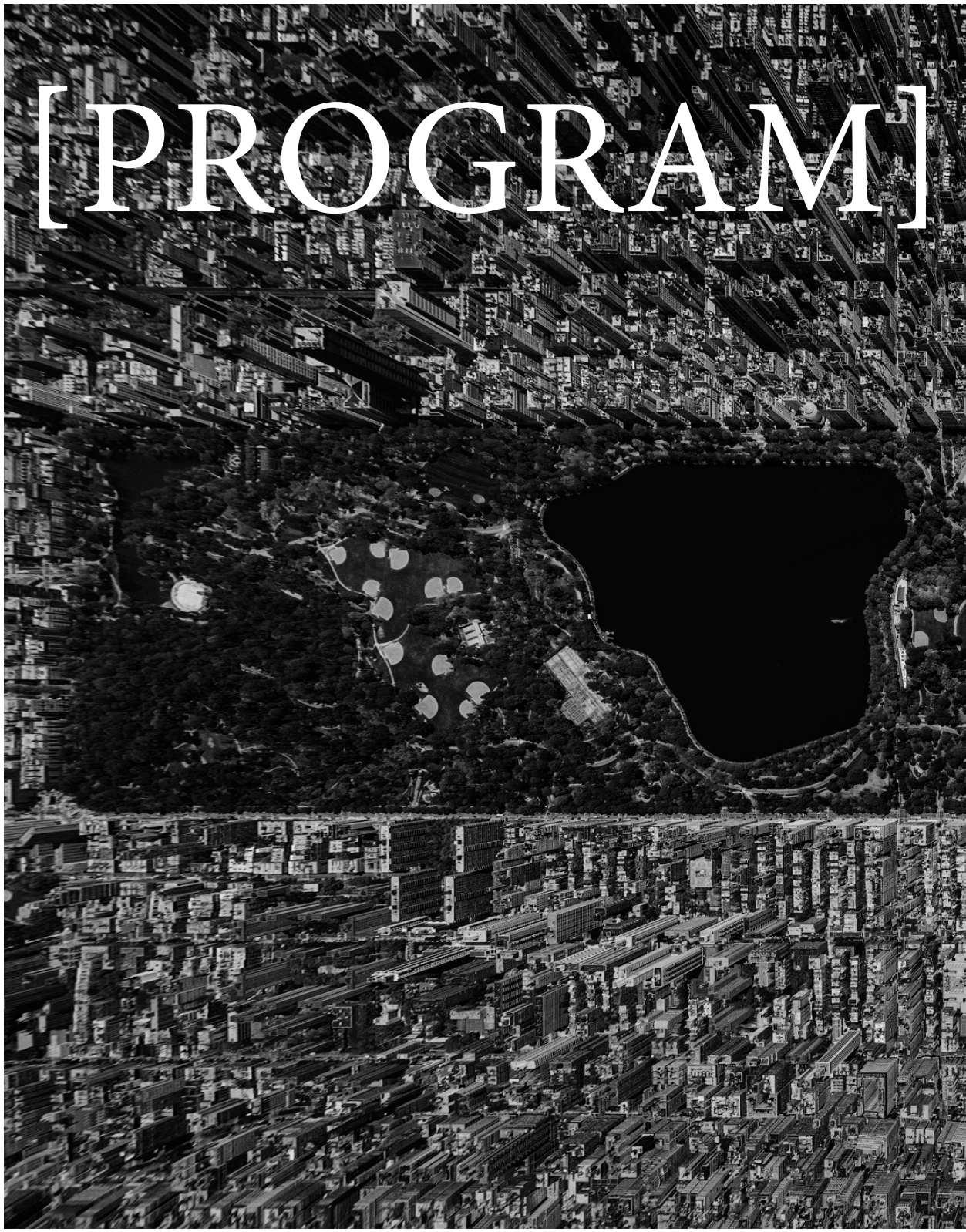
Antithesis: The antithesis will be taking place for the most part during the design process, where the preliminary ideas and visions will be tested, through digital studies, physical studies and analysis other studies.

Synthesis: In the synthesis contradicting conflict between the prior stages are resolved and potential synergies are unified, to conclude a new and improved thesis.



ill. 01 - Method Diagram

[PROGRAM]



[KNOWLEDGE WORKERS]

Approximately 50% of Europe's workforce is currently classified as knowledge workers, a number that is predicted to rise in the future. (Cashman, 2012) The knowledge workers constitute an increasingly important role our economy. They are becoming the backbone of our society, and providing optimal working condition and offices for the knowledge workers to optimize their cognitive performance and keep them healthy is essential for business owners and governments around the world.

The open space office has been embraced as the predominant new type of work environment in most companies and offices of today, with an estimated 70% of all knowledge workers operating in this work environment. (Harrison, 2015) Benefits such as transparent communication, real-

...providing optimal working condition and offices for the knowledge workers to optimize their cognitive performance and keep them healthy is essential...

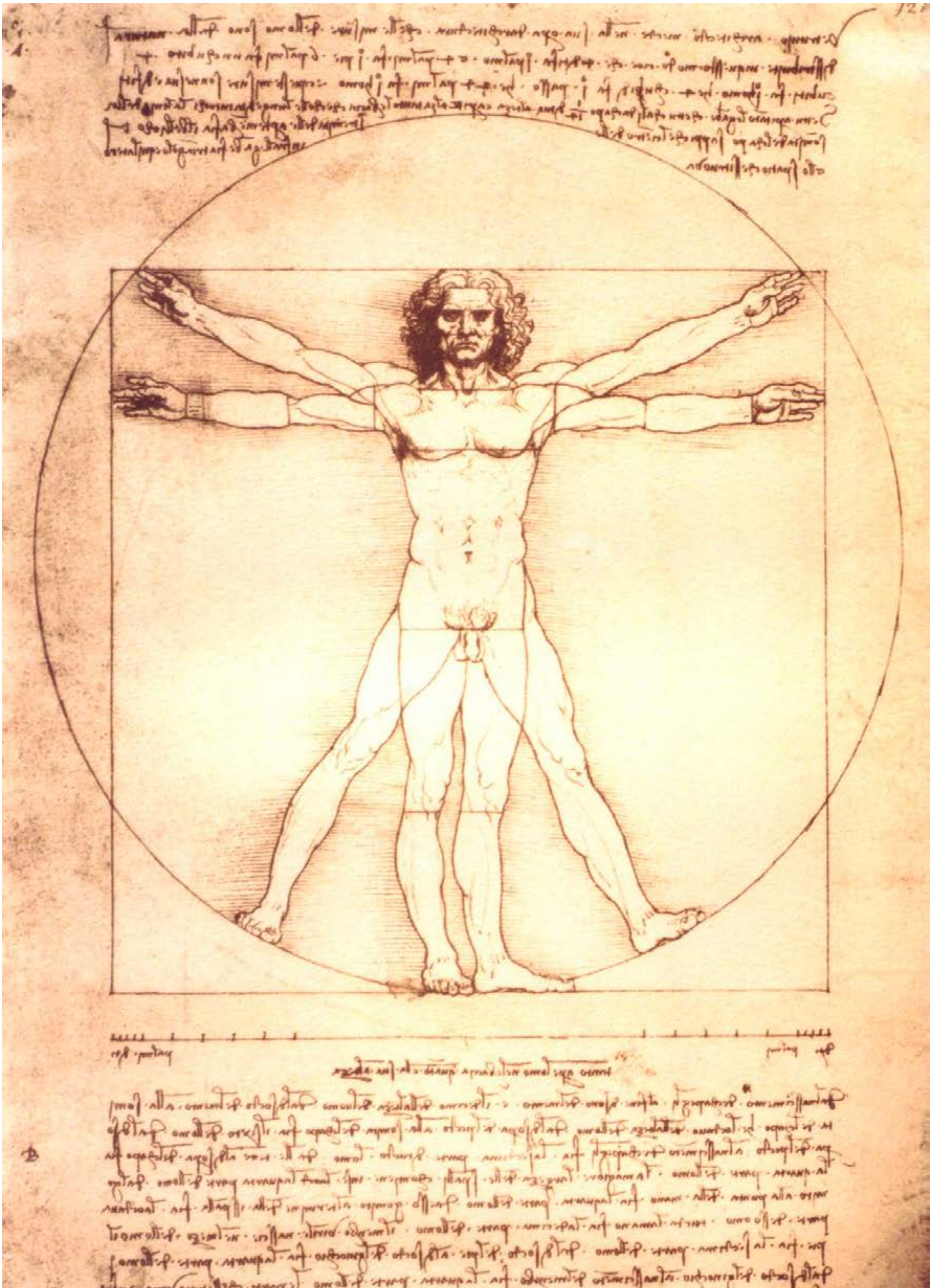
time collaboration and improved workplace efficiency and productivity have made the open office an obvious successor to the cubicles.

While the many open space offices helps spur innovation and collaboration they do still have significant drawbacks. They often lack behind in providing secluded rooms for tasks that requires intense focus, and the users are often distracted, though often unknowingly by background noise and other distractions.

In general many open offices likewise lack a sufficient amount of differentiated zones for the employees to manage different tasks. As work is increasingly transitioning into the digital realm, employees are often struggling finding appropriate physical spaces for plugging-in and tuning-out of various digital channels, making employees less productive and more

stressed. (Harrison, 2015) Though some physical spaces like conference rooms or lobbies can be used for this kind of work, they are not always available nor do they necessarily provide optimal conditions for the task at hand. Research into traditional work environment issues and solutions will be investigated, but proposing a novel office-design that aligns fully with human physiological needs, boost productivity and increase well-being in offices will be the cornerstone of this project.

ill. 02 - Human Evolution



ill. 03 - Vitruvian Man

[PHYSIOLOGY]

Research suggests that humans in hunter gather cultures, walked between 25-30 kilometers a day roughly 35.000 steps. (Pontzer, 2012) Compared to the average activity levels todays knowledge workers at 4352 steps a day, (Bray, 2014) there's an alarming and clearly unhealthy discrepancy.

Our physiology and metabolism hasn't evolved since the hunter-gatherer era nor has our need for physical activity. Physical activity is very important to maintain physical and mental health, and many modern lifestyle disease like obesity, cardiovascular disease, depression, diabetes, back-pain etc. are unheard of in the few remaining hunter gatherer communities of today. (Pontzer, 2012) Apart from mental and health issues associated with lower levels of activity, research have found that higher levels of physical activity can in fact boost productivity, even when the activity is taking place while working.

A yearlong study from University of Minnesota has shown that treadmill desk boost performance of the user's that are using them. After an initial drop in activity during the phasing-in process, of a few months, the user experienced an increased performance on all three parameters measured; quantity of work, quantity of work and quality of communication with other colleagues. (Avner Ben-Ner, 2014) While walking at low speeds can improve performance while working, the office treadmills does have its own set of disadvantages. They can be noisy and thereby be a source of annoyance to colleagues nearby and they take up significant amounts of space in offices. On top of that some user reported that they felt moderate motion sickness similar to that one can experience after un-boarding a ship after a long voyage. (Shontell, 2014)

A solution for incorporating the significant benefits of low intensity physical activity during regular knowledge based work in a more desirable way than the current treadmill solution, will be proposed in this project.

[DAYLIGHT]

Other crucial parameters linked to increased performance, increased well-being and health, are natural daylight and views. Both factors that will play an essential role in the design process to achieve a desirable result.

A sufficient high quality level of natural daylight and a good daylight factor in offices can boost performance, learning abilities and decrease number of sick days drastically. (Wright, 2003) The average company operating in the information based sector have the following allocation of operation costs, salaries 90%, rent 9%, energy 1%, which emphasizes the importance of boosting employee productivity to progress. (Alker, 2014)

However designing office building with high levels of daylight can pose potential problems with regard to glare from direct sunlight and overheating and heat loss due to the properties of glazing. The proposed solution will focus on minimizing these undesirable side-effects and provide a high amount of indirect natural daylight which is the preferred light source.

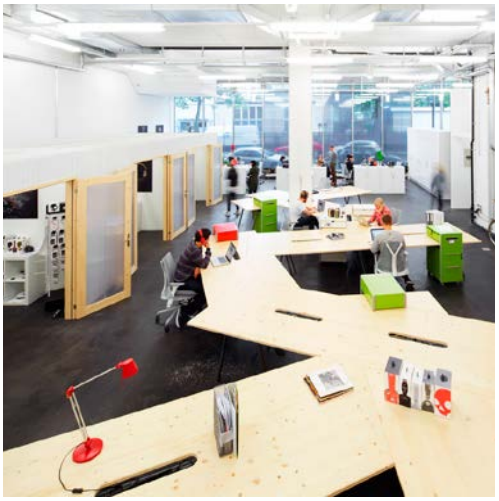
Other studies have found that apart from daylight, views have a profound effect on the same performance parameters as daylight does. According to a Lawrence Berkley National Laboratory study, users in an office with a large unblocked view to outdoors performed 10% better in cognitive acuity test and 16% better in a memory test, than in offices with the same amount daylight but with no views. (LBNL, 2015)

ill. 04 - Sunrise over Manhattan

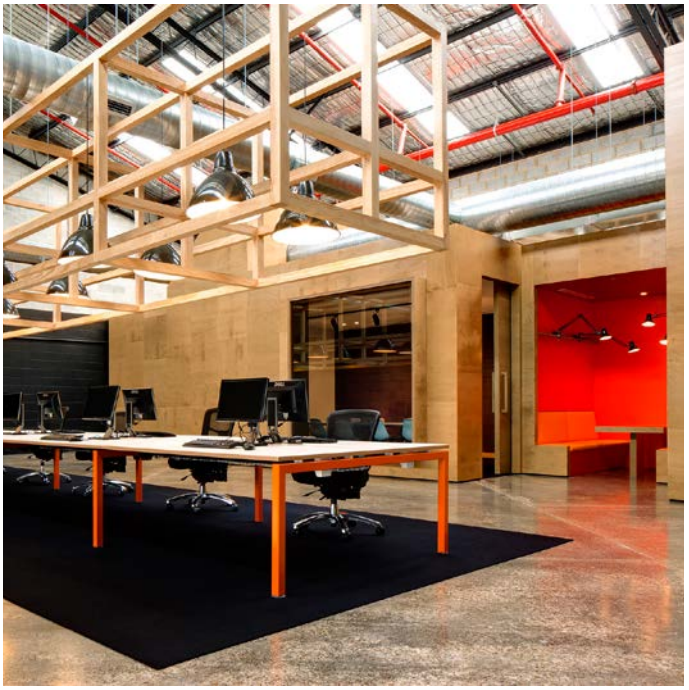
[WORKSPACES]

To establish some design guidelines for the workspace for future knowledge workers a deeper understanding of the trends and development within the field will be needed. In the following section some of the essential trends and studies within the field will be covered.

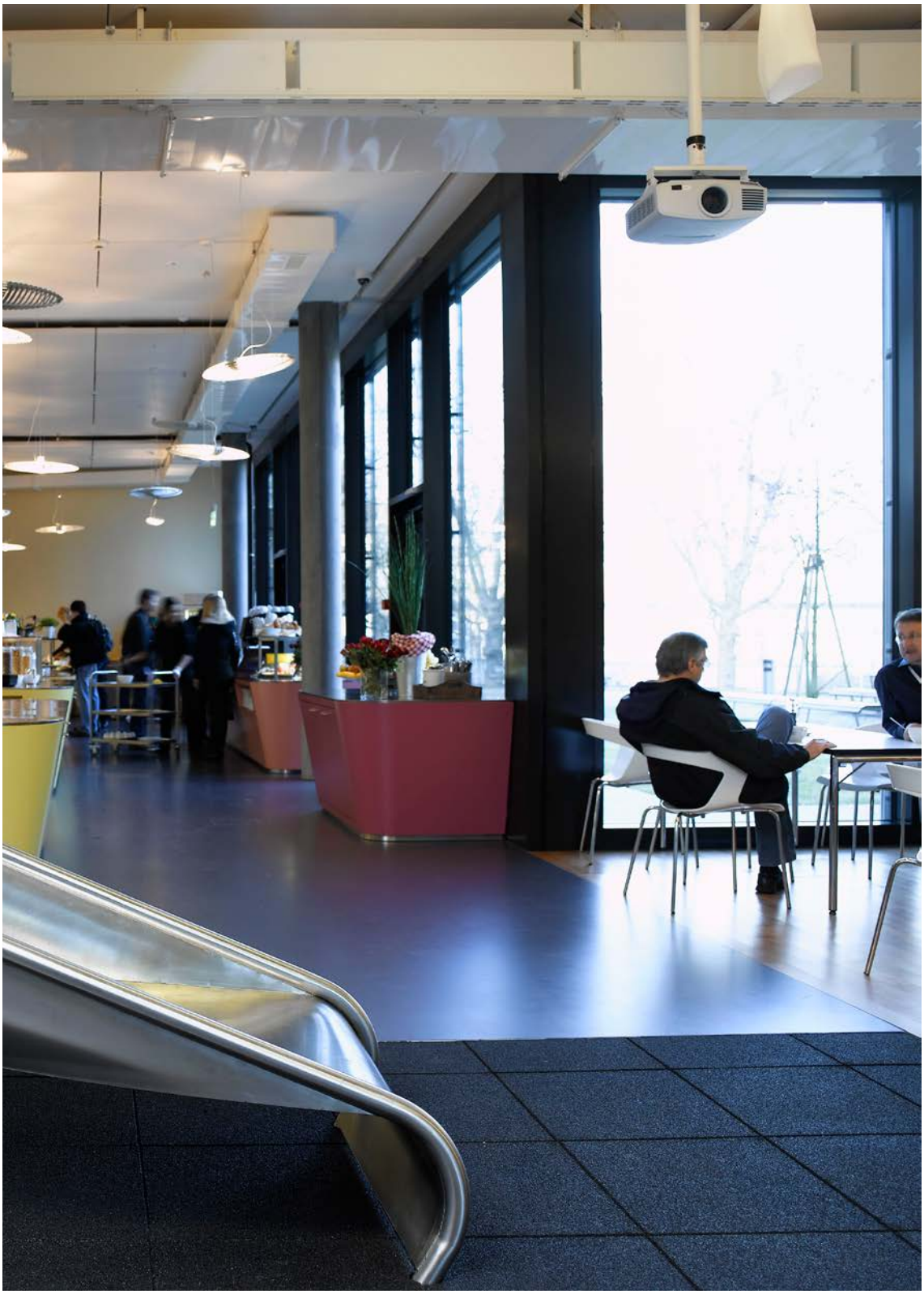
OPEN & PRIVATE - The open office is the predominant form of workspaces for knowledge workers these days. Despite having a lot of critics it remains the dominant form because it fosters collaboration and learning, while nurturing a strong and transparent company culture. (Congfon, 2014)



ill. 05 - Skullcandy Office, Zurich



ill. 06 - Unit B4 Office, Sydney



ill. 07 - Google Office, New York

Research have shown that there's a prevailing way for most teams and people within them to collaborate. People work alone or team up in pairs during idea generation and information processing. At later stages they tend to come together in larger groups to build on and develop those projects or ideas initially created in the smaller teams, only to break apart again to perform specific tasks within the growing project. The need for private moment for people to think or recharge have shown to increase with more demanding collaboration tasks. (Congfon, 2014)

Balancing the need for private and collaborative workspaces, with such dynamic work processes has been a big issue for many companies in the last decades. This has caused many companies and employees to establish a new set of workspaces outside the office, with employees working at home, in coffee shops or in libraries, to accommodate the individual needs of the knowledge

98% of the most highly engaged employees reported that they "had the ability to concentrate easily".. .."were able to work in teams without being disrupted" and "were able to choose where to work according to the task at hand"

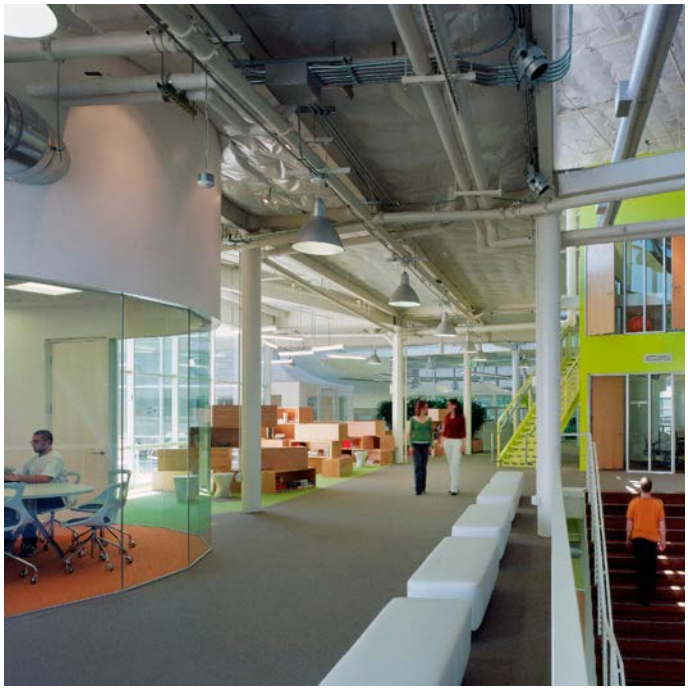
workers. This solution does however create its own set of problems, such as decreased engagement, weaker company culture, less collaboration, diminished transparency and exchange of knowledge. Combining this with a new set of potential distraction that can arise in such workspaces makes this an undesira ble permanent solution.

Private workspaces are defined in terms of acoustic, visual and territorial borders. The private spaces for focus intensive work are most effectively created by empowering individuals to control their stimulatory inputs to their own preferences, without actively putting any effort in to the process of controlling them. The adaptability of the private workspaces is further emphasized by the fact that not only do different individuals have different preferences, but they have different preferences for different modes of focus-intensive work.

A study by Harvard Business Review have shown that providing an ecosystem of different spaces or adaptable spaces that accommodate the knowledge workers individual needs is key to achieve a highly productive company with highly engaged employees.

"98% of the most highly engaged employees reported that they "had the ability to concentrate easily".. .."were able to work in teams without being disrupted" and "were able to choose where to work according to the task at hand"." (Congfon, 2014)

In conclusion - successful workspaces are created through empowering individuals to choose and control their work environment. By giving employees the capacity to draw ideas, knowledge and inspiration from colleagues and easily transition into moments of solitude to recharge, re-energize and do focus intensive work one will get a highly engaged and productive workforce.



ill. 08 - Google Headquarter, Silicon Valley

A perfect example of the success of adaptable workspaces and teams can be found at Valve. Valve is a gaming company with 400 employees, who are allowed to allocated 100% of their time to projects they feel are valuable to the customers. The employees forms small teams called "Cabals" on a basis of their own convictions and skills, the physical location and shape of these cabals are not being managed but are purely created by the individuals the teams and their needs. They do however all tend to start out in small secluded areas of the company, and gradually transition into being more open and transparent as the projects scales. This development of the lack of transparency in the early stages is crucial to Valve's success according to the founder, because many projects need time to mature and evolve before they are ready to be presented and convince more people to join.
This approach has ensured that Valve is a very profitable company, with higher revenues per employee than Microsoft and Apple. (Bernstein, 2014)

The flexibility that comes with system like this adaptable one has the added benefit of being able to address the peak utility issue that many offices are facing. Research suggest that during a normal work day in a traditional knowledge work environment space utilization peaks at 42%. By introducing a more adaptable system where people work where and when they need it, a much higher level of square meters efficiency can be achieve, thus lowering the companies rental expenditures. (Bernstein, 2014)

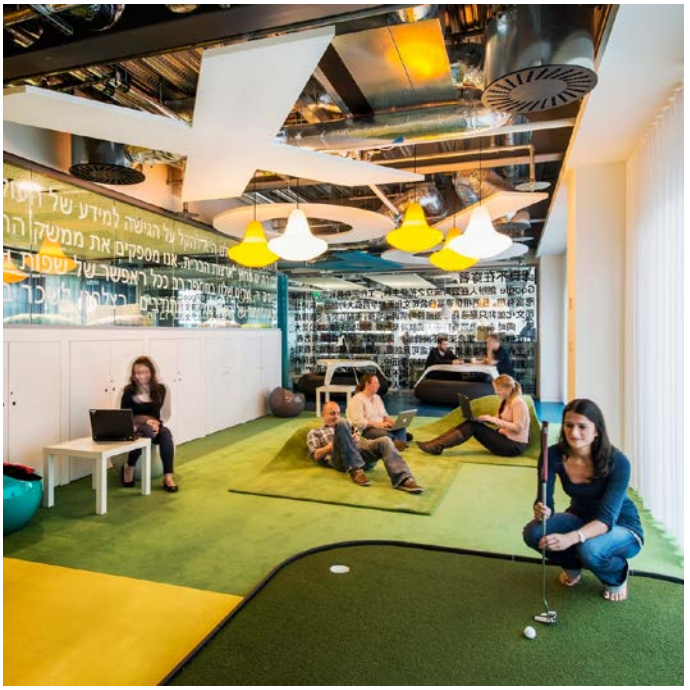
INNOVATION - Many of the most successful companies of today from Google, to Facebook and Yahoo have headquarters that are specifically designed to maximize change encounters between employees, and for good reason. Random change encounters are some of the best agents for innovation in companies, the interdisciplinary discussions of these meets can create new a valuable insights and projects for the company. As the chief of human resources at Yahoo puts it "some of the best decisions and insights come from hallway and cafeteria discussions." (Wabler, 2014)

Promoting random chance encounters by strategically placing kitchens, toilets, coffee machines and other amenities is a crucial for a successful workspace design of today that fosters innovation. Another method for promoting these encounters are the hot desk approach, where employees don't have a assigned seat but are working in a location that they find most practical for the task at hand.

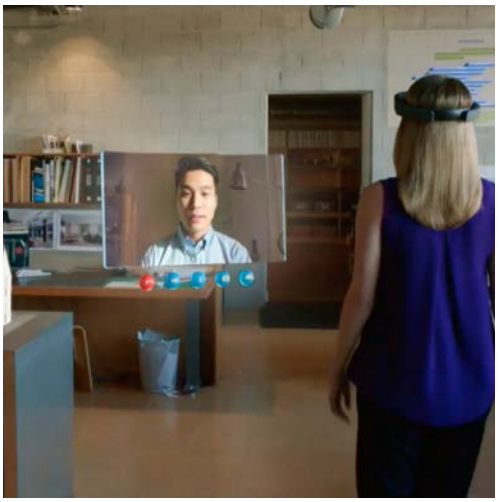
"some of the best decisions and insights come from hallway and cafeteria discussions."

Playful environment and facilities that promote the action of play and relaxation are not only a result of company's wide range of offers to entice talent, but they are legitimate assets for the companies. They too encourage the random chance encounters and provide an often needed break in which employees can relax, re-energize, and perhaps return to their problem with a new perspective or with a new idea generated in the break.

ill. 09 - Google Office, Dublin



ill. 10 - Google Office, Dublin



ill. 11 - Virtual Meetings with Hololens, Microsoft

ill. 12 - Integrated Technology with Moto 360, Motorola

TECHNOLOGY - Using technology for collaboration, storing-, managing- and sharing data have been essential to businesses for many years. But as the technology and the devices become cheaper, more efficient, ubiquitous and more essential, they start to re-shape the way we should think about architecture. (Ouye, 2011) Technology is increasingly becoming a more integrated part of our everyday life and work routines, as the ease-of-use and fidelity is improving. This development will escalates further and become even more pronounces with the emergence of wearable tech.

According to Deloitte this chance will lead to a new borderless knowledge economy where global networks of talent and big-data will be the new currency. Companies will increasingly utilize outside expertize on a temporary or project based level, in various projects, because of the accessibility and flexibility given by new collaborative technologies. (Bourke, 2013)

Cross site and external collaboration through technological platforms will become much more common practice. This means that future offices will needed to be designed to connect and accommodate the facilities for external interaction in to a much bigger extent than we see today in a typical office space with a few videoconference rooms.

[CONDITIONS]

In the following section a few project conditions will be outlined, as the project isn't tailored for a specific brief, these conditions will help to establish a design brief for the project.

- The project will propose a novel design for an office building that accommodates the necessary facilities for future workspaces of the information age, while proposing solutions to the existing problems of today's offices.

- The proposed design should adapt to conditions in year 2020 and beyond, due to the typical time frame of large scale project of 5-10 years, from initial sketches to completion.

- The project will be designed for no particular branch of knowledge workers, but for multiple larger companies that will use the work spaces on a leasing basis. This approach is very similar to that of many large scale projects, where real estate investors cover all construction costs, to keep full ownership and leasing revenue.

- The building must be placed in a dense urban context due to the sustainable advantages of building in dense urban contexts. To narrow down the field of potential sites, the building must be placed in Manhattan in New York City.

- The specific site in Manhattan should be carefully selected on a basis of where the project could contribute the most to the city, the context and to the users of the building.

- The scale of the project should be justifiable by the urban context and the potential economic and societal gains. It should contribute to creating a vibrant and appealing area in the vicinity of the building.

[URBAN DENSITY]

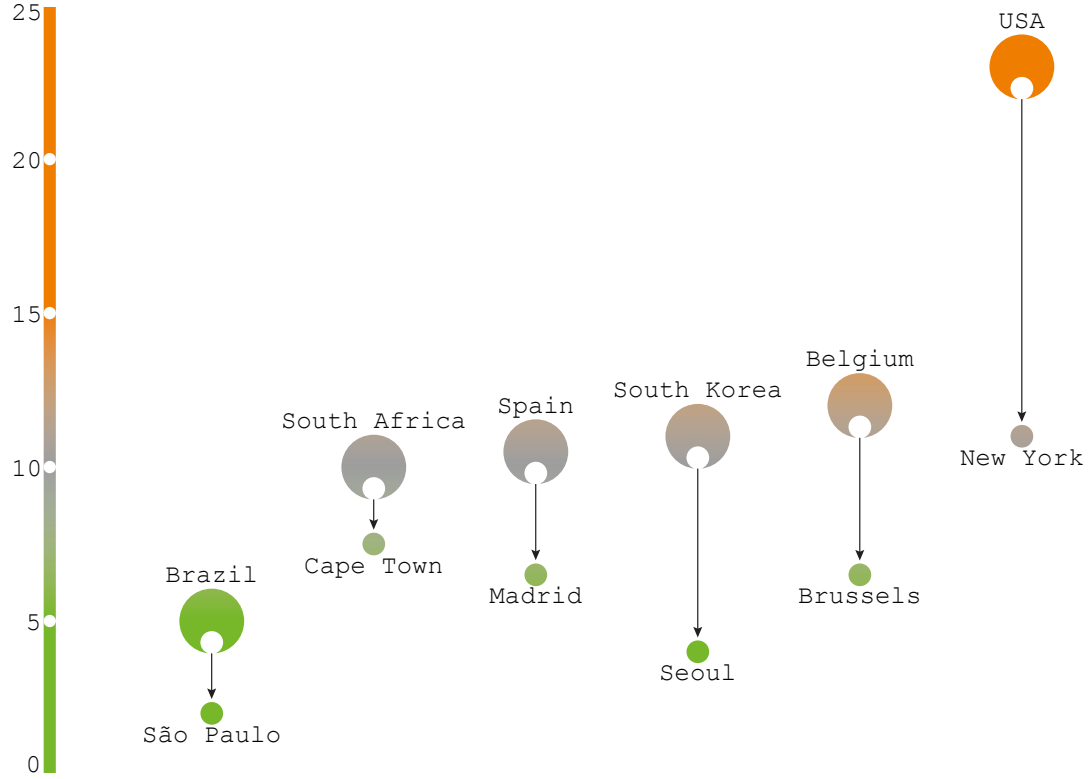
An important aspect of building sustainable is considering the urban density of the proposed site. Dense and compact urban areas have many sustainable advantages over open and low density and scattered topologies, fund in the suburbs and in rural areas. Dense cities provide for shorter distances between various facilities which results in less traffic per inhabitant, shorter supply chains and more efficient ways of recycling and collecting waste and distribution goods.

High density cities optimize the use of land, and the increased demand in dense cities ensures a more sophisticated array of economic, cultural and social services. This array of offers creates a vibrant and lively precinct, which is one of the most sought after contextual assets for employers and employees alike when

"In general densely populated cities emit less CO2 per capita than the national average" (Nat, 2012)

choosing office locations. (Bourke, 2013) When large corporations settles in such areas they contribute to vibrancy of the area generating a self-perpetuating pattern, that is a vital part of the rising prosperity and popularity many large cities are experiencing these years.

Walking, biking and public transportation are often faster and more efficient than commuting by car in high density areas, which is another argument for choosing to build in dense areas when building sustainable. Furthermore are many building typologies found in dense urban areas bigger and benefits from a lower surface to floor area ratio, which makes them less prone to overheating issues and high heat loss rates. (Pedersen, 2009) Based on these advantageous reasons the project will be located in the high density settings of Manhattan.



ill. 13 - Carbon Dioxide emmission per capita in tonnes. (Nat, 2012)

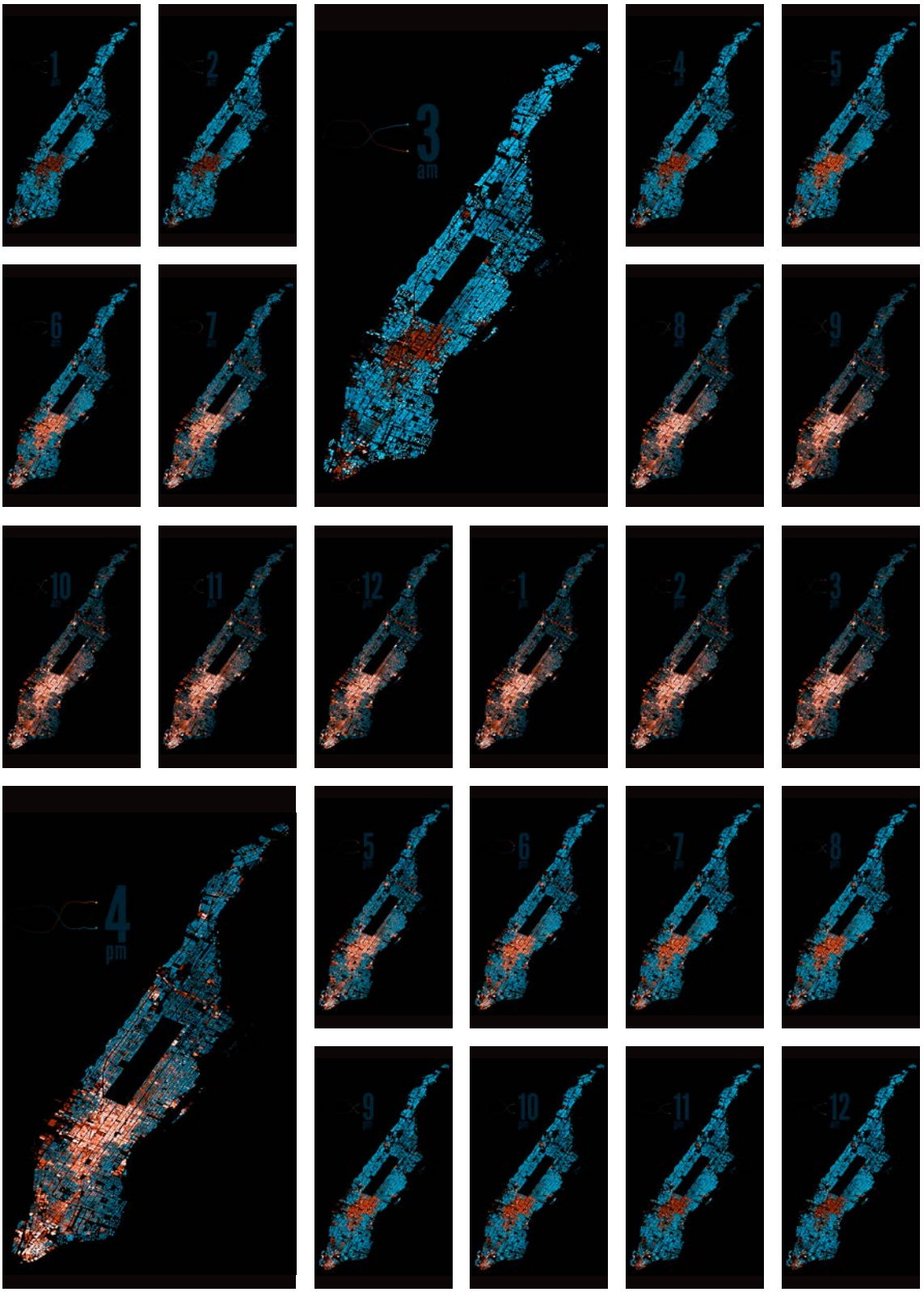
[PROPOSED SITE]

Outlining a few parameters for defining a propose site in Manhattan will be necessary to due to the vast number of possible sites. The selection of the proposed site must be based on the users preferences, urban scale and local considerations.

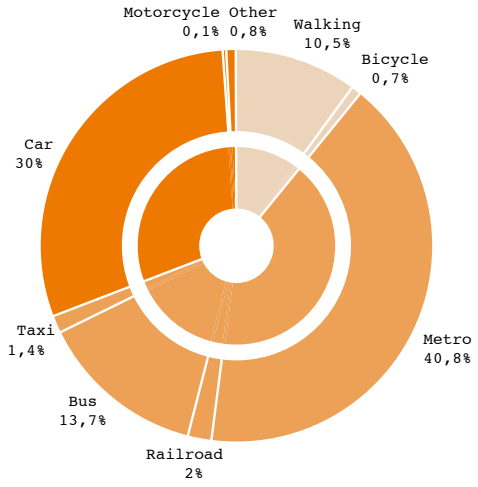
CBRE, an American commercial real estate company, carried out a research in 2014 to determine what location-parameters were most desirable among knowledge workers working in urban environments. The study found that the most four most sought after feature among employees were (CBRE, 2014):

1. A premium location in an attractive neighborhood.
2. Good accessibility to transport for commuters.
3. Staying in a vibrant precinct with nearby amenities and retail options.
4. Good views.

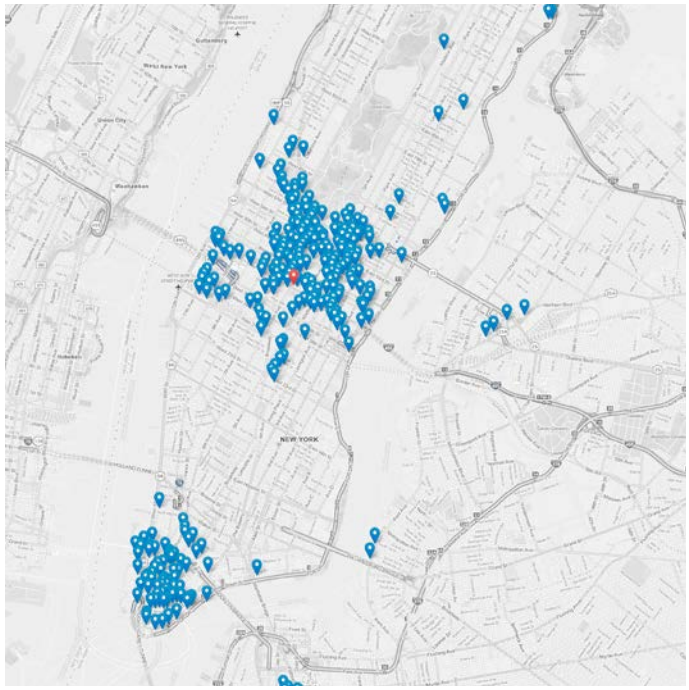
Based on the location preferences in the study the proposed site for this project will be "1100 6th Avenue" in midtown Manhattan. The site is located just north of the popular Bryan Park in a very vibrant and well-connected precinct, with two Metro stations nearby, the preferred transport option amongst New Yorkers, and many other commuting facilities.



ill. 14 - Manhattan's Work (Orange) and Home (Blue) Population by Hour



ill. 15 - Means of transportation in NY



ill. 16 - Location of Buildings of 150m and above in New York.

Site Indicated by the Red Pinpoint.

The site currently hosts an existing office building from 1906 that doesn't receive much praise from the public. "The building is *boring. I am drawn to the Grace building next door. Given its site on Bryant Park and 42nd, more thought should have been put into it* (The existing Building on the site)" Richard Preston.

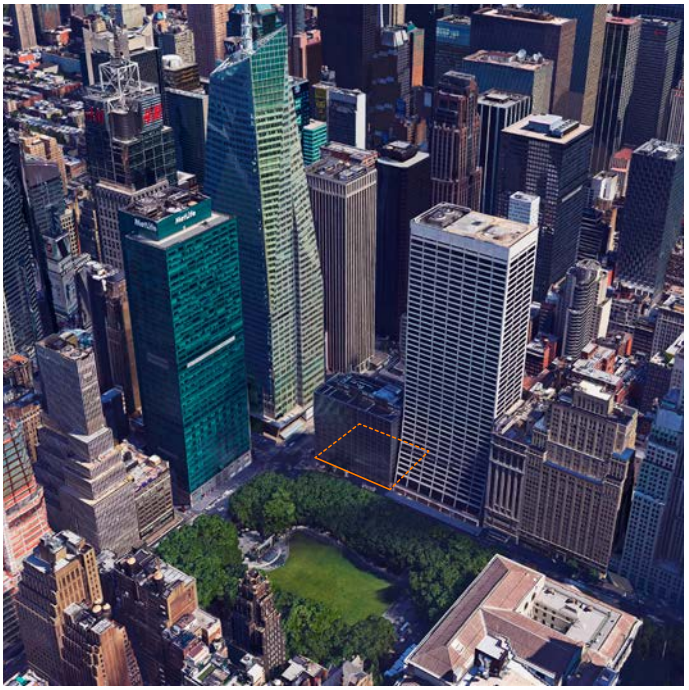
The site is furthermore home to a small public square which is fairly dark, but does offer some recreational facilities to the public. The facilities are however not appreciated by the public "*I didn't like the location (the square), very small and very dark*" Diva.

The final proposal will seek to enhance these facilities and offer recreational spaces for the public of a higher quality. The low density and the poor reception from the public, makes the premium site an ideal candidate for renewal and reprograming.

A different approach was taken with regards to the zoning laws. The zoning laws of Manhattan are rather complex and hard to come by for specific proposals, the laws are essentially a refined version of the 1961 Zoning Resolution for New York City, but has undergone many changes since then and exceptions to the refined zoning restrictions are often made based on another complex reward based system. (Bressi, 1993)
The zoning law guidelines for the project will be based on the contextual environment, and not specific restrictions for the aforementioned reasons. This approach does however closely assemble what zoning laws is all about – "Zoning is a negotiation: it's a balance between the public good and private property rights." (Tarleton, 2014)

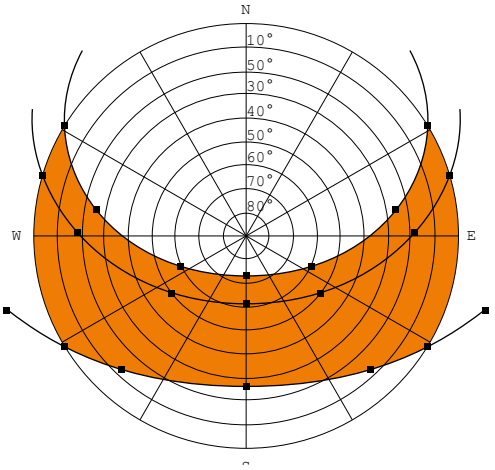
ill. 17 - Siteplan for the Proposed Site

ill. 18 - Location Reference for the Siteplan

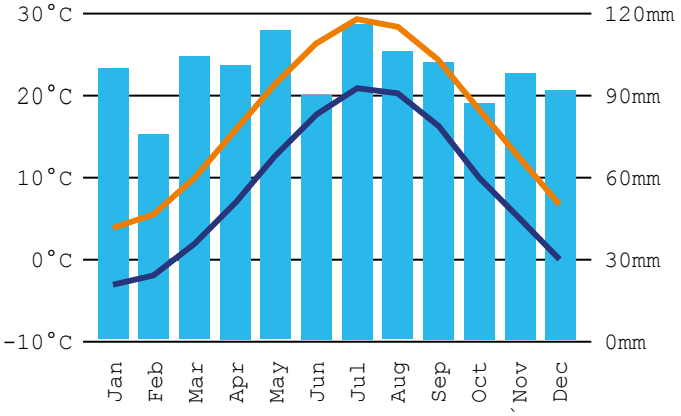


ill. 19 - Site, North of Bryant Park

ill. 20 - Sunpath Diagram for New York



ill. 21 - Monthly Precipitation and avg. Temperature for New York



[CLIMATE]

The climate of New York is humid continental with basically two longer summer and winter seasons. Winters are cold and damp, with offshore wind patterns that minimize the, otherwise moderating, effects from the Atlantic Ocean.

The summer season lasts from May to September with average temperatures in the mid-20s to low-30s. The summer is usually hot and humid with humidity levels above 70%. The heat is further intensified by the Urban Heat Island phenomenon where heat gets trapped in the atmosphere by pavement and other surfaces that absorb high amounts of the sunlight. The lack of greenery and ventilation in the streetscape and the high thermal mass of the buildings and pavement cause this effect, where the temperature in the city can be up to 12 °C higher than in the adjacent rural areas. (Ferro, 2013)

New York experience high temperatures and high levels of insolation from a steep angle of 60 to 70 degrees during summer. Yet it also experience harsh winters with continental climate conditions and very low temperatures. These conditions and the challenges they pose will be taken into consideration for the proposed design.

[URBAN SYNERGY]

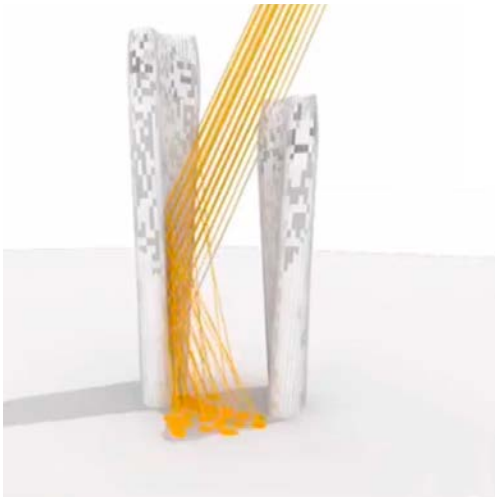
Cities are neither 'built' nor 'planned' but rather steered in a certain direction according to local urban guide lines and plans. These plans are adopted to meet the greater interest of the public good and restrict private property owners to carry out projects that may harm this interest. Some of the most predominant rules and tendencies for current urban development in New York will be covered in this section to establish a project-specific set of guidelines.

In recent years many new and changing trends in the public space have taken place all over the world. Most modern world cities are becoming greener and more people-orientated. The public space is being use for new

"…the areas surveyed in New York have a significantly lower ratio of stationary activities per 100 yards of street compared to other capital cities. Sitting activities are especially few in New York". (Gehl, 2008)

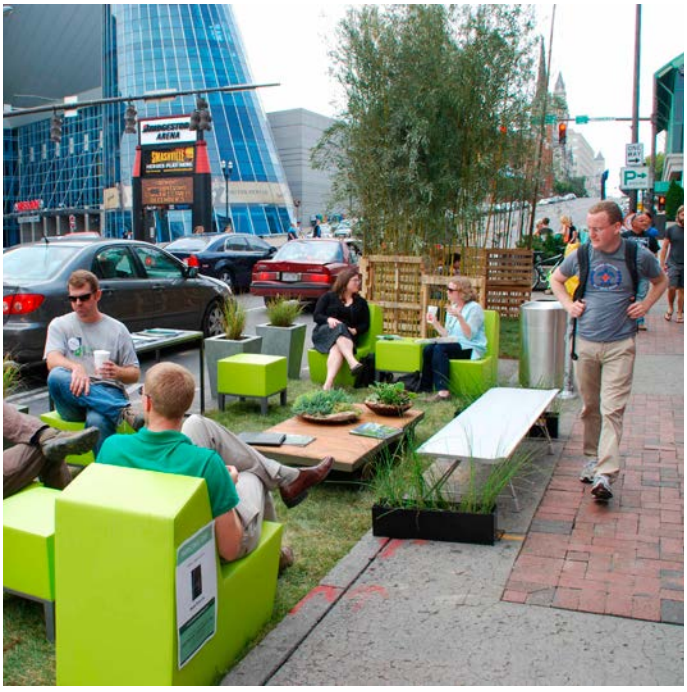
activities and needs to meet new demands. There's an increased interest in sports, cultural events and year-round outdoor activities in the public space. Amenities like waterfronts, parks, nature and fresh air offered by the cities is likewise being requested and utilized by the public. (Gehl, 2008)

The survey carried out by Gehl Architects on New York found that the city had a vibrant street life despite the poor public facilities, but as a result of the density. "…the areas surveyed in New York have a significantly lower ratio of stationary activities per 100 yards of street compared to other capital cities. Sitting activities are especially few in New York". (Gehl, 2008) Among other issues related to the streetscape of New York was the lack of inviting public spaces or rather the inaccessibility of these spaces. There was a lack



ill. 22 - Shadow Strategies for Large Scale Buildings, NBBJ Design.

ill. 23 - Shadow Strategies for Large Scale Buildings, NBBJ Design.



ill. 24 - Breaks in the Streetscape

of inviting public space near the big main roads of the city.

The public spaces offered by the city were cut off from interacting with the indoor environment due to the urban scheme where parks and plazas are separated from adjacent buildings as a result of the grid layout of the city. This design negated the interest for year-round outdoor activities and eliminated other potential urban synergies.

The closed shutter many store front was catalyst for insecurity in the streetscape during night and in the weekends, which left some areas deserted during these periods. An open and inviting ground floor façade that can be illuminated at night would provide a sense of safety, and could revive these areas.

Shadows in the streetscape are another aspect that needs to be taken into consideration especially when designing Skyscrapers. The proposed site is situated just north of the vibrant Bryant Park and doesn't affect the shadows in the park, but one must consider the adjacent public space north of the building during the design process to minimize the negative effects.

Building Specific guidelines for NYC - (Lehnerer, 2013)

- The eaves height of new buildings must be equivalent to that of the neighboring buildings in the local area, to generate a more uniform skyline.
- A block is delimited on all sides by streets, public spaces & parks. Buildings in each block must stay within the vertical extruded boundary of the block.

The proposed design must provide a green and inviting urban space, with a base that easily relates to the human scale. The environment generated at the base should offer a break in the street scape near the big adjacent roads, with adequate seating opportunities and a vibrant urban space where indoor and outdoor environments interacts.

ill. 25 - Open vibrant public space with indoor/outdoor interactions

[FORM FOLLOWS FINANCE]

Finance plays a significant role in the development of the tall building typology in today's urban context. This has been commonly accepted since Cass Gilbert famously announced that "A skyscraper is a machine that makes the land pay" in 1900. There is however a lot more to it. The adaptation of tall buildings works like an organism that migrates and reacts to its new surroundings, cultural- and environmental conditions, and it thrives especially in prosperous economic districts and eras.

The cultural influence is however much less pronounced for office towers than it is for residential skyscraper, as cultural differences in the offices are much less

ill. 26 - Cultural similarities between office buildings in Asia & USA

ill. 27 - Residential Skyscraper in New York Designed Outside-In

ill. 28 - Residential Skyscrapers in Hong Kong Designed Inside-Out

prominent, that they are in the homes of various cultures. Office building tends to adapt more to environmental conditions and less to cultural differences than their residential counterparts. (Chen, 2015)

The famous quote from Gilbert Cass, emphasize the fact that skyscrapers are becoming the only feasible way to profit from very popular central site of today's mega cities, not only from an economical point of view but also from a societal aspect, as the density this approach offers brings many along desirable traits for the local community.

Most office towers have been speculative investment projects from an economic viewpoint. They we're built and designed to house many smaller tenant with profit as an end goal, even in the case of large corporate headquarters that are more often than not build to house other tenants as well.

"A skyscraper is a machine that makes the land pay"
- Cass Gilbert

This emphasis of the economical aspect, leasing income vs built costs, have put some very determining restraint of the design of office towers, as the investors have sought secure and profitable projects for their capital, and true innovation is hard in the field architecture yet the financial risks are very high.

An important part of the predominant economical aspect of designing office towers are the floor to façade area ratio (FFR), as Facades typically constitutes 20% of the combined cost. The important of this aspect can be directly read from the floor plate typology of most office towers where triangular towers rarely occurs , as the triangular floor plate has one of the worst FFR. (Watts, 2010) The typologies for the FFR is naturally sensitive to proportions, but a rectangular floor plate is typically the least efficient followed by a triangular, then the square and the most efficient FFR is found in circular floor plans. The circular and the triangular floor plans

do have some interior layout issues that cause them to appear less often than their FFR justifies. Larger building volumes also generate a good FRR, but the deep volumes can cause poor daylight performance and lack of views.

Another important ratio is the Floor ratio efficiency (FRE), it determines how much of the floor plate area that can be used for offices. The FRE goes down as buildings gets higher, due to requirements for a more extensive core structure at the lower levels, to transfer loads and house elevators shafts. It is important from an efficiency standpoint to seek ways to minimizing infrastructure, ventilation and other "wasted" space in order to maximize the floor plate efficiency, but also to build skyscrapers that are no higher than what is feasible for an efficiency standpoint. Most projects in New York do have relative high levels of FRE, whereas some ego projects as Burj Khalifa have very poor FRE.

[PREMIUM ICONS]

Entrepreneurs and developers rank Iconic Design among their top priorities when building and marketing projects in premium locations, and for good reasons. Iconic buildings like the Gherkin in London can charge well above market rates for their property and have little to no vacancy. The emphasis on the importance of a well-designed iconic building should however not be implemented at the expense of other valuable aspects of the buildings, such as floor plate efficient, which also are among the top priorities for entrepreneurs and developers. (CBRE, 2014)

Other features apart from the iconic qualities are likewise being inquired by tenant of the premium office buildings of today. In North American there's a preference for larger unblocked floor plates of 2000m2 or more, as they give the tenants high levels of flexibility for the interior layout. Some contemporary buildings have been design with a decentralized core to better comply with the preference for the large unblocked floor plates. (Chen, 2015)

A revived focus on the importance of daylight is likewise being implemented in many new premium buildings. Before the advent of electrical light the high levels of daylight was a necessity that were achieved with floor height of around 3.5 meters and shallow room depths of 6-8 meters, which unfortunately are not compliable with todays preference for larger than 2000m2 floor plates.

The proposed design should be a simple, well-articulated and memorable building. That can build a long term affectionate bond with the citizens of the city and generate larger revenue for its investors and developer. The form should balance sculptural vision with rational floor plates and commercial viability, while proposing new and novel ways of incorporating high levels of daylight for the users.

ill. 29 - The Iconic Swiss Re Building, London. aka the Gherkin

ill. 30 - Next Generation Maglev Rail-based Elevators

[INNOVATION]

An essential part of designing a state of the art premium office tower is to utilize the potential of the latest advancements in tech, innovation and material science. A non-comprehensive set of solutions among these advancements will be investigated in this section, with the intention of incorporating them into the design process.

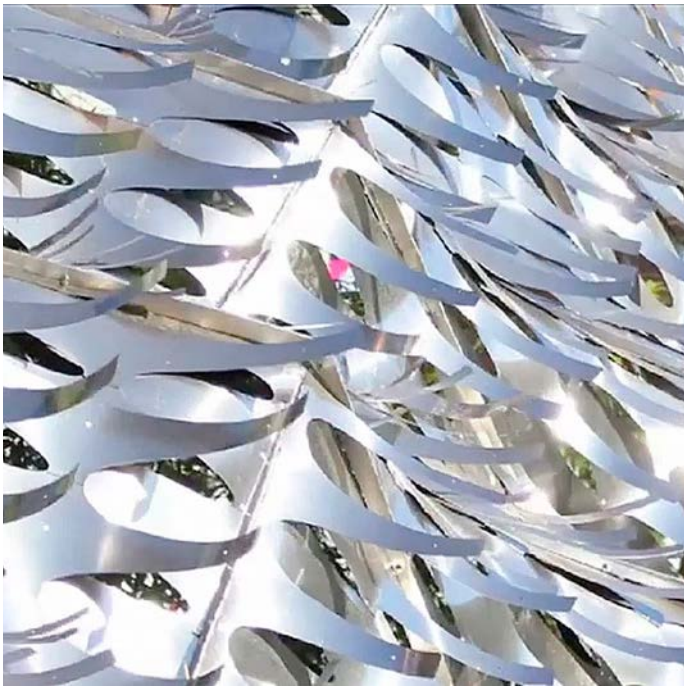
NEXT GEN. ELEVATORS – Cores have traditionally constituted a large part of the floor plate area, especially in taller skyscrapers. This "wasted space" in the found in all premium locations are caused not so much by the load bearing structure, but more so by the extensive elevator

network required operate these tall buildings. The basic design of the elevator hasn't changed much since it revolutionized the city scape in the late 19th century, but the next gen. maglev based wireless elevators by ThyssenKrupp may cause a breakthrough in the industry.

The new maglev based elevator system called MULTI, do away with the inefficient notion that one elevator shaft only can support one cabin. The new system allows for multiple cabins per shaft, while simultaneously supporting vertical and horizontal transportation of the cabins. (Schierenbeck, 2014) This allows for many new and much more efficient infrastructure design schemes for skyscraper with circular flow and little to no delay for the passengers.

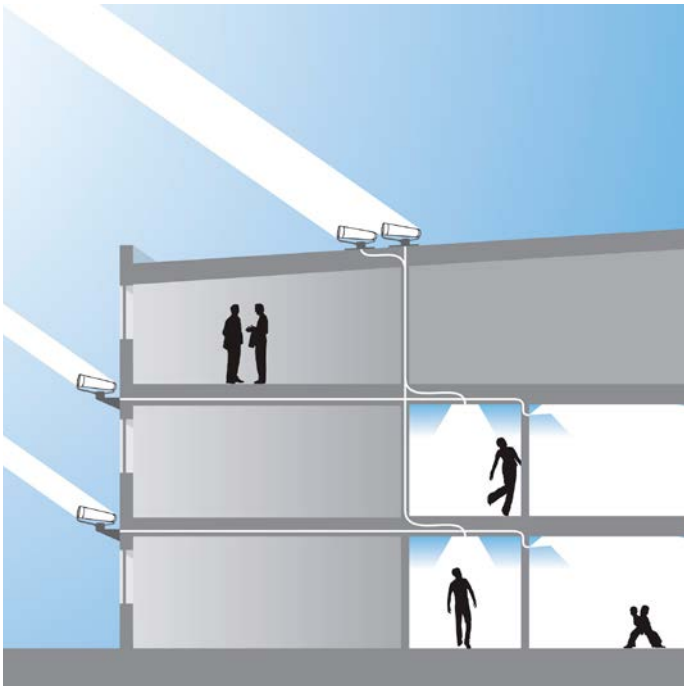
Approximately 20% of any high-rise building is used for elevators but with the MULTI system this wasted area could be reduced by 50%, allowing for far better utilization of space and a denser more sustainable urban environment. (Grush, 2015) Combining that with the higher levels of flow efficiency in the building makes MULTI an ideal solution for future urban skyscrapers.

THERMO-BIMETALS – Large buildings accounts for 45% of New York's energy consumption, a large portion of this consumption comes from cooling and ventilation, of office buildings. (Hsu, 2012)
Thermal bimetals is a "smart material" that adapts to temperature-related changes in the environment. It is made of a lamination of two different metals, with different heat coefficients of expansion that cause the material to bend as desired upon change in temperature. (Sung, 2012) Thermo-bimetals material can be used in various parts of building design from shading to ventilation and in other application where a change in temperature may call for adaptation of the building. The advantages of this material is that it requires no control and no externally infused energy other than that found in the environment. Thermo-bimetals can complement, enhance or substitute existing solutions in a building in a desirable way through its distinct advantages.



ill. 31 - Thermo-bimetal Surface Prototype

FIBER OPTICS - The majority of the expenditures for any tenant working in the information based economy are usually salary for employees, so getting the most of the employees is essential. High levels of natural light are linked to increased well-being and increased productivity by up to 16% (Nilsson, 2013), but distribution natural light into deep building volumes can be a challenge. Fiber optic lighting channels can be a solution to this problem. By redirection natural sunlight from rooftops and façade or other areas with abundant sunlight, via fiber optics cables to nearby areas, like central parts of a deep building volume. This solution ensure adequate amount of the highest quality of light, natural sunlight, in areas where it is much needed.



ill. 32 - Fiber Optic Lighting Channels

[VISION]

The proposed design should challenge the sedentary work style of the modern office worker of the information age, and propose a healthier more productive scheme, with higher levels of physical activity, that would benefit employers and employees.

It should generate a premium, yet financial feasible, indoor working environment with high levels of natural light and exclusive views will be essential.

A balance between the benefits of open office environments and the need for secluded spaces, while providing proper settings for future methods of communication, should be emphasized in the room program.

The iconic building should be a beacon for urban life, with inviting public facilities, open spaces and indoor/ outdoor interactions for the public to enjoy. It should be able to build a long term affectionate bond with the citizens, and provide a high level of urban synergy with the context.

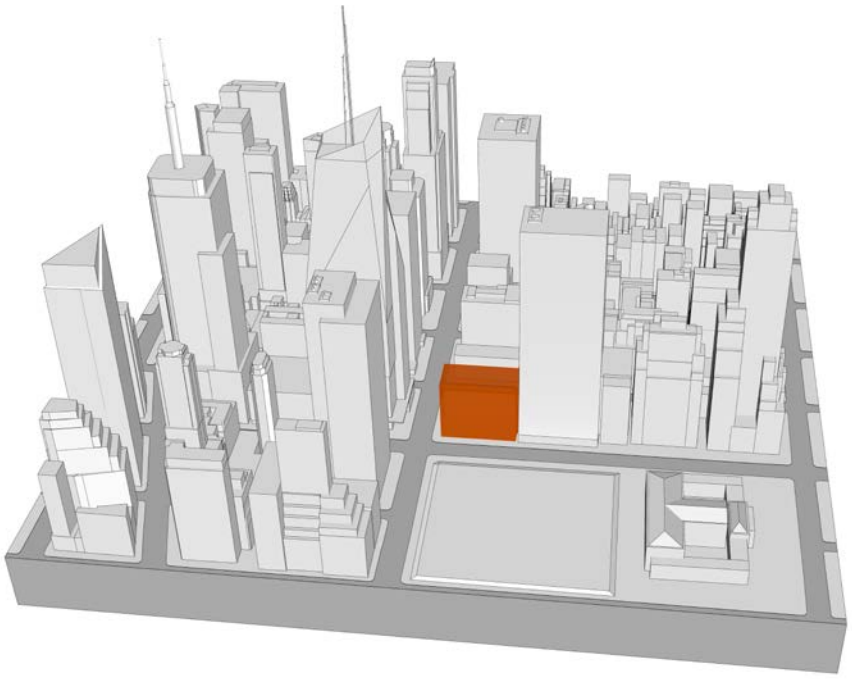
The layout should promote a strong company culture and generate a high level of random chance encounters among employees, to spur innovation and company transparency. A flexible workspace with a consequently higher level of floor space utilization that empowers the individuals to choose and control their work environment will be the objective.

The goal will be to create an efficient cutting edge building with desirable features, by utilizing the latest advancements in tech, innovation and material-science within the field.

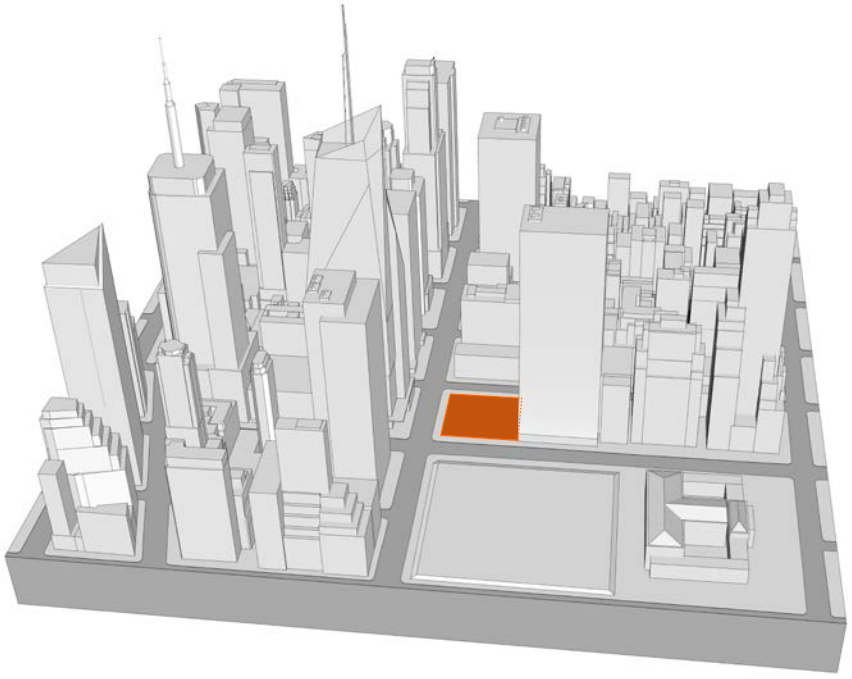
[CONCEPT]

[DCP]

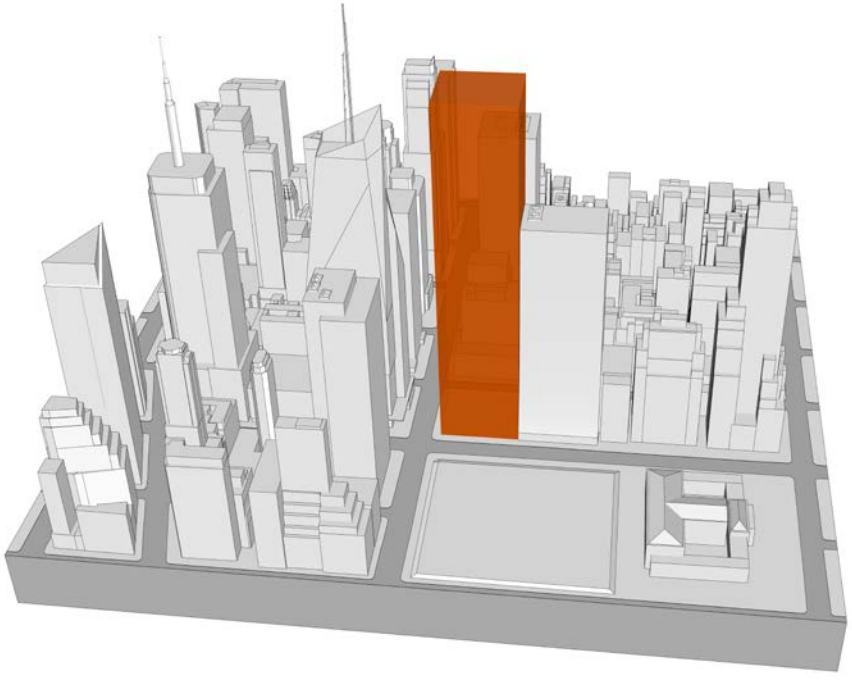
The proposed development control plan (DCP) in this section will be established to serve as a guideline for the later massing studies and concept development stages. The DCP guidelines are traditionally established by the city council to achieve a balance between urban synergy and private property interests. The building mass must be contained within the DCP and infringements of the DCP guidelines only occur in rare instances when very strong arguments are given.



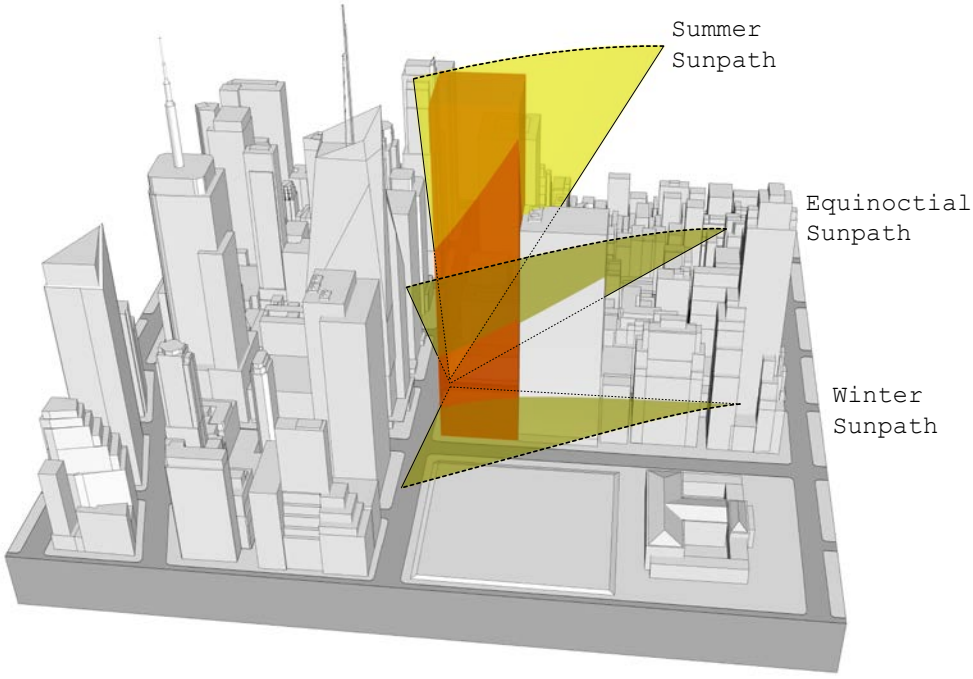
ill. 33 - Existing Building
The existing building will be demolished, to densify the city and generate higher levels of urban synergy.



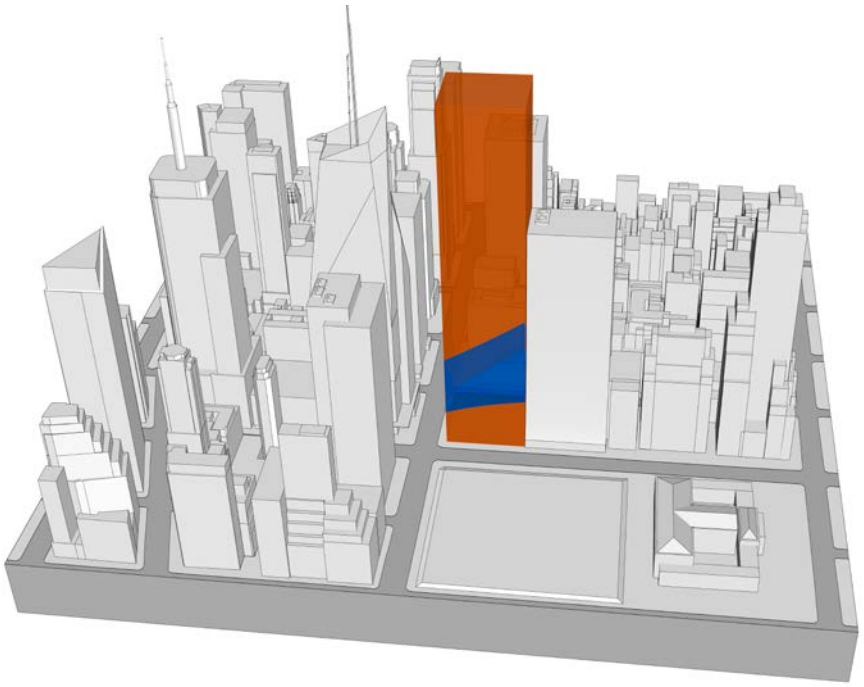
ill. 34 - Site Boundary
The site boundary is defined by the standard block size with standard sidewalk width of 7,5m.



ill. 35 - Initial DCP
The initial DCP will be set at 300m to maximize the utilization of the premium site, match the urban context and densiify the urban fabric.



ill. 36 - Seasonal Sun Paths
Utilizing the solstice and equinoctial sun paths as guidelines for the proposed DCP.



ill. 37 - Proposed DCP
The structural elements and the buildings mass should be minimized in the blue zone of the proposed DCP to emit sunlight into the street scape during fall winter and spring. The shading provided by the orange primary building mass zone will be most distinctive during the hottest months of the year, and provide a more comfortable space in the street scape near the building.

[DAYLIGHT]

The crucial rule of natural light in healthy office environments calls for a profound daylight strategy for the site, in order to utilize it to its fullest potential.

The square footprint typology, determined by the site, the low floor to façade area ratio (FFR) and the good interior layout conditions, will be typology of choice for this project and the daylight studies.
Coming to terms with the basic typology opens up for further research into optimizing the particular form in terms of dimensions and proportions. To find an optimal solution some quantifiable goals is needed.

A daylight factor of 3% or more is considered adequate and well lit conditions for office environment (Otis, 2009), and will be used as one of many yardsticks for quality of the final proposal. Another important aspect is to maximize the amount of square meters on the site, in order to achieve high levels of urban density and consider developers interest. However, maximizing square meters often results in deep building volumes with poor daylight conditions.

In these studies quantifiable data will be used to optimize the amount of proper lit square meters that the site can host. Computational evolutionary algorithms combined with environmental simulation tools will be used to determine the proportions for the design scheme with highest amount of square meters that has a daylight factor for 3% or more. In the study the effect of various floor heights, floor slab inclinations, floor slab size, and orientation will be investigated.

The following parameter will be used in the study in order to achieve an optimal design for the given fitness:

1. Floor Height
2. Floor Slab Inclination
3. Floor Slab Size
4. Floor Slab Orientation

EVOLUTIONARY ALGORTIHMS - there are certain benefits and limitations linked to using evolutionary algorithms. The mechanisms behind digital evolutionary algorithms, is very similar to those of biological evolution that has changed living organism for the past 3.5 billion years. It is mechanisms like reproduction, mutation, recombination and selection that produce candidate solutions to meet the fitness function, which in this case most square meters with a DF of 3% or more.

In nature many fitness functions are combined, making the process an open-ended process which is much more complex, mutative and innovative. Some fitness functions in nature might be; to develop methods to escape a predator or build fat deposits to survive the winter, but little to

no restraints are put on these open-process which is why they are so complex.

When creating artificial digital evolution the fitness functions doesn't change over time due to the restrained nature of the variables in the algorithm. By making the algorithm drastically more simple and restrained, it is possible to achieve usable result in less than the millions of iterations that used in nature. But even when simplified, artificial evolution or evolutionary algorithms are slow, especially when dealing complicated calculations.

The daylight calculations used in this study are fairly complicated. Each iteration takes app. 15 seconds, with many generations and a population of 50 in each generation the computation took more than 36 hours to complete.

The process is a trial and error approach that is making use of the aforementioned mechanisms, it doesn't guarantee a "best" solution, but over time it will converge towards an optimal solution for a design scheme for the given fitness.

The easiest way to illustrate the process is make an example with 2 genes (variables), and a fitness function which calls for the highest possible value.

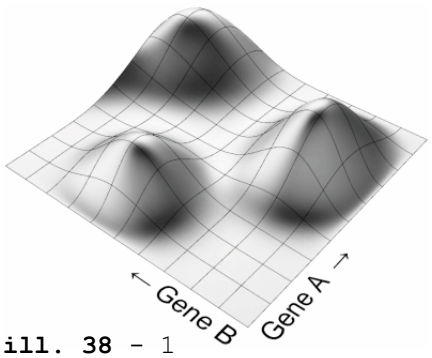
1. The evolutionary solver is not intelligent nor does have any idea where the best solution may be found. The fitness landscape (the grey surface) does not yet exist, but it will be displayed in this example for the sake of comprehension.

2. In the first generation all solutions are spread randomly across the fitness field as the algorithm has no idea where to find the best solutions. Each red dot represents a solution.

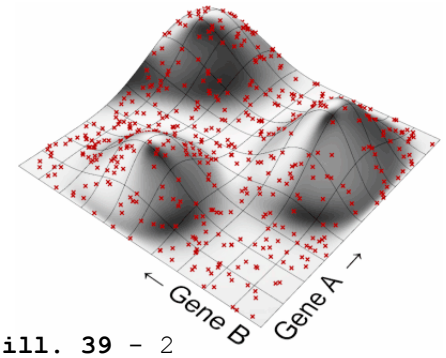
3. After the first generation/ iteration the algorithm knows how fit every genome/solutions in that specific generation is. As the fitness function is searching for

the highest possible value in the fitness landscape the algorithm starts to kill off solutions with lower values, as it is reasonable to assume (but not always true) that genomes with a high value will be closer to an even better genome/solution. The high value solutions that haven't been killed off will be set to breed with other high value solutions or mutated into new solution thus exploring new ground.

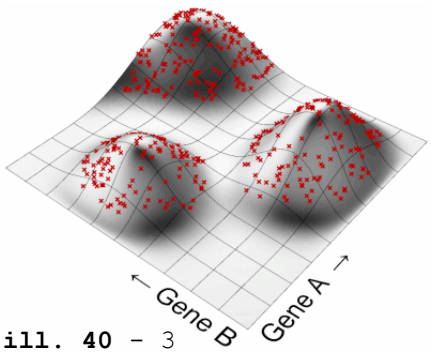
4. Over time the lower value solutions will gradually be killed off, and the solutions will begin to cluster around the fitness peak values.



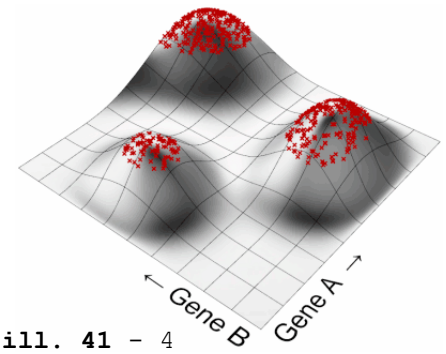
ill. 38 - 1



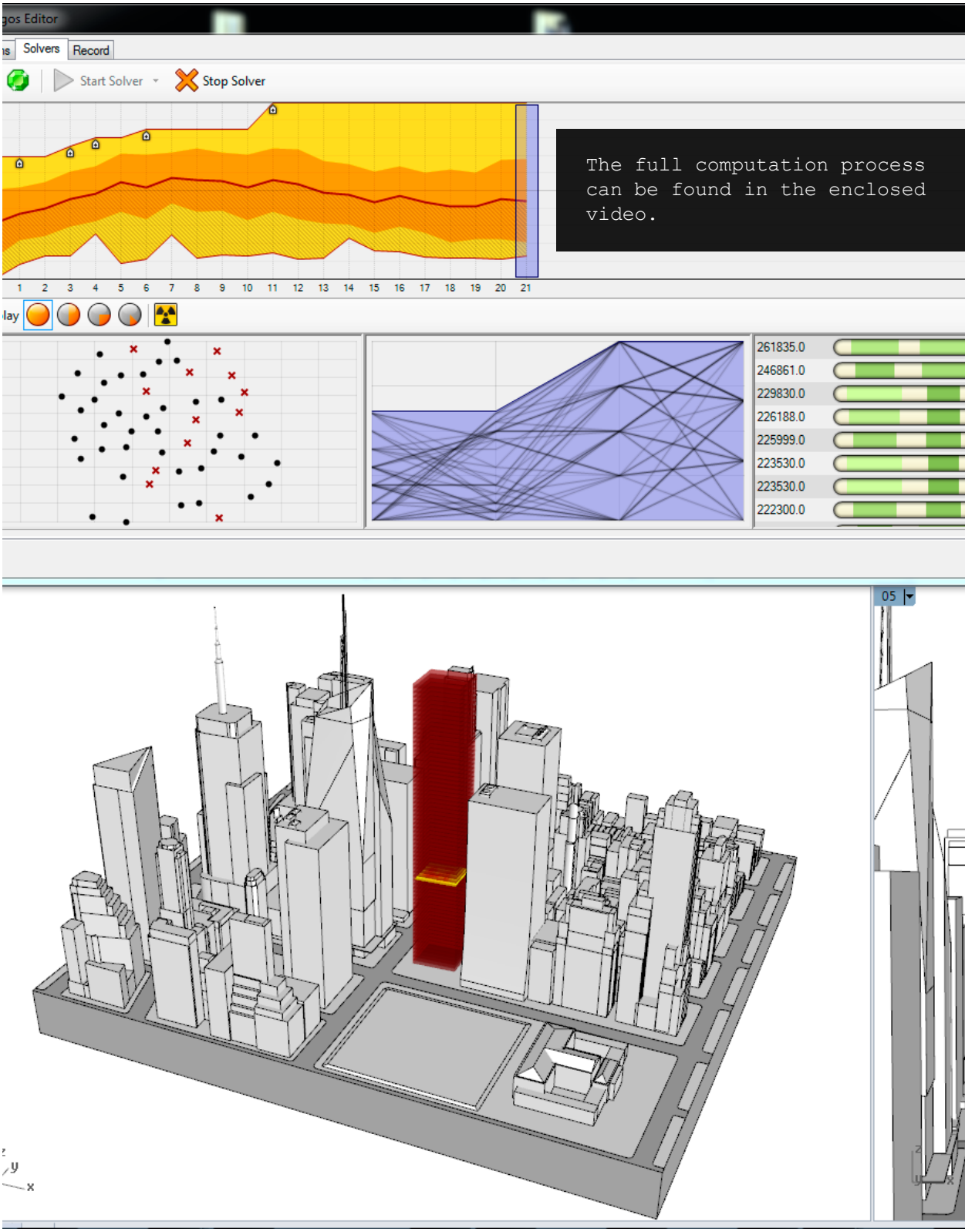
ill. 39 - 2



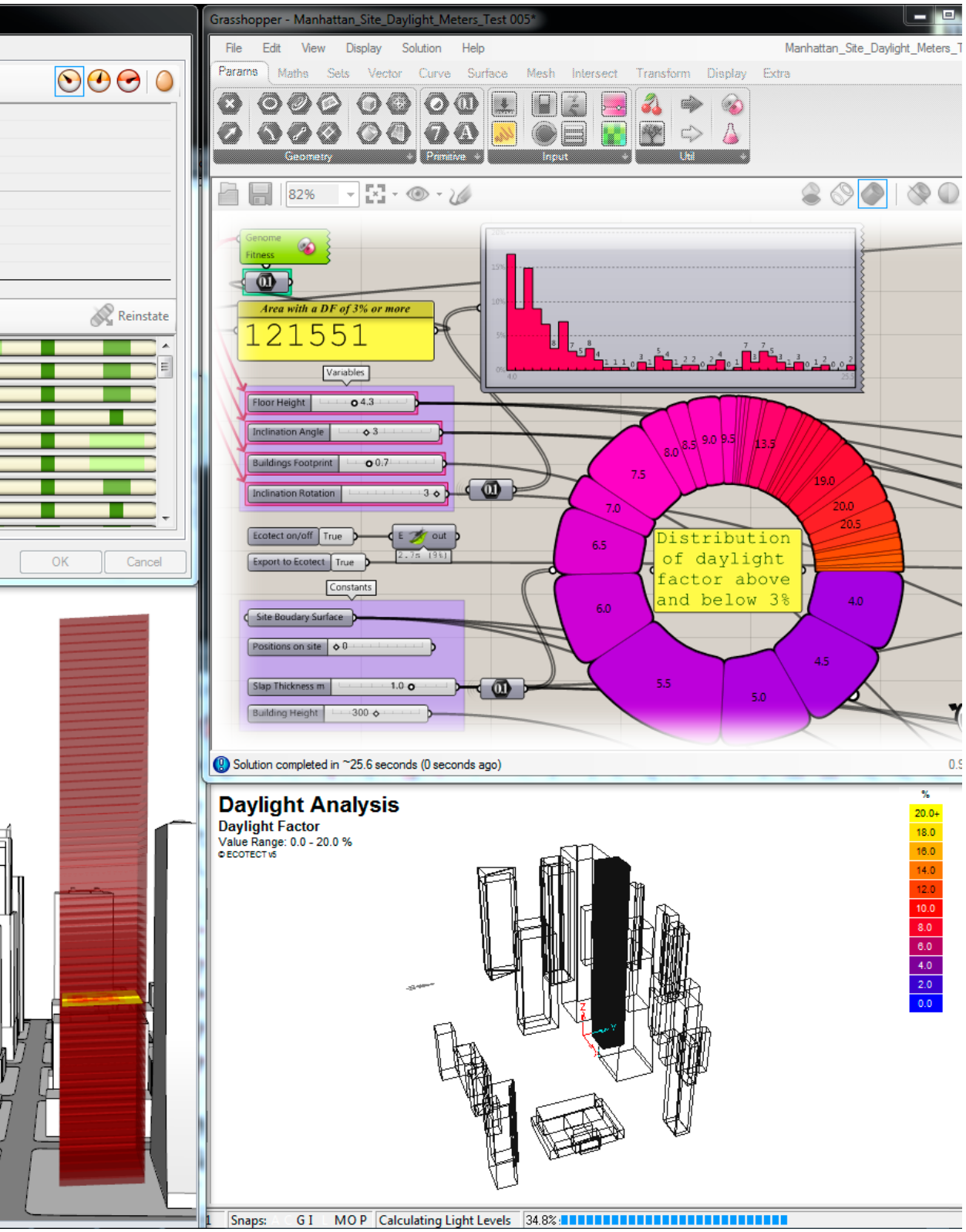
ill. 40 - 3



ill. 41 - 4



ill. 42 - Evolutionary Computation Process

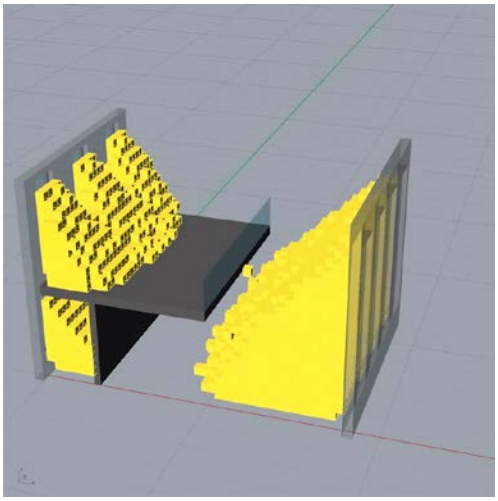

Grasshopper - Manhattan_Site_Daylight_Meters_Test 005*
File Edit View Display Solution Help
Manhattan_Site_Daylight_Meters_T
Params Maths Sets Vector Curve Surface Mesh Intersect Transform Display Extra
Geometry Primitive Input Util
82%
Genome
Fitness
Area with a DF of 3% or more
121551
Variables
Floor Height 4.3
Inclination Angle 3
Buildings Footprint 0.7
Inclination Rotation 3
Ecotect on/off True
Export to Ecotect True
Constants
Site Boudary Surface
Positions on site 0
Slap Thickness m 1.0
Building Height 300
Distribution of daylight factor above and below 3%
Solution completed in ~25.6 seconds (0 seconds ago)
Reinstate
OK
Cancel
Daylight Analysis
Daylight Factor
Value Range: 0.0 - 20.0 %
© ECOTECT v5
%
20.0+
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Snaps: G I MO P
Calculating Light Levels
34.8%

COMPUTATION SUMMARY - The hypothesis that the inclined floor slabs would provide a better daylight factor for the workspaces, by extending the daylight penetration depth of the room, with a floor slab that was more parallel to that of natural daylight distribution in room (see illustration), didn't hold true.

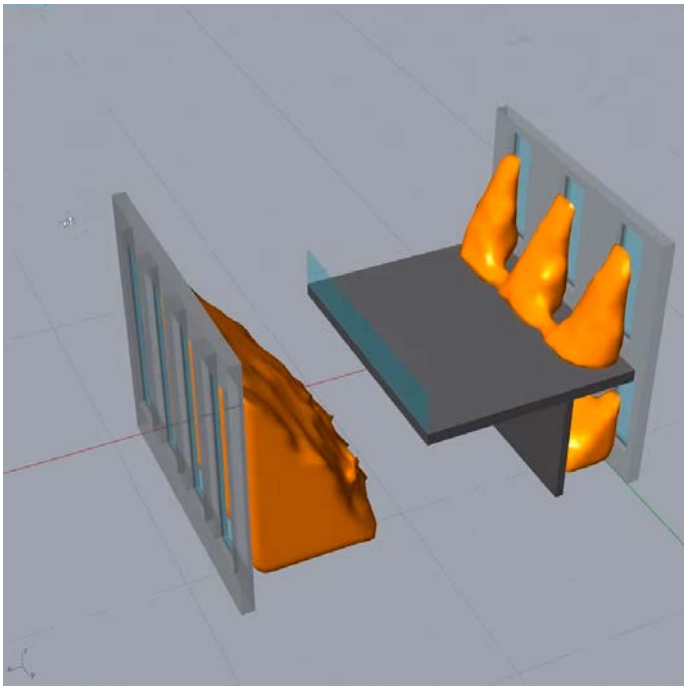
The difference in achieved daylight factors with and without inclined floor slabs, where insignificant, and most of the optimal solutions found had little to no inclination angled of the floor slab. The inclined option will be discarded as it has no significant benefits to the traditional flat floor slabs, yet it would be more difficult to execute from a structural point of view. The minimal effect of the inclined floor slabs was likewise reflected in the inclinations orientation which seemed to have very little to no effect on the overall daylight factor performance.

On the following pages some of the best iterations from the computation will be studied to generate the foundation for the proposed design.

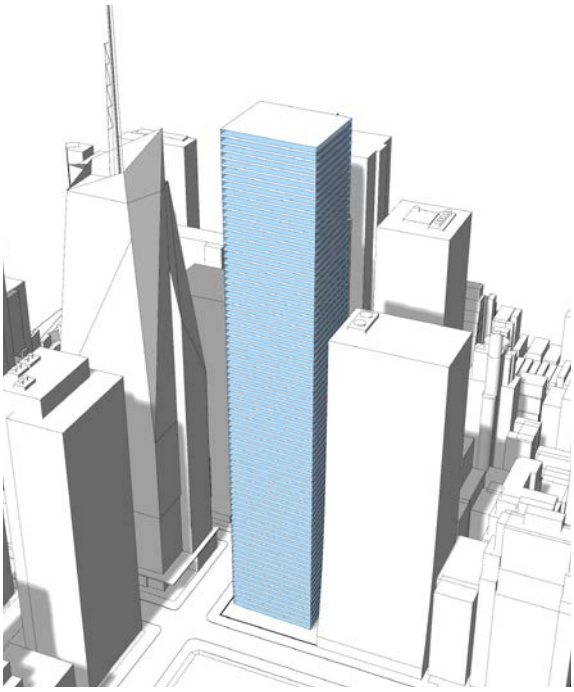
The highest performing iterations generated by the evolutionary computational evolutionary process share many similarities in the parameters and proportions. The eight iterations at display on the following pages were picked as they represented most of the range in the high performing end of the gene pool. These Iterations will be used as a reference point for the massing studies.



ill. 43 - Illustration and study of natural daylight distribution through windows.



ill. 44 - Illustration and study of natural daylight distribution through windows.



Workspace Area - with 3% DF
177.231m²

Façade to Floor Area Ratio
0,306m² : 1m²

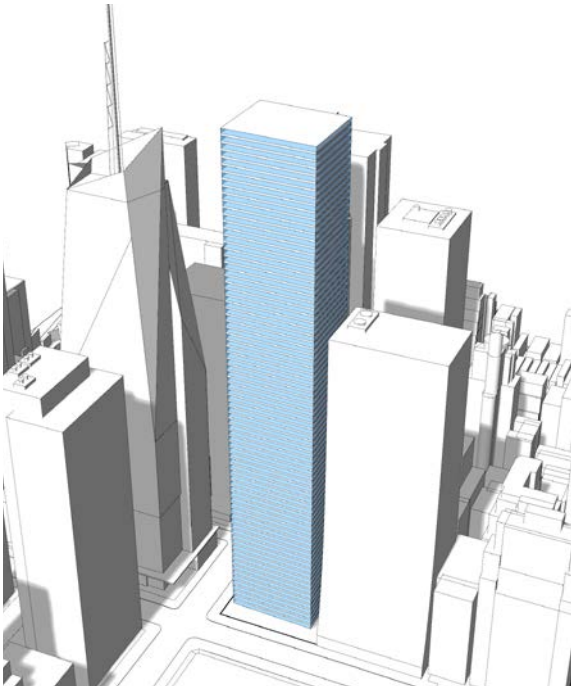
Floor Height
3,7m

Inclination
2°

Building Footprint
2335m²

Inclination Orientation
West High / East Low

ill. 45 - Iteration 01



Workspace Area - with 3% DF
203.603m²

Façade to Floor Area Ratio
0,301m² : 1m²

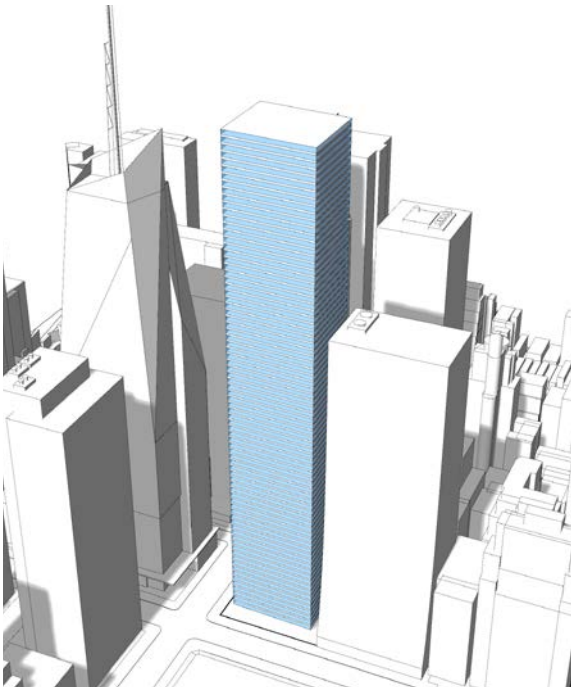
Floor Height
4,1m

Inclination
0°

Building Footprint
2955m²

Inclination Orientation
N/A

ill. 46 - Iteration 02



Workspace Area - with 3% DF
214.686m²

Façade to Floor Area Ratio
0,304m² : 1m²

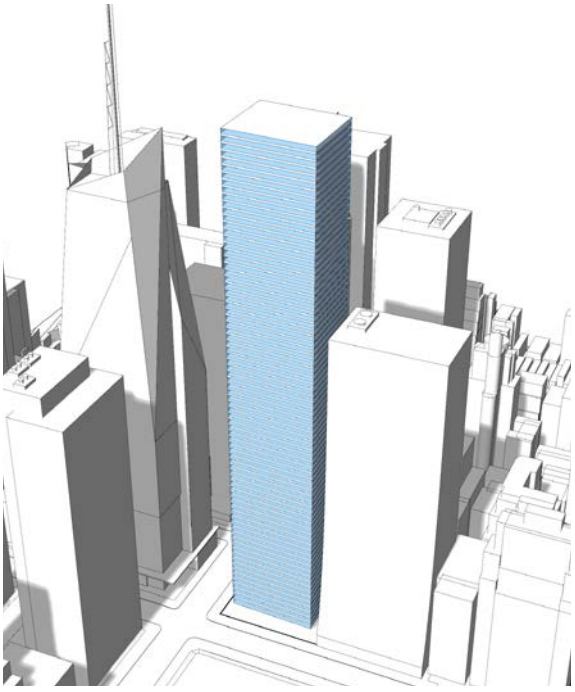
Floor Height
4,6m

Inclination
9°

Building Footprint
3645m²

Inclination Orientation
West High / East Low

ill. 47 - Iteration 03



Workspace Area - with 3% DF
215.177m²

Façade to Floor Area Ratio
0,304m² : 1m²

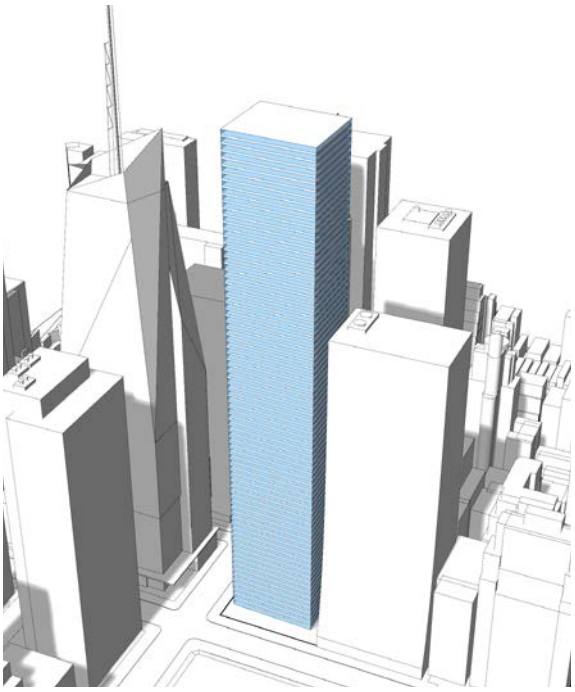
Floor Height
3,7m

Inclination
5°

Building Footprint
2955m²

Inclination Orientation
North High / South Low

ill. 48 - Iteration 04



Workspace Area - with 3% DF
229.830m²

Façade to Floor Area Ratio
0,304m² : 1m²

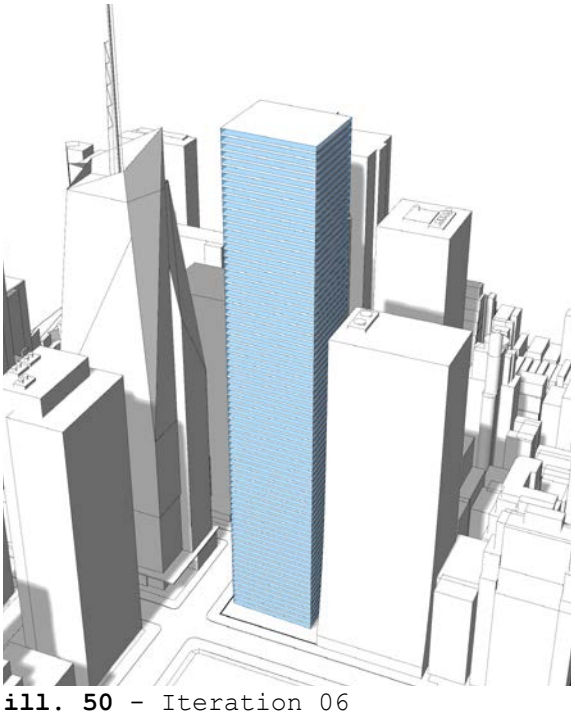
Floor Height
4,6m

Inclination
0°

Building Footprint
3645m²

Inclination Orientation
N/A

ill. 49 - Iteration 05



Workspace Area - with 3% DF
232.560m²

Façade to Floor Area Ratio
0,284m² : 1m²

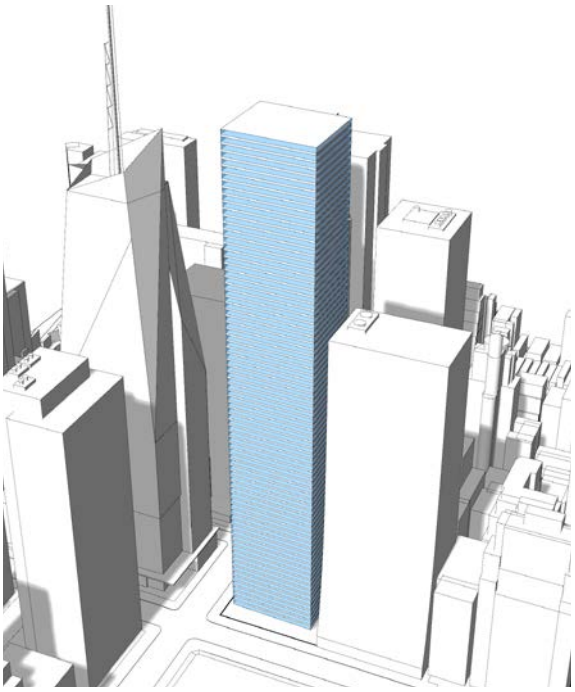
Floor Height
4,3m

Inclination
2°

Building Footprint
3645m²

Inclination Orientation
West High / East Low

ill. 50 - Iteration 06



Workspace Area - with 3% DF
246.861m²

Façade to Floor Area Ratio
0,306m2 : 1m²

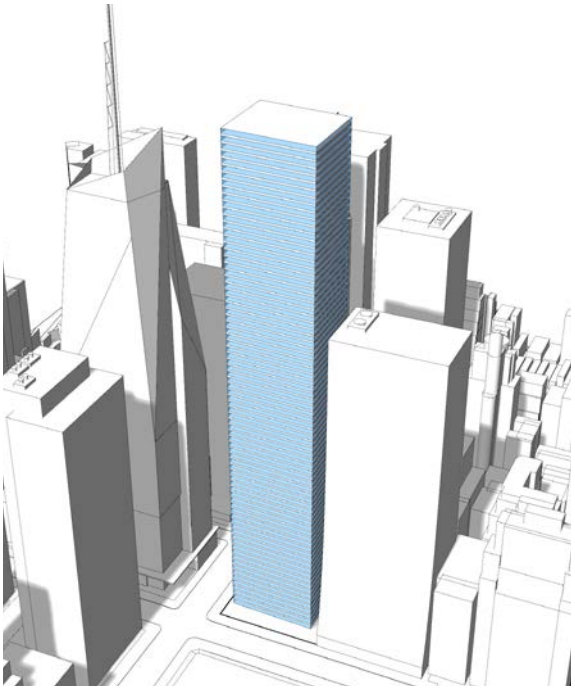
Floor Height
4,1m

Inclination
4°

Building Footprint
3645m²

Inclination Orientation
North High / South Low

ill. 51 - Iteration 07



Workspace Area - with 3% DF
261.835m²

Façade to Floor Area Ratio
0,258m2 : 1m²

Floor Height
3,9m

Inclination
2°

Building Footprint
2335m²

Inclination Orientation
North High / South Low

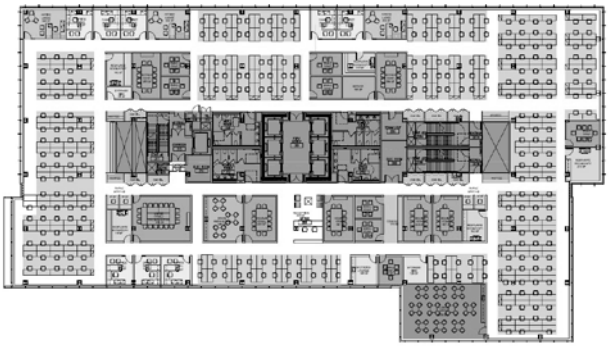
ill. 52 - Iteration 08

[FLOW]

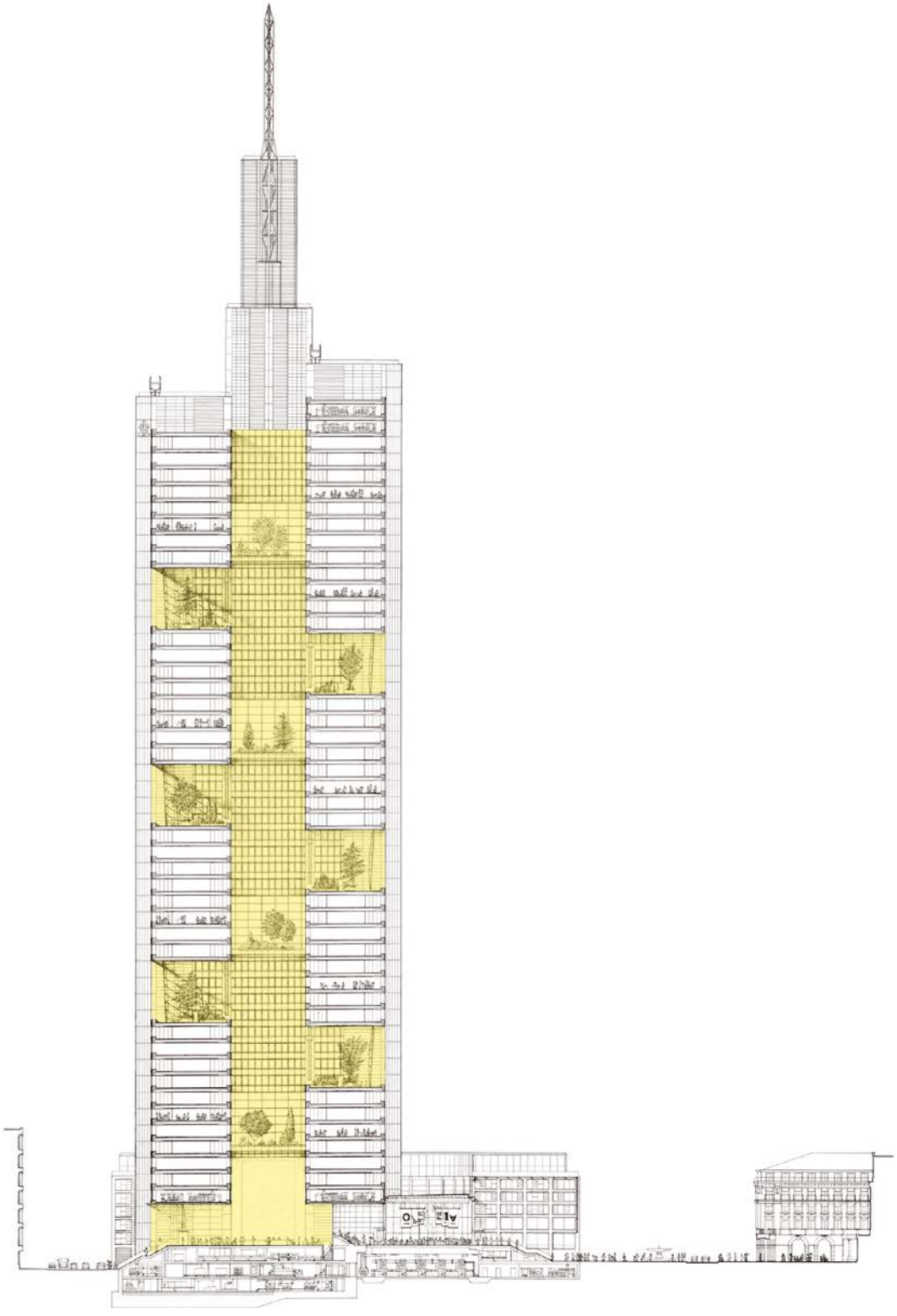
Most high-rise buildings are built around a core. The functions implemented in traditional core design typically include; efficient convenient vertical transportation, structural support, egress and MEP (Mechanical, electrical and plumbing installations).

Traditionally cores have been placed at least attractive space with poor views and daylight conditions in the center of the building. The space in and around the core have been a low-quality, inflexible, closed, poorly lit and undesirable space, that hosted inefficient elevators systems with one cabin per shaft.

The proposed design for this project will seek to reengineer the core from an inefficient necessity, to a flexible high quality space, that will function as a light-well for the building and host a highly efficient rail-based elevator system.



ill. 53
Traditional core design

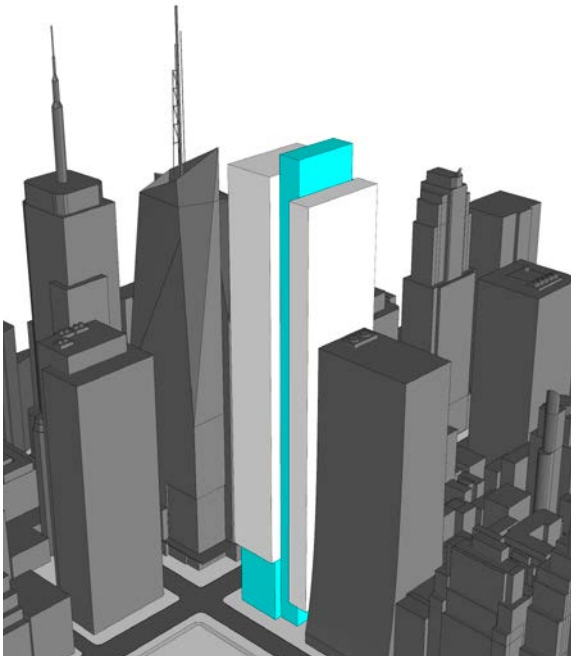


ill. 54 - Light-well Design, Commerzbank, Frankfurt

[MASSING]

In the following section different proposed massing concept will be evaluated on their applicability of the project vision, their aesthetical qualities and their feasibility.

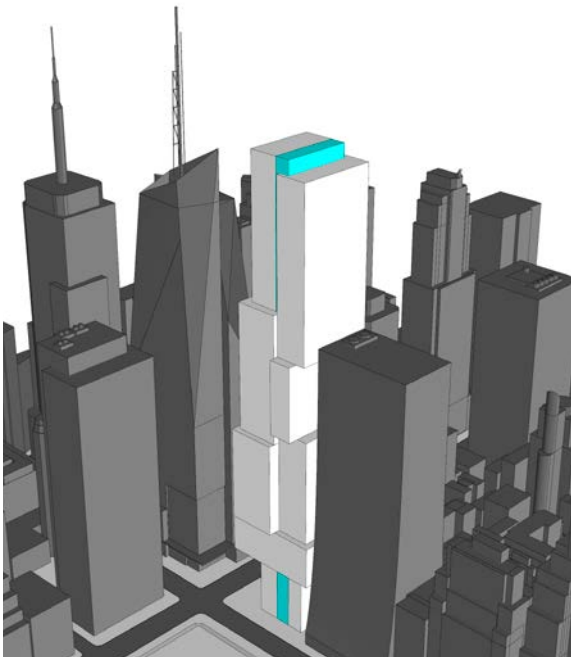
The preferred massing concept will undergo further studies in order to refine and enhance the proposed massing concept.



ill. 55 - Massing Concept 01

Massing Concept 01

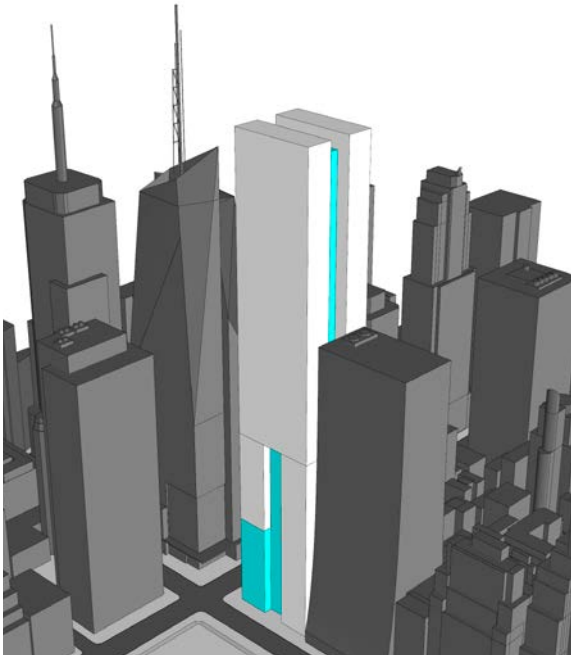
Floor plate Design	***
Spatial Qualities	***
Light well efficiency	****
Feasibility	***
Façade Ratio	***
Icon Shape	**
Scale/readability	**
Aesthetical qualities	***
Street Level Synergy	***



ill. 56 - Massing Concept 02

Massing Concept 02

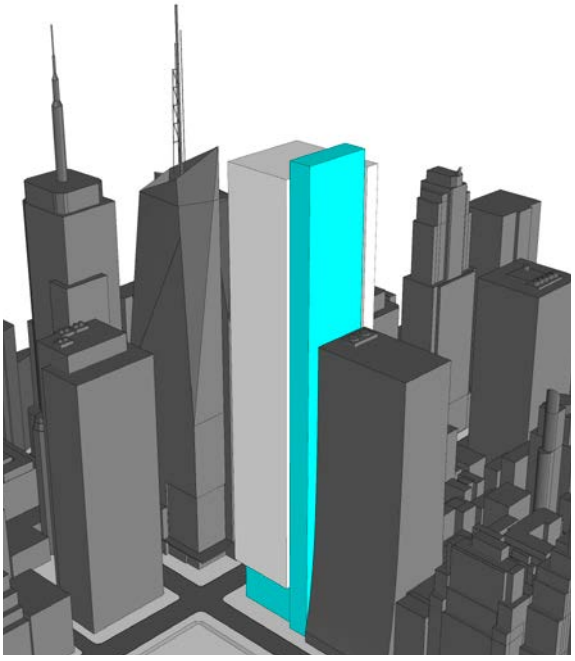
Floor plate Design	***
Spatial Qualities	****
Light well efficiency	**
Feasibility	**
Façade Ratio	***
Icon Shape	****
Scale/readability	****
Aesthetical qualities	****
Street Level Synergy	***



ill. 57 - Massing Concept 03

Massing Concept 03

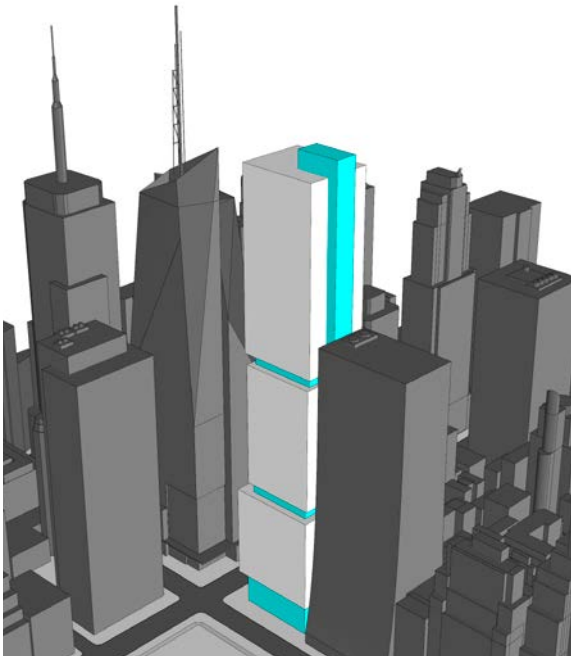
Floor plate Design	**
Spatial Qualities	**
Light well efficiency	***
Feasibility	**
Façade Ratio	***
Icon Shape	**
Scale/readability	**
Aesthetical qualities	**
Street Level Synergy	***



ill. 58 - Massing Concept 04

Massing Concept 04

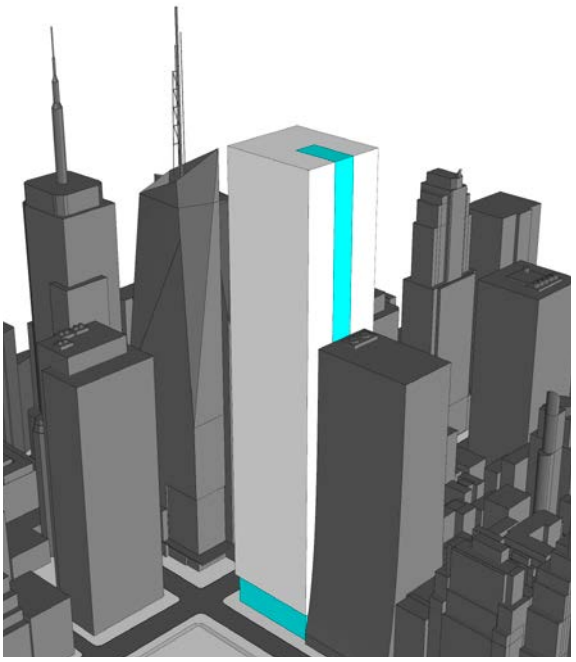
Floor plate Design	****
Spatial Qualities	***
Light well efficiency	*
Feasibility	***
Façade Ratio	****
Icon Shape	**
Scale/readability	**
Aesthetical qualities	**
Street Level Synergy	**



ill. 59 - Massing Concept 05

Massing Concept 05

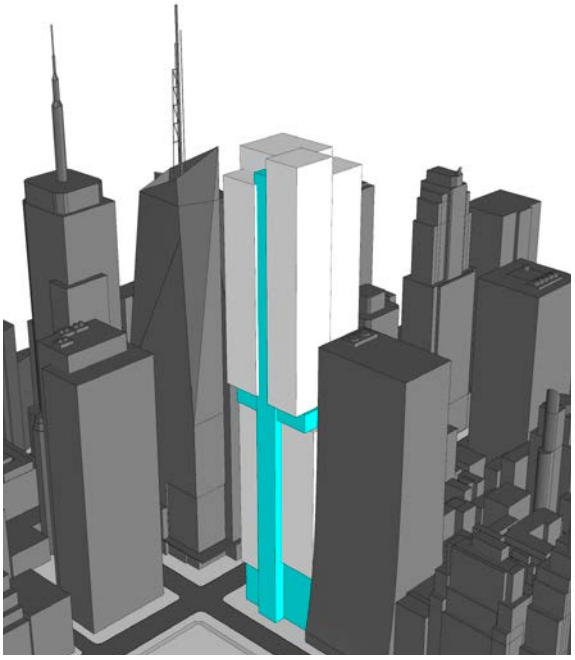
Floor plate Design	****
Spatial Qualities	****
Light well efficiency	***
Feasibility	***
Façade Ratio	****
Icon Shape	***
Scale/readability	****
Aesthetical qualities	***
Street Level Synergy	**



ill. 60 - Massing Concept 06

Massing Concept 06

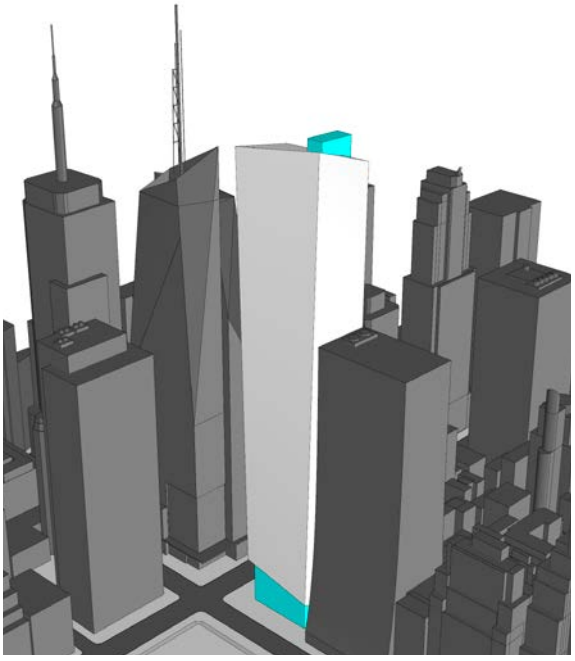
Floor plate Design	****
Spatial Qualities	**
Light well efficiency	***
Feasibility	****
Façade Ratio	****
Icon Shape	*
Scale/readability	*
Aesthetical qualities	**
Street Level Synergy	**



ill. 61 - Massing Concept 07

Massing Concept 07

Floor plate Design	**
Spatial Qualities	***
Light well efficiency	**
Feasibility	**
Façade Ratio	**
Icon Shape	***
Scale/readability	***
Aesthetical qualities	**
Street Level Synergy	***

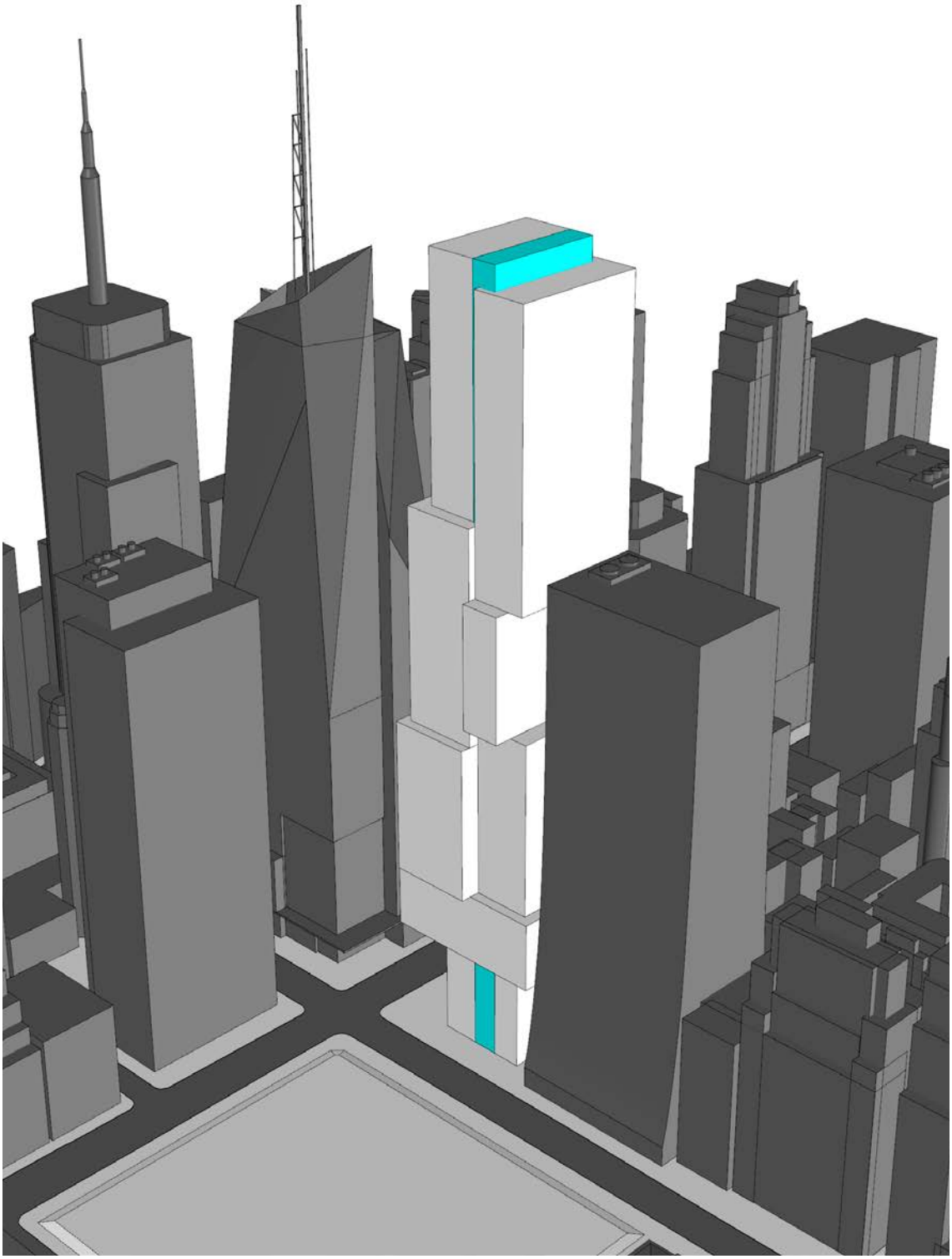


ill. 62 - Massing Concept 08

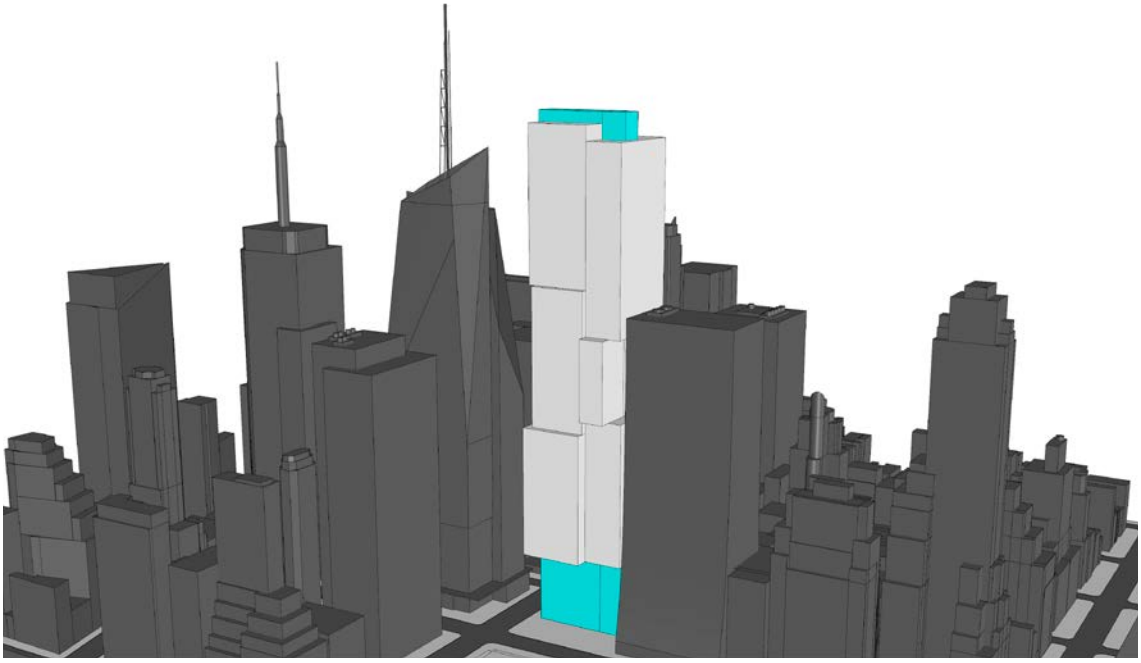
Massing Concept 08

Floor plate Design	***
Spatial Qualities	***
Light well efficiency	***
Feasibility	**
Façade Ratio	****
Icon Shape	**
Scale/readability	**
Aesthetical qualities	***
Street Level Synergy	***

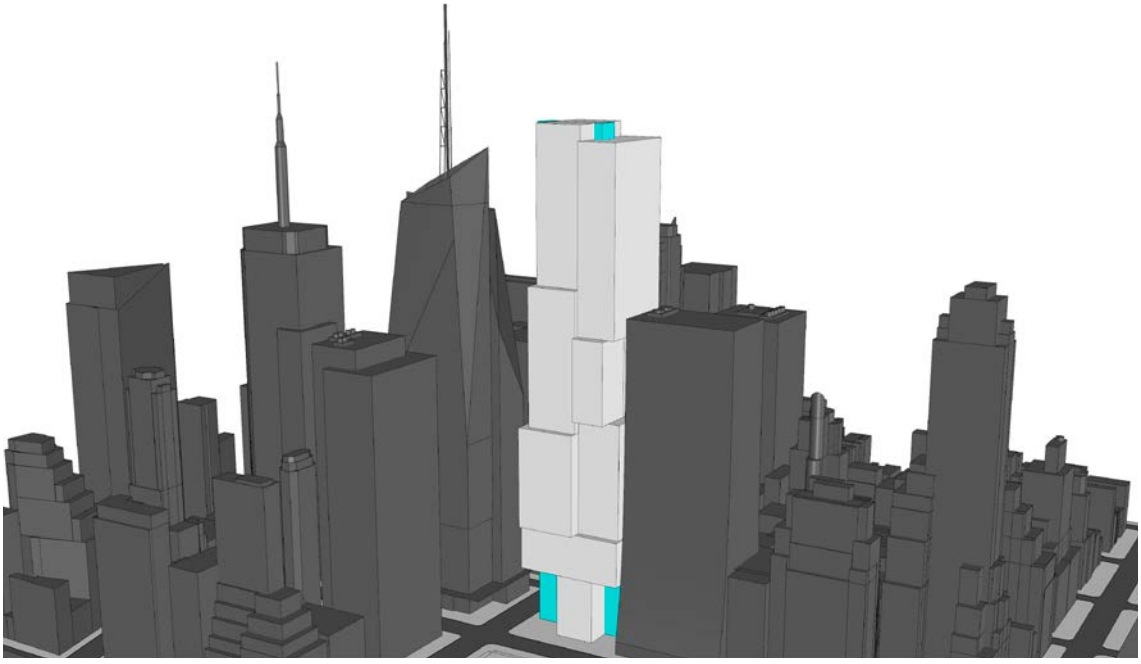
Massing concept 02 will be used for further studies, as the concept have successfully combined spatial qualities with a relatively efficient floor plate design in a highly readable icon shape that relates to the human scale. Proportional changes, street level synergy, spatial qualities, structural alignment and light well design will be the areas of focus in the following studies, to refine and enhance the massing concept.



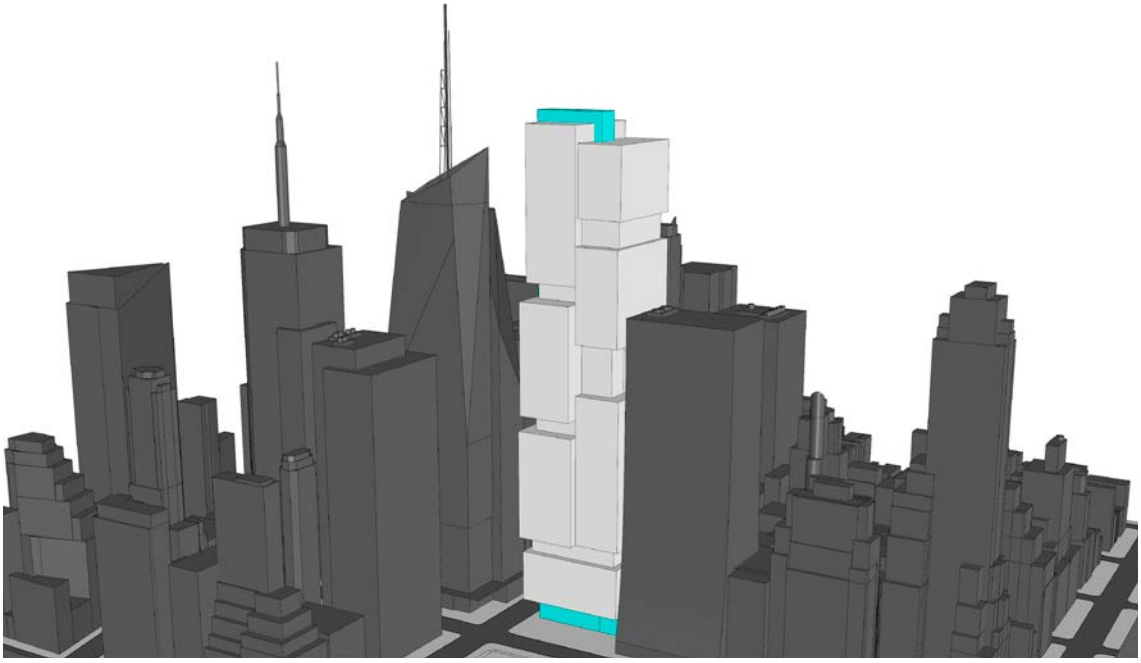
ill. 63 - Massing Concept 02



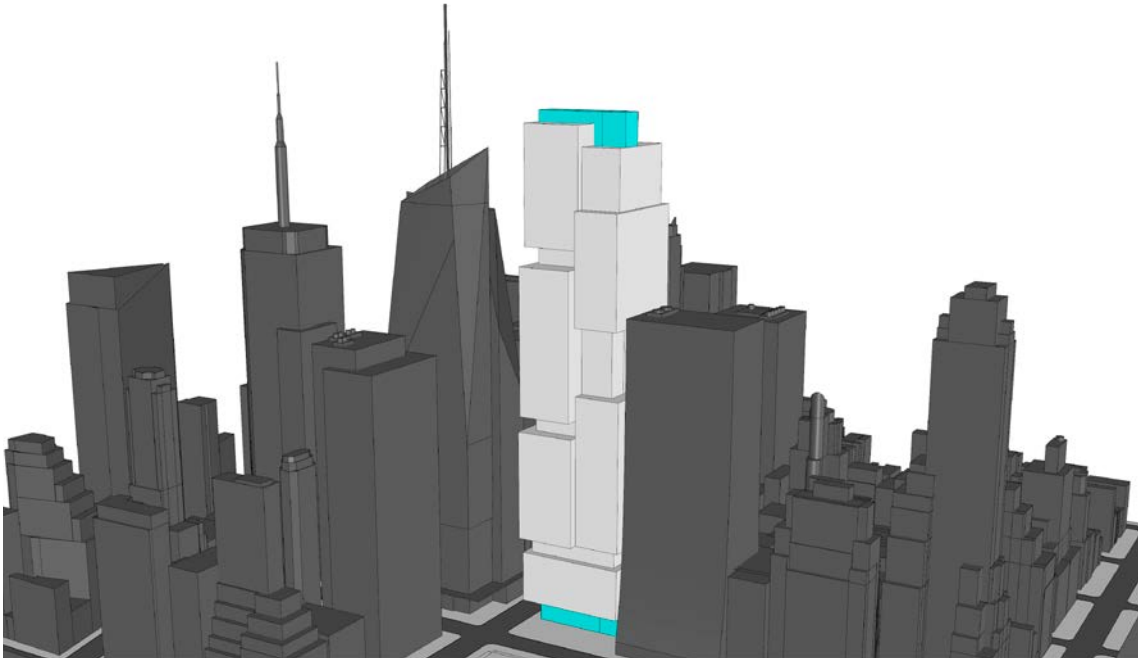
ill. 64 - 1st Massing Proposal



ill. 65 - 2nd Massing Proposal

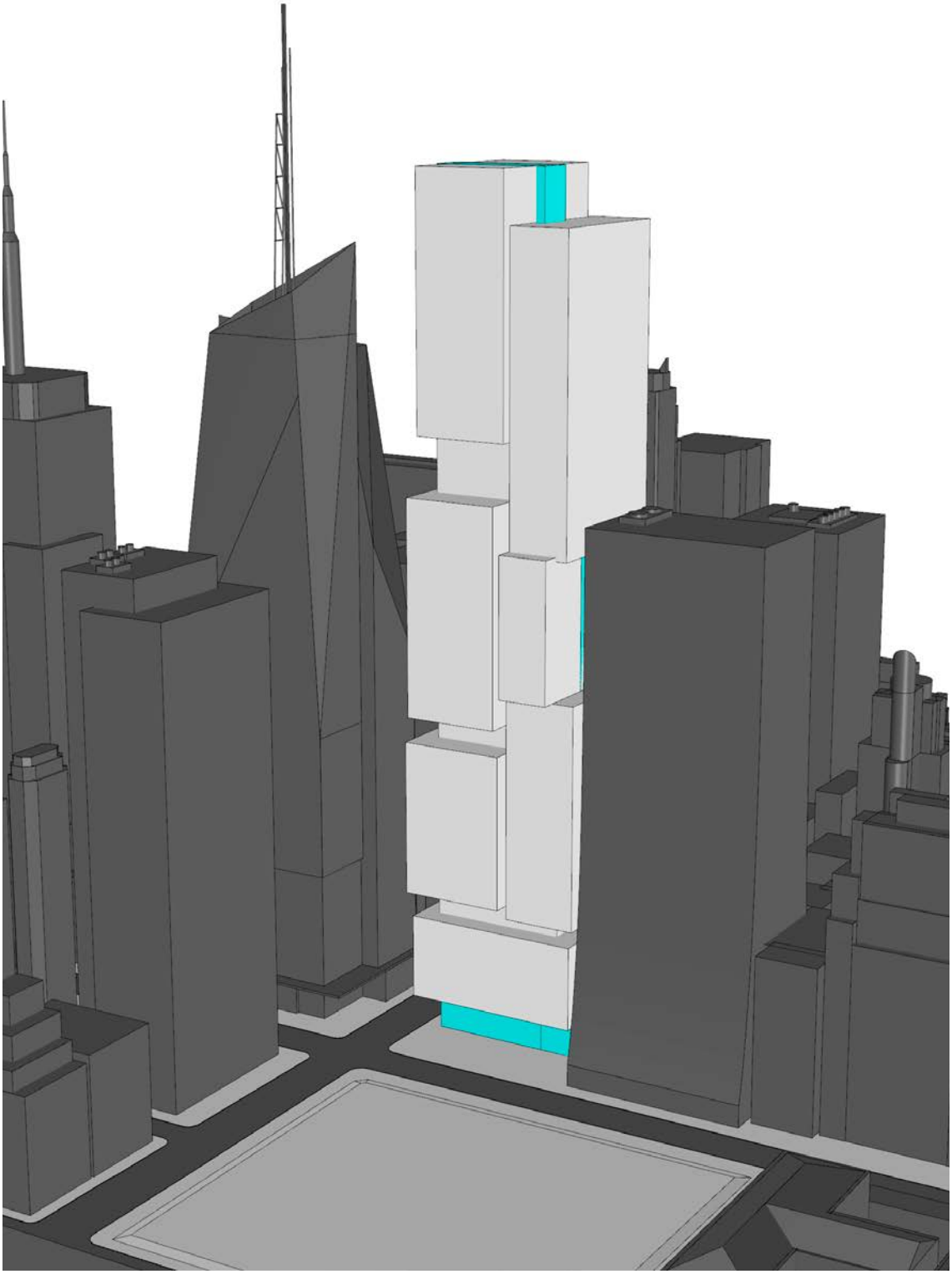


ill. 66 - 3rd Massing Proposal

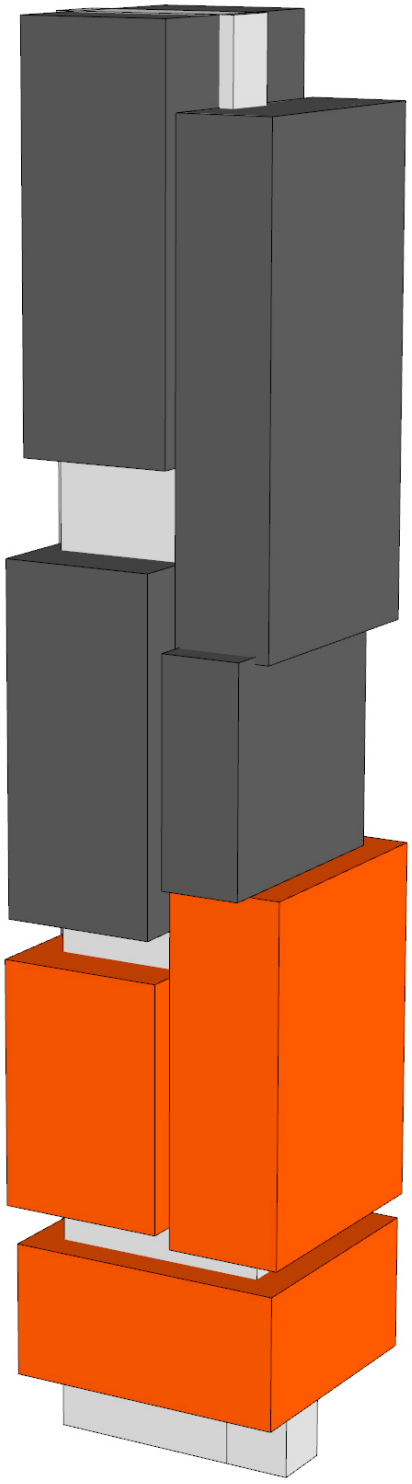


ill. 67 - 4th Massing Proposal

The preferred massing proposal based on spatial qualities, structural feasibility, daylight, readability and iconic and aesthetical qualities.



ill. 68 - 5th and Final Massing Proposal



ill. 69 - Iteration Diagram

Floor height 4,1m

Floor height 4,3m

Floor heights from the best performing iterations from the daylight computation that has similar dimensions to the different parts of office building, will be used as a reference for the specific floor heights.

The dimensions on the deeper orange volumes are very similar to the 6th iteration at display on page 84 from the daylight computations. The suggested 4,3m floor height from floor to floor will be used for this section of the building.

The more slender grey volumes are very similar to the 2nd iterations on page 82, which have a floor height of 4,1m.

[STRUCTURE]

Good structural design is an essential part of a well-designed high-rise building due to its crucial role in the final construction cost and the spatial implications it might have.

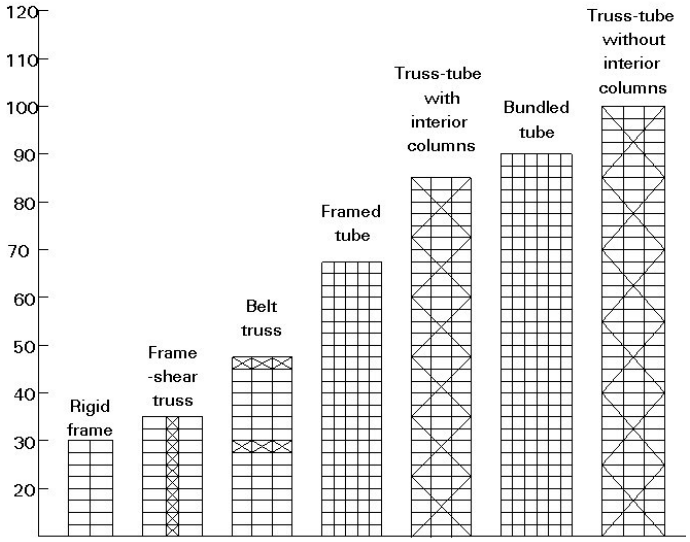
The predominant and most material efficient approach for buildings above 40 floors is the framed tubular systems and variations thereof – bundled tubes, trussed tubes, framed tubes and tubes in tubes etc. (Khan, 2004) The tubular concept is designed like a hollow tube, where the vertical columns constitute the perimeter of the tube. The columns tied together by spandrel beams thereby creating a strong, and relatively light, load bearing structure that is capable of transferring big lateral loads.

The proposed structural system for this project will be a "Tube in Tube" structural steel system. The specific structural system for this project has an interior tube which is part framed steel tube and part solid concrete core that holds the elevators and MEP. The exterior structure will be a framed steel tube system and will through its properties handle the majority of the lateral loads as well as gravitational loads.

The loads from the cantilevers of the building will be transferred back to the exterior tubular structure through spandrel beams in cases where the cantilever is less than 8meters. The load from the larger cantilevers of 8 meter or more will be transferred back to the exterior tube through a structural grid made up of raked beams, perimeter columns and spandrel beams. See the illustrations in the following page.

Structural calculations can be found in the enclosed appendix.

ill. 70 - Bundled Tube Structure, Sears Tower, Chicago



ill. 71 - Tubular Steel Structure Systems, with Number of Floors.

Tubular Steel Columns

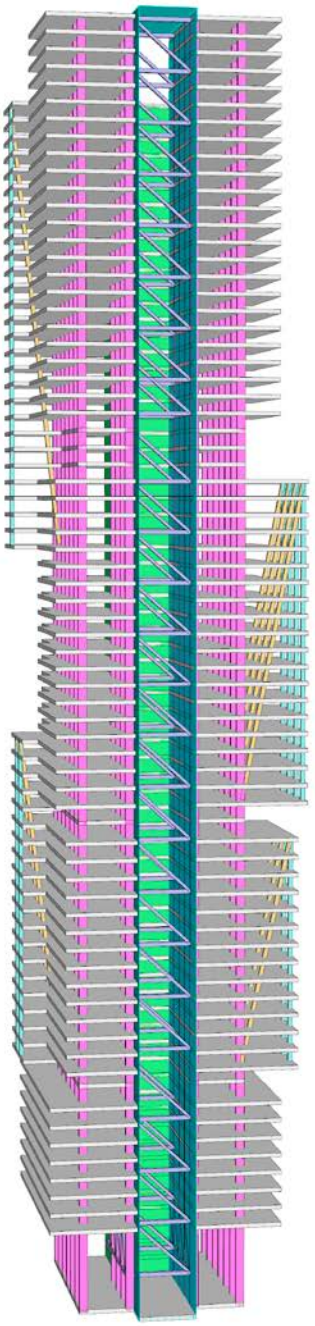
Concrete Core

Beams

Perimeter Columns

Raked Beams

Floor Slab with Spandrel Beams



ill. 72 - Proposed Structural System, West

Tubular Steel Columns

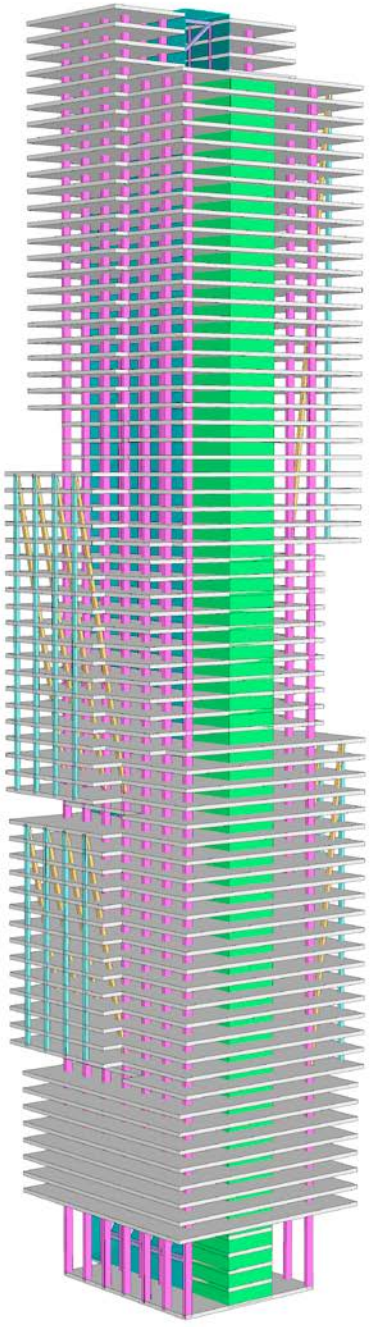
Concrete Core

Beams

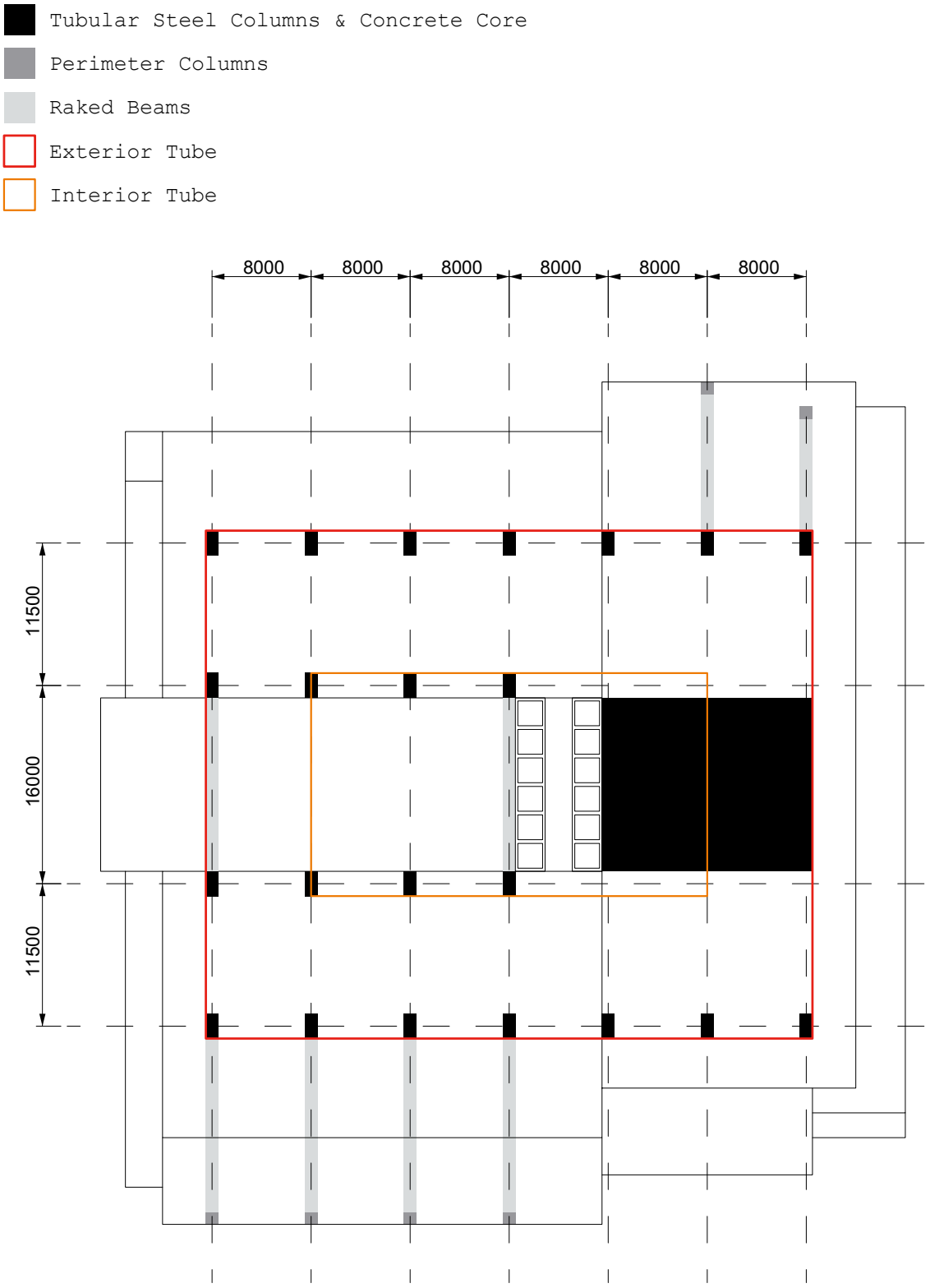
Perimeter Columns

Raked Beams

Floor Slab with Spandrel Beams



ill. 73 - Proposed Structural, East



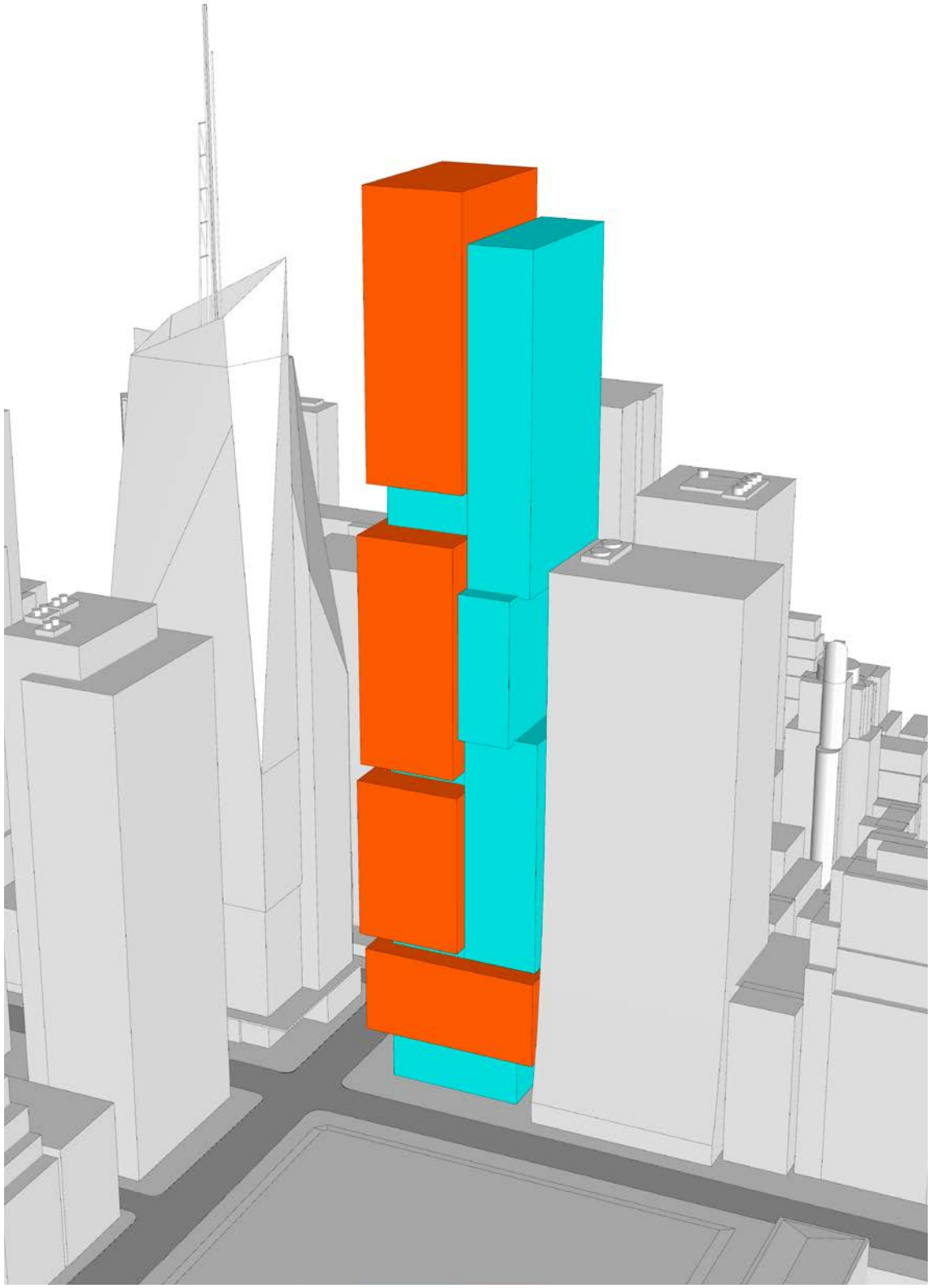
ill. 74 - Plan, Tubular Structural Grid

[FACADE]

The following façade studies will be used to determine the proposed façade solution. Different façade systems will be applied to the different blocks of the building, to make the relative deep building volume apear more slender and to break up the large scale of the building into a more readable scale.

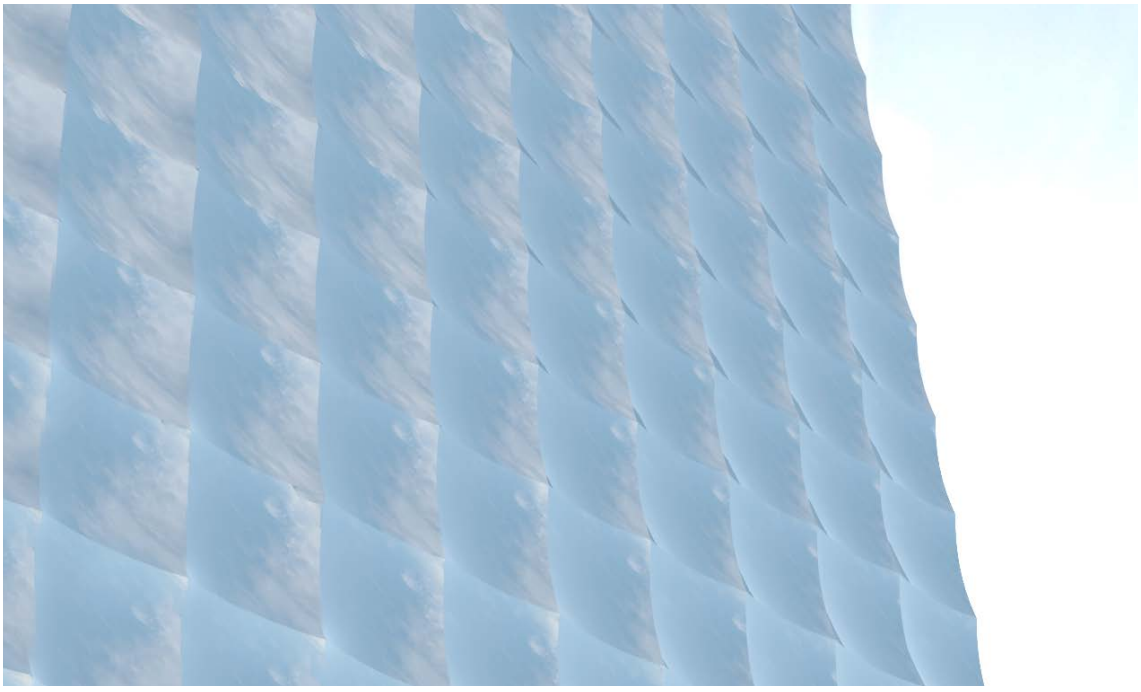
Facade System A

Facade System B



ill. 75 - Facade System Diagram

ill. 76 - 1st Facade Proposal

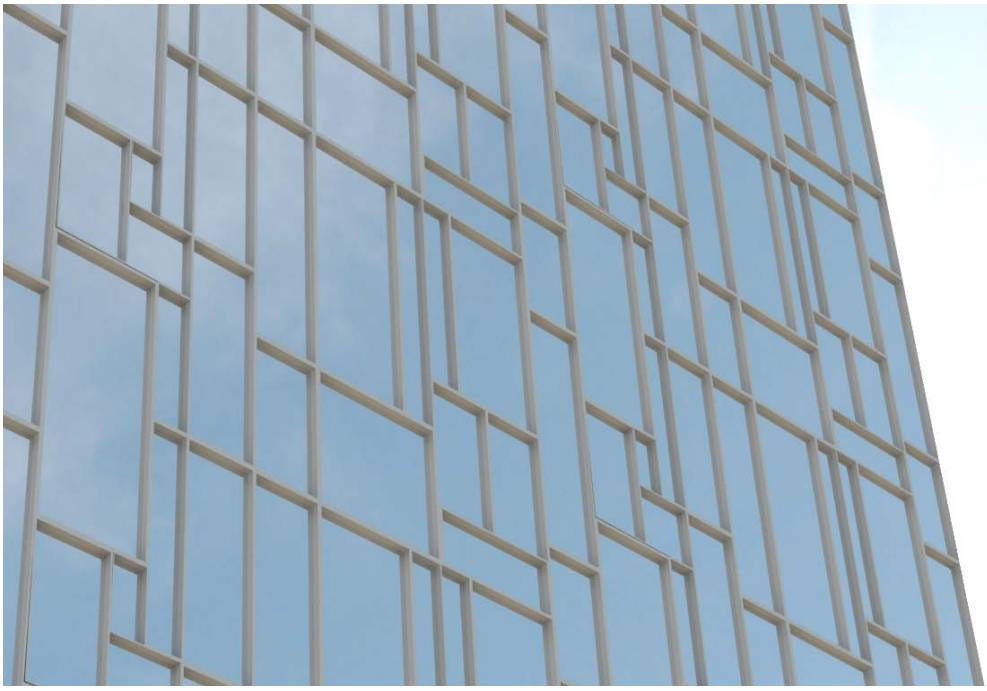


ill. 77 - 1st Facade Proposal

ill. 78 - 2nd Facade Proposal

ill. 79 - 2nd Facade Proposal

ill. 80 - 3rd Facade Proposal



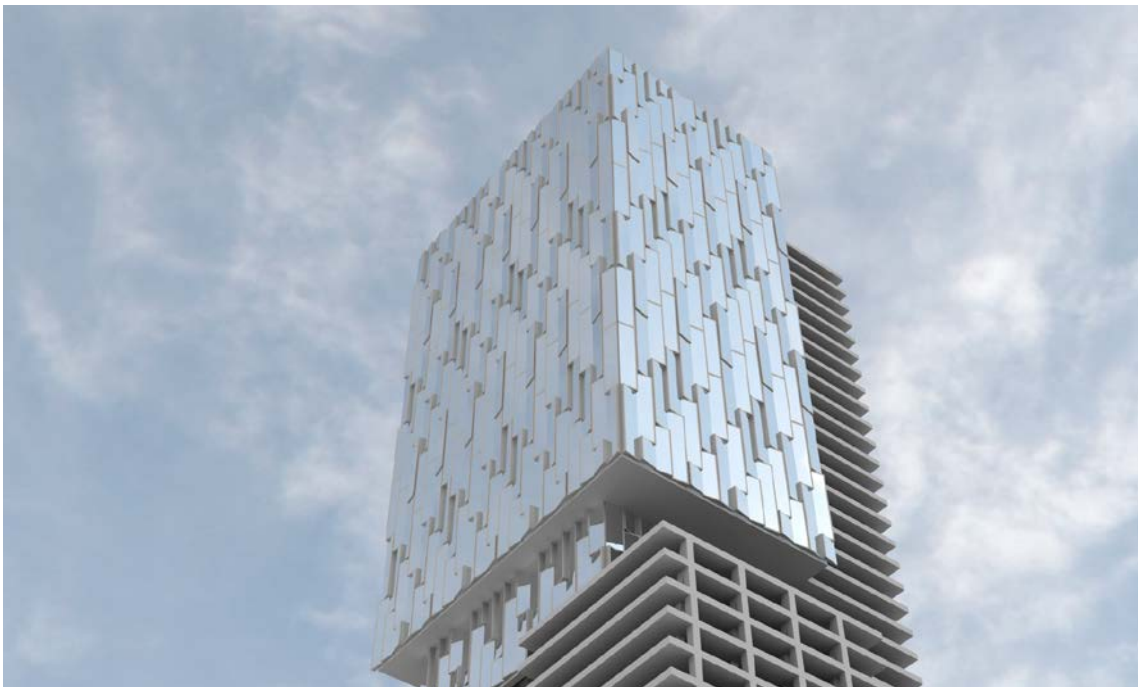
ill. 81 - 3rd Facade Proposal

ill. 82 - 4th Facade Proposal

ill. 83 - 4th Facade Proposal

ill. 84 - 5th Facade Proposal

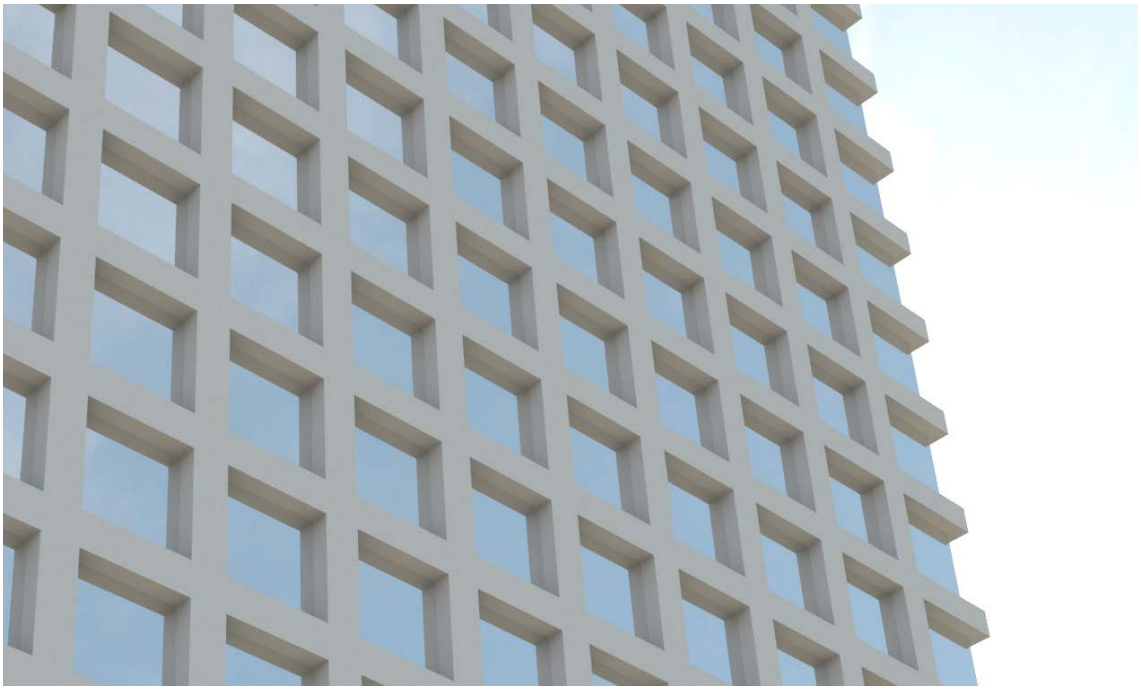
ill. 85 - 5th Facade Proposal



ill. 86 - 6th Facade Proposal

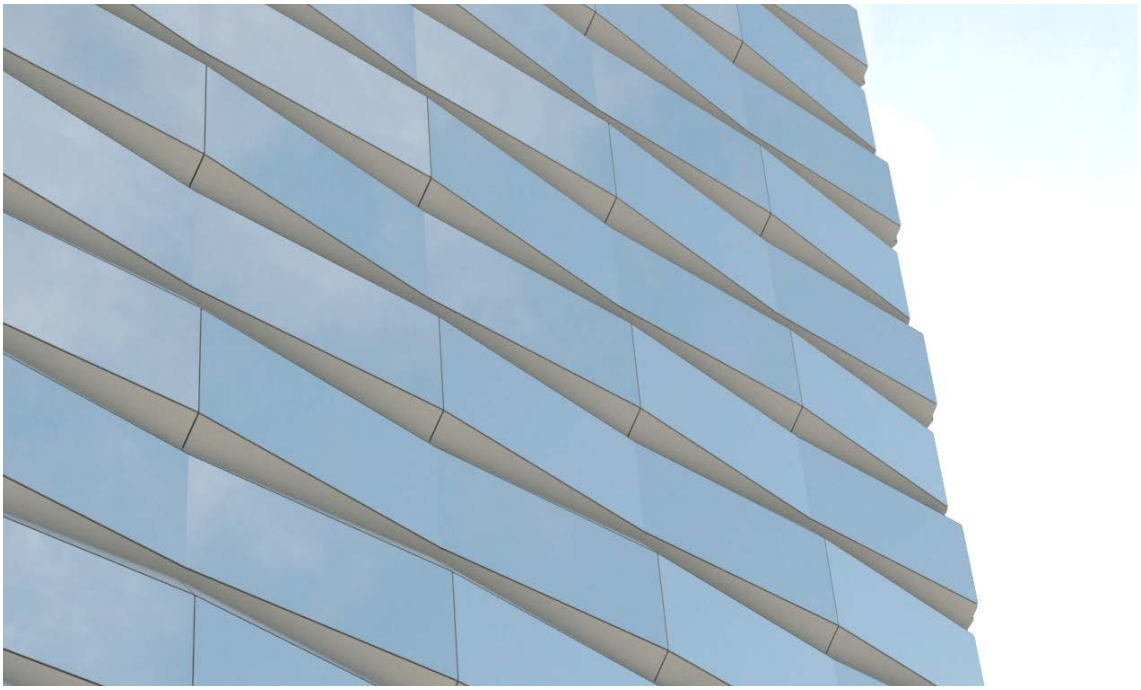
ill. 87 - 6th Facade Proposal

ill. 88 - 7th Facade Proposal



ill. 89 - 7th Facade Proposal

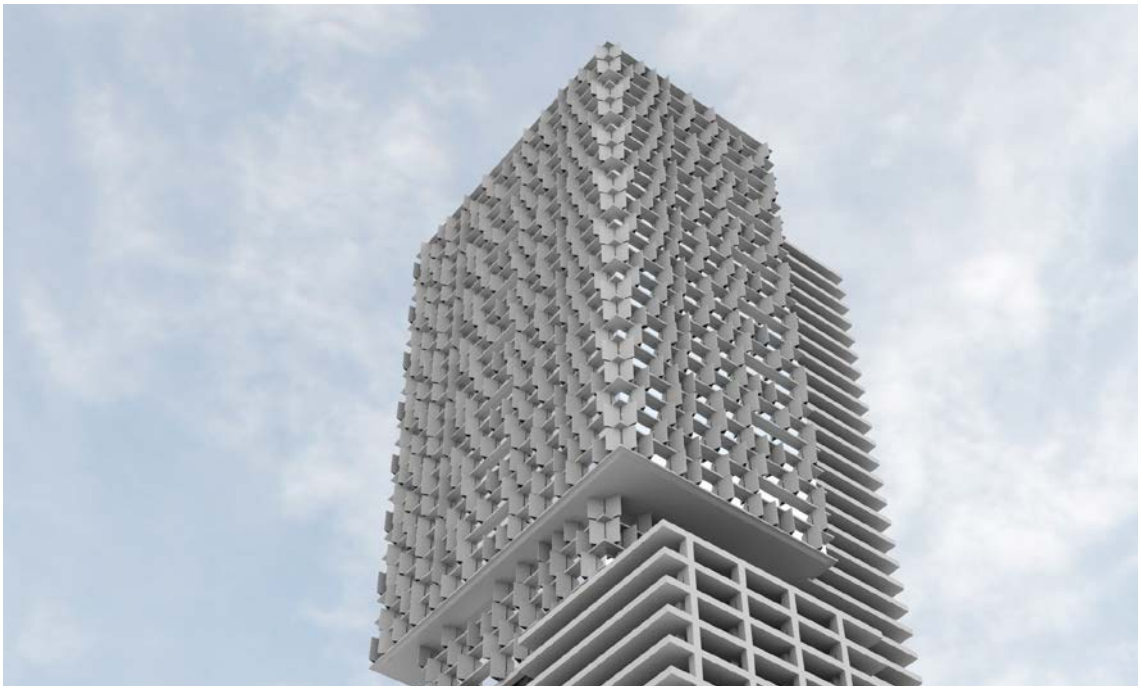
ill. 90 - 8th Facade Proposal



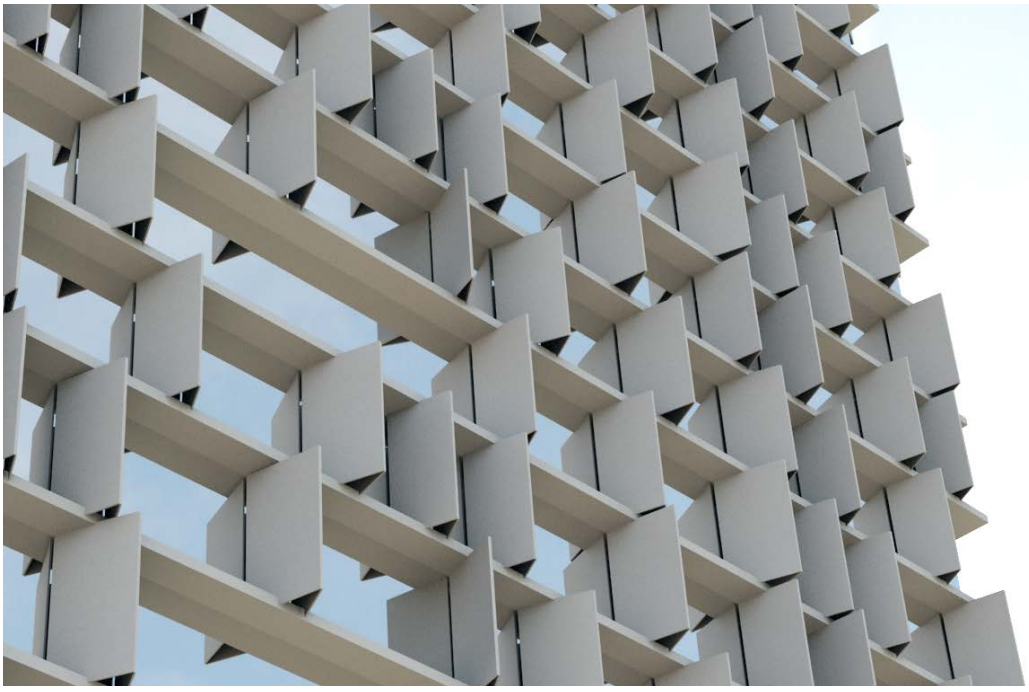
ill. 91 - 8th Facade Proposal

ill. 92 - 9th Facade Proposal

ill. 93 - 9th Facade Proposal

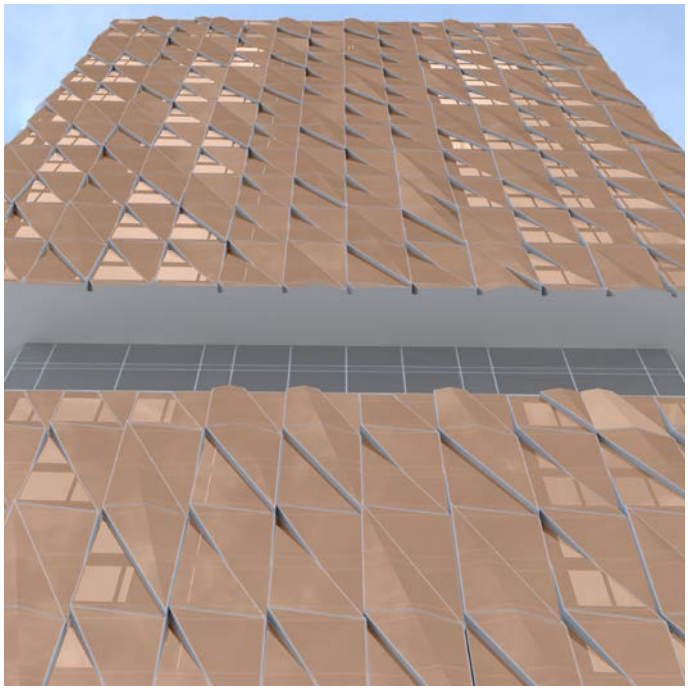


ill. 94 - 10th Facade Proposal

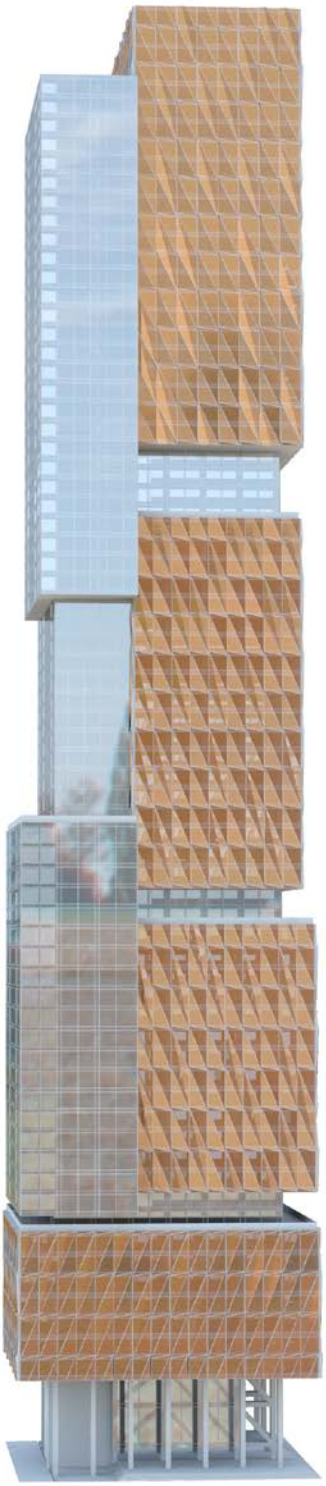


ill. 95 - 10th Facade Proposal

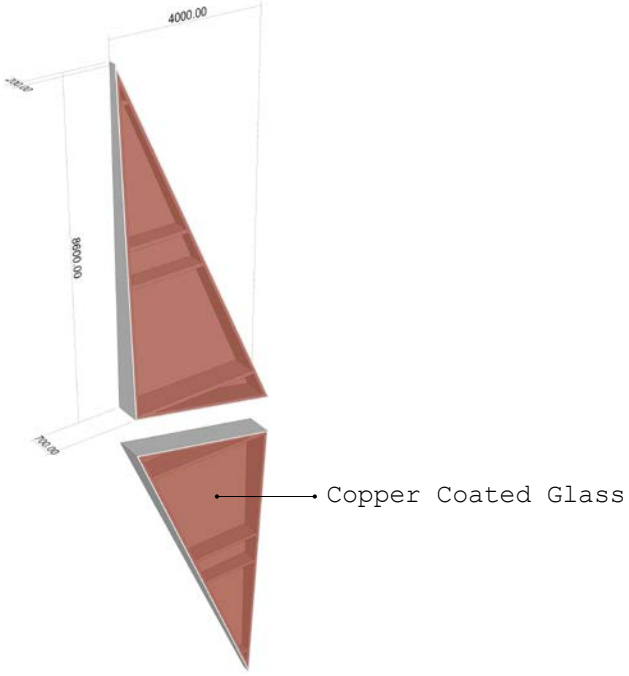
The proposed façade system will, as stated be a combination of two different façade systems - specifically a deep cavity system and a slim cavity system. The deep cavity system will consist of two different modules, with slight alterations in the built-up and angle of façade glazing. The deep cavity modules will be coated with a reflection copper coating. The reflective surfaces with the varying angles will cause the façade to appear more kaleidoscopic, by reflecting different areas of the sky and the adjacent buildings, which will contribute to the icon nature of the building. The slim cavity system will in contract to the dominant deep cavity system appear calm, clean and neutral. This contrast will help underlining the intentions for the façade vision.



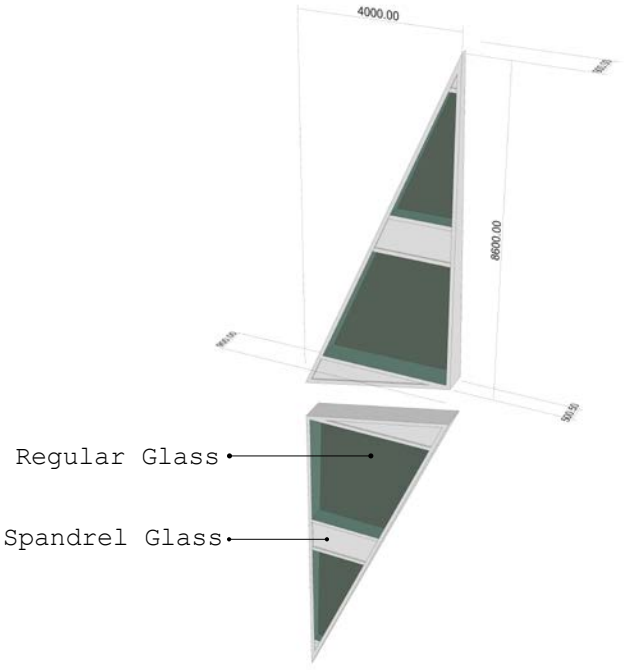
ill. 96 - Facade Close-up



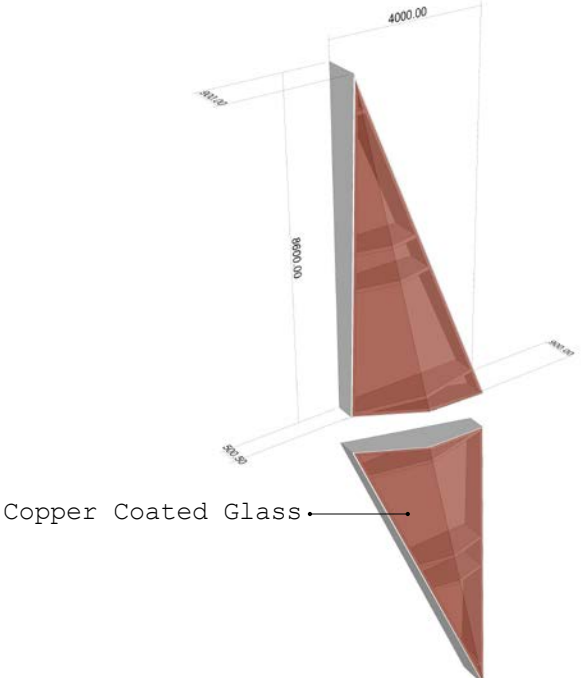
ill. 97 - Proposed Facade System



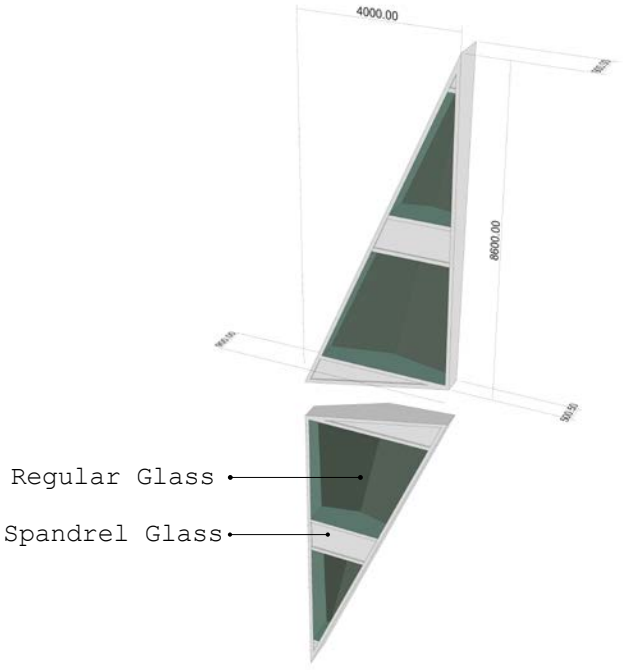
ill. 98 - Front of Facade Module A - Deep Closed Cavity, Copper Coated



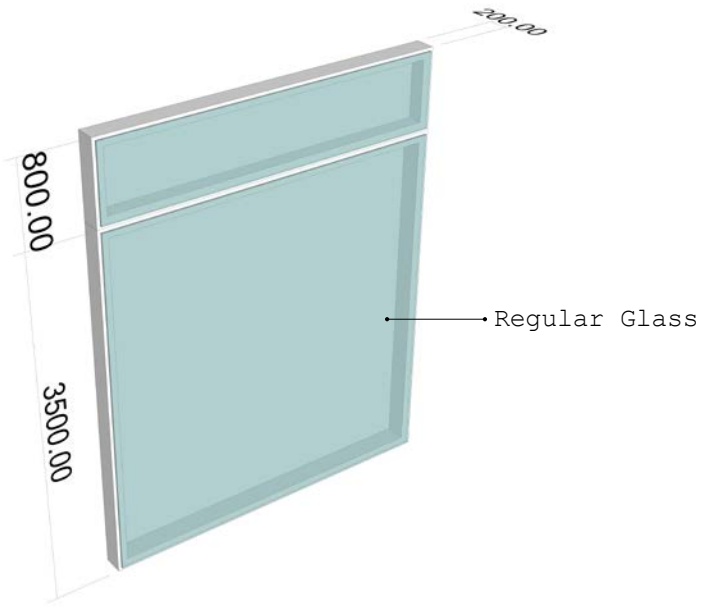
ill. 99 - Back of Facade Module A - Deep Closed Cavity, Copper Coating



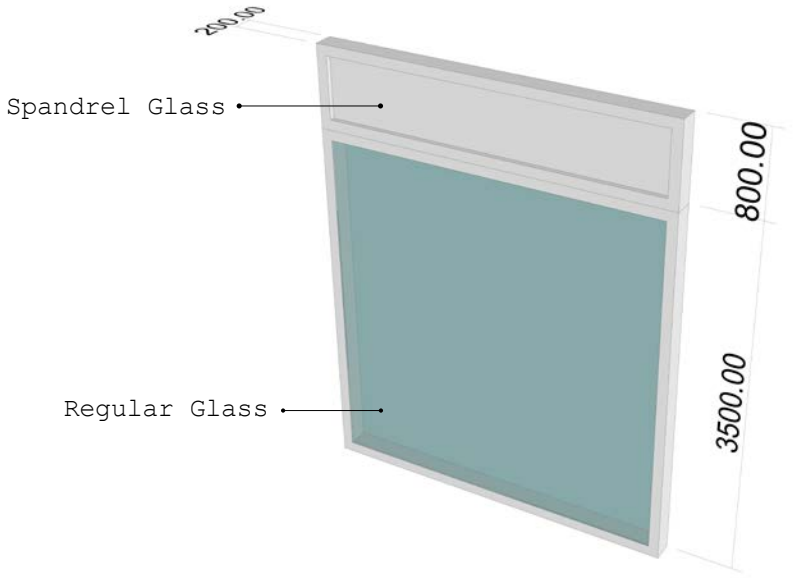
ill. 100 - Front of Facade Module B - Deep Closed Cavity, Copper Coating



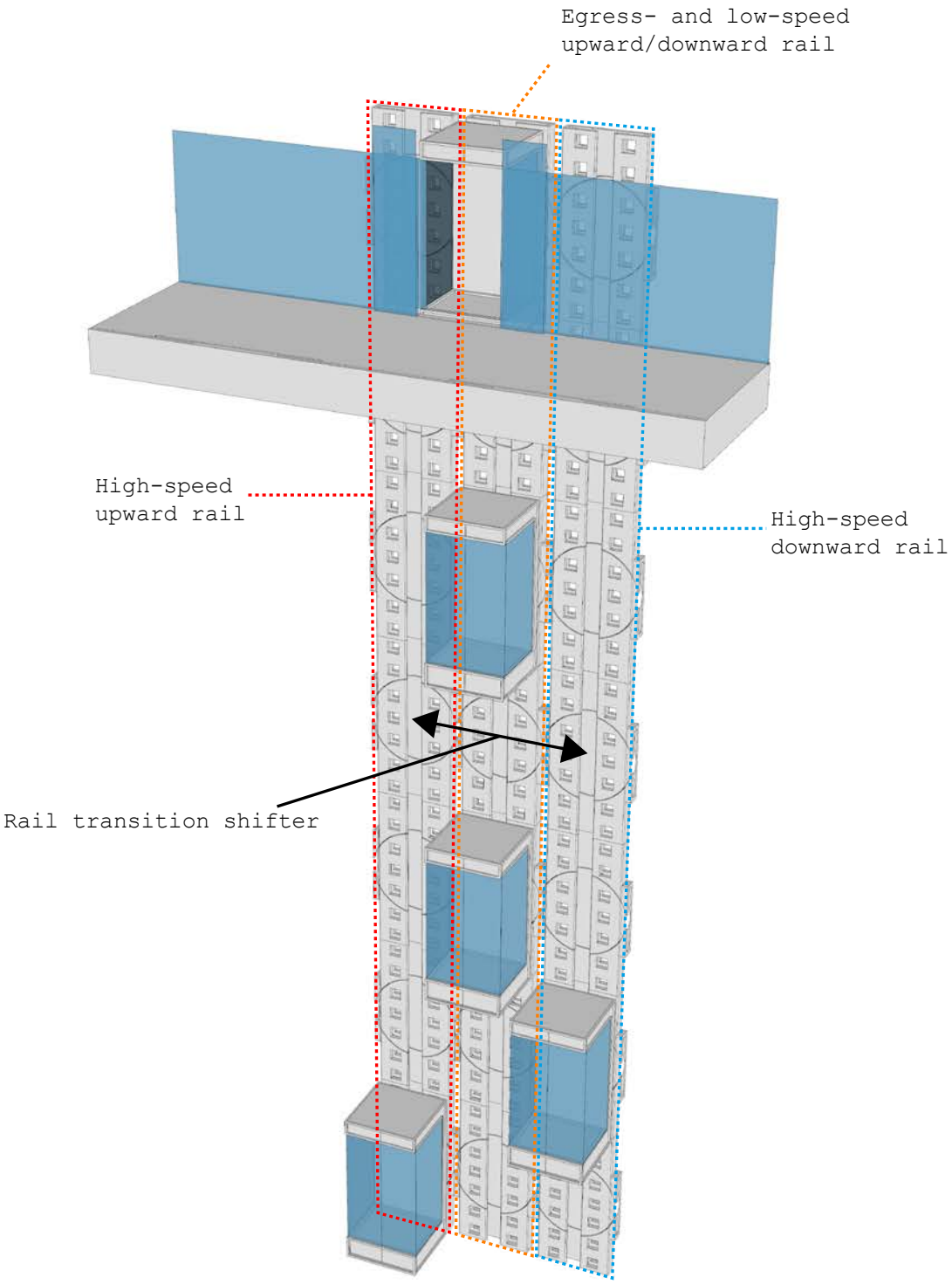
ill. 101 - Back of Facade Module B - Deep Closed Cavity, Copper Coating



ill. 102 - Front of Facade Module C - Slim 200mm Closed Cavity



ill. 103 - Back of Facade Module C - Slim 200mm Closed Cavity



ill. 104 - MULTI-elevator system

[FLOW]

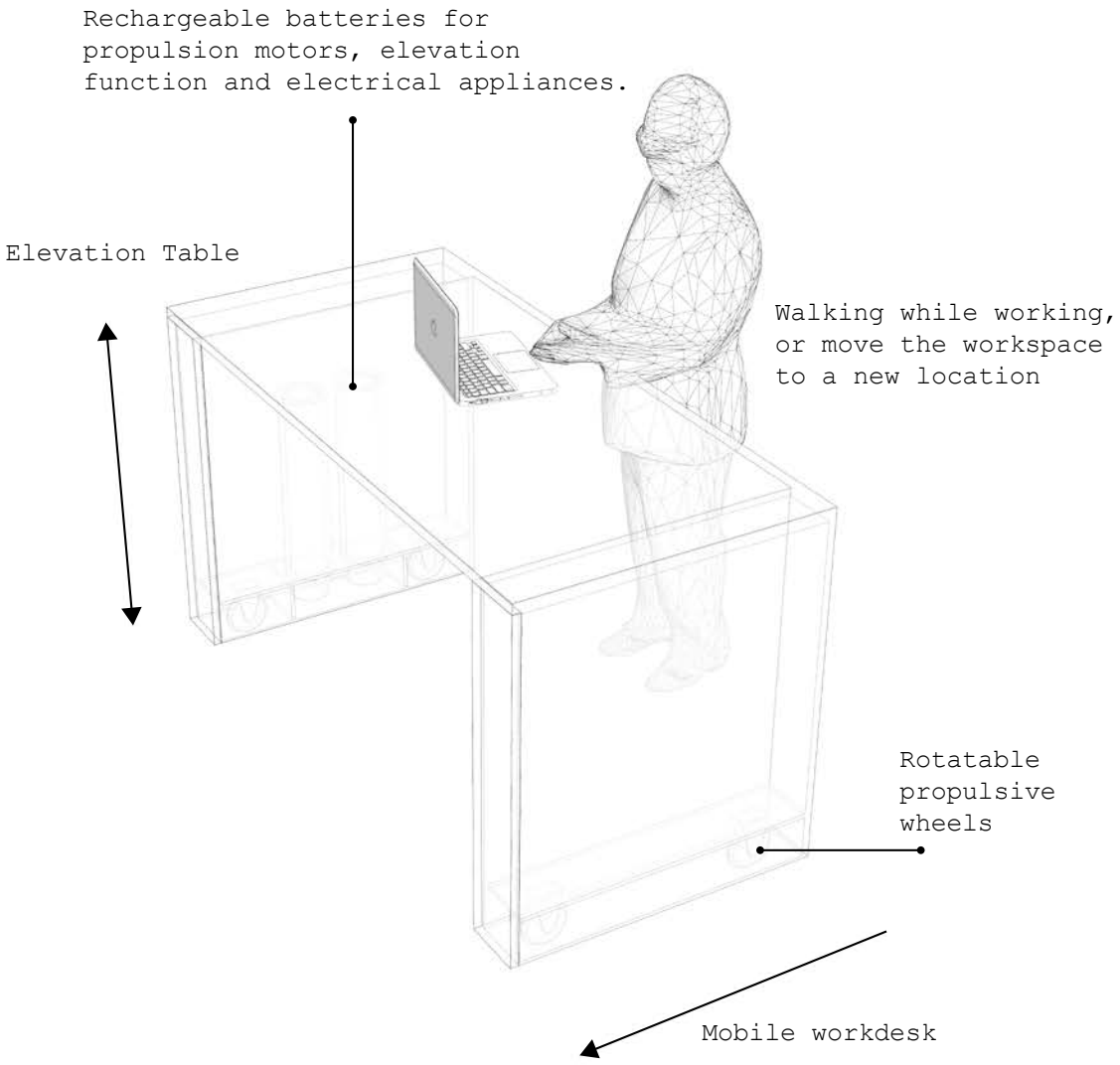
The MULTI-elevator system will be integrated into the proposed scheme. A total of 9 rails or "shaft" will be used. A build this size, of roughly 200.000m^2, would normally hold around 40 shaft, but due to the significantly higher efficiency of the rail based system only 9 rails would be sufficient. The diagram to the left shows how the system is intended to work.

[EXERCISE]

A mobile workstation in the form of a battery driven desktop with rotatable propulsive wheels will be introduced as an essential part of increasing the physical activity for the users. The layout of the building should work in synergy with the conceptual table.

The mobile work stations will be personal, yet an essential part of the flexible and adaptable workspaces in which the knowledge workers can work secluded, in teams or while being physical by walking along with the table while working, to achieve the benefits of low intensity physical activity during regular knowledge based work.

The dimensions of the autonomous mobile desktops make them compatible with the MULTI-elevators so that the users can switch floors, and the tables can be tugged away in the basement when the users are away from the office. This feature further increases adaptability and floor space efficiency.

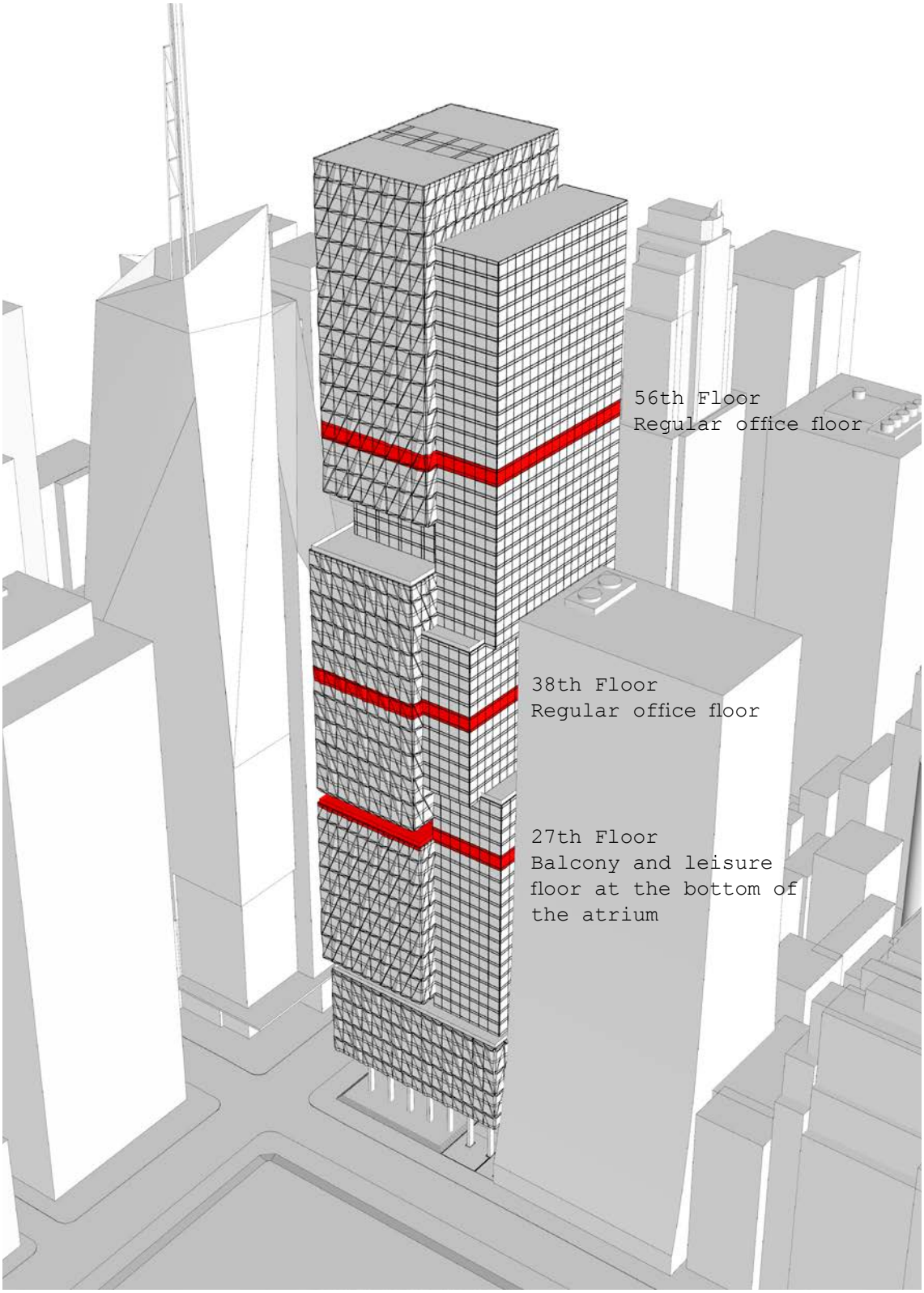


ill. 105 - Mobile Workstation

[ROOM PROGRAM]

Three typical but different floors will be picked to illustrate the different room programs. The three floors represent the majority of the floors in the buildings, when leaving minor chances out of account.

ill. 106 - Room Program Funtions



ill. 107 - Floors used for room program

Open Workspaces

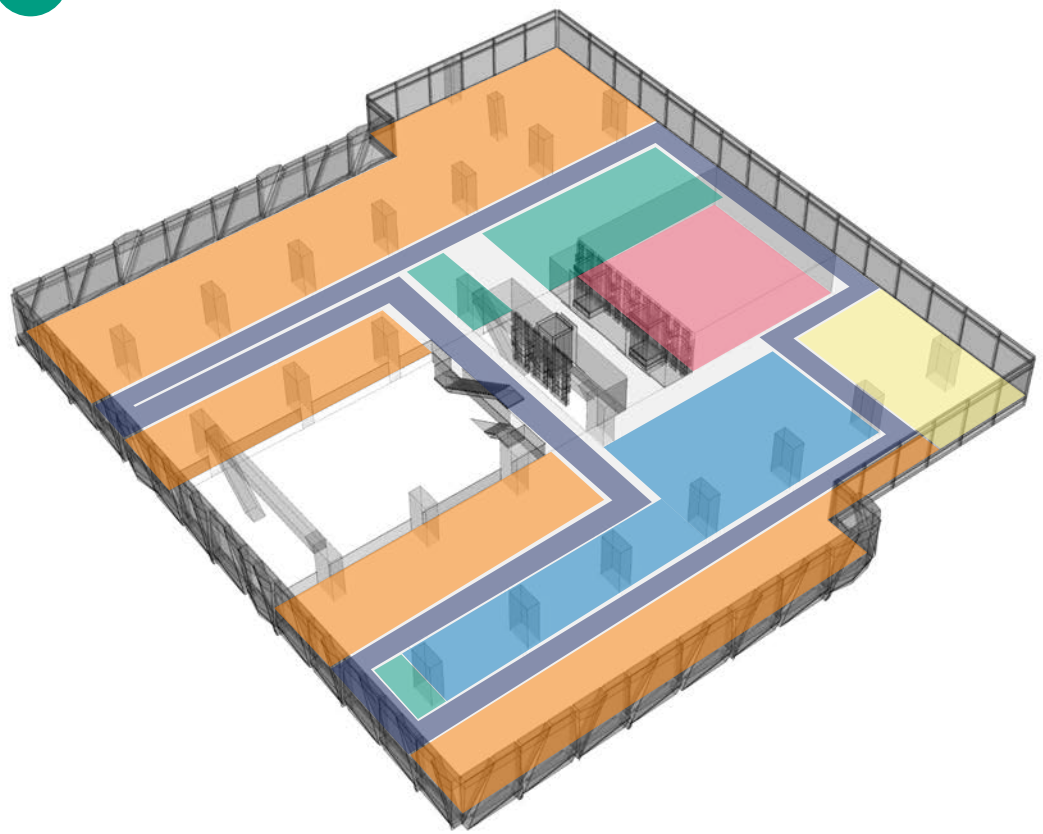
Active Workspaces

Secluded Workspaces

Conference Rooms

Egress & MEP

Leisure



ill. 108 - 56th Floor. Regular office floor

Open Workspaces

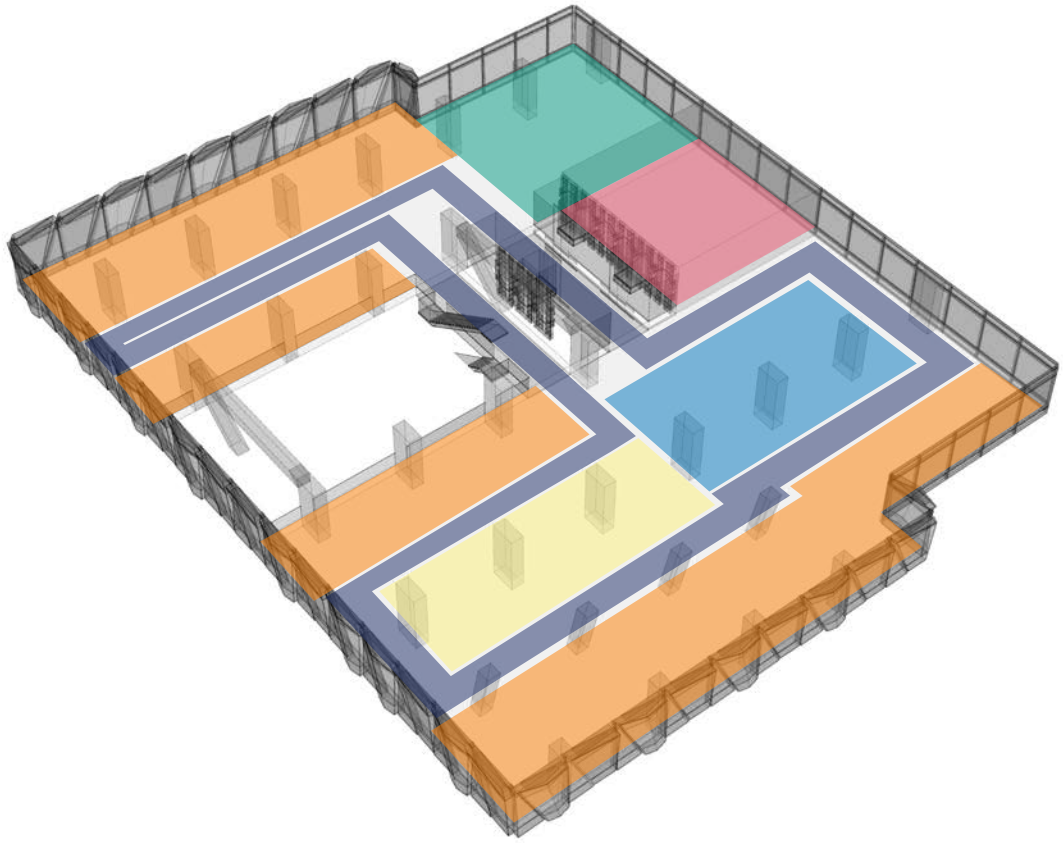
Active Workspaces

Secluded Workspaces

Conference Rooms

Egress & MEP

Leisure



ill. 109 - 38th Floor. Regular office floor

Open Workspaces

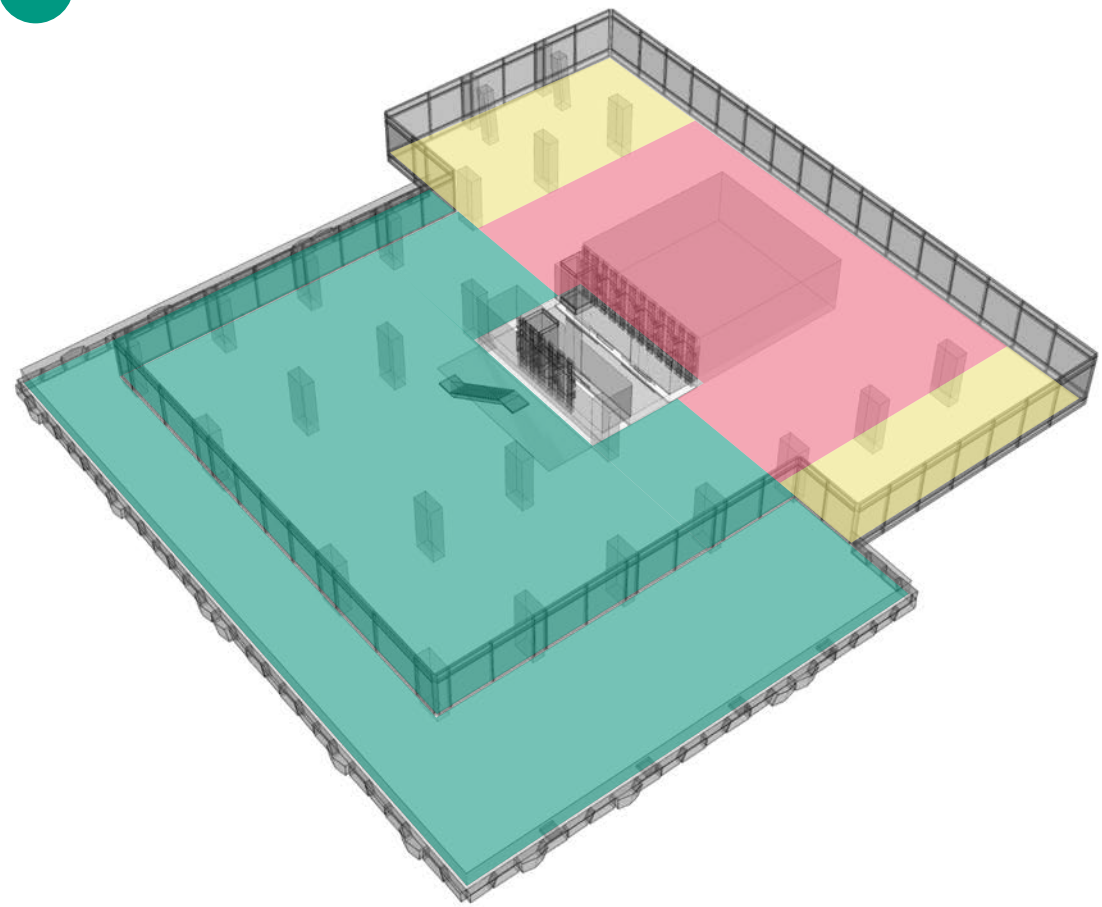
Active Workspaces

Secluded Workspaces

Conference Rooms

Egress & MEP

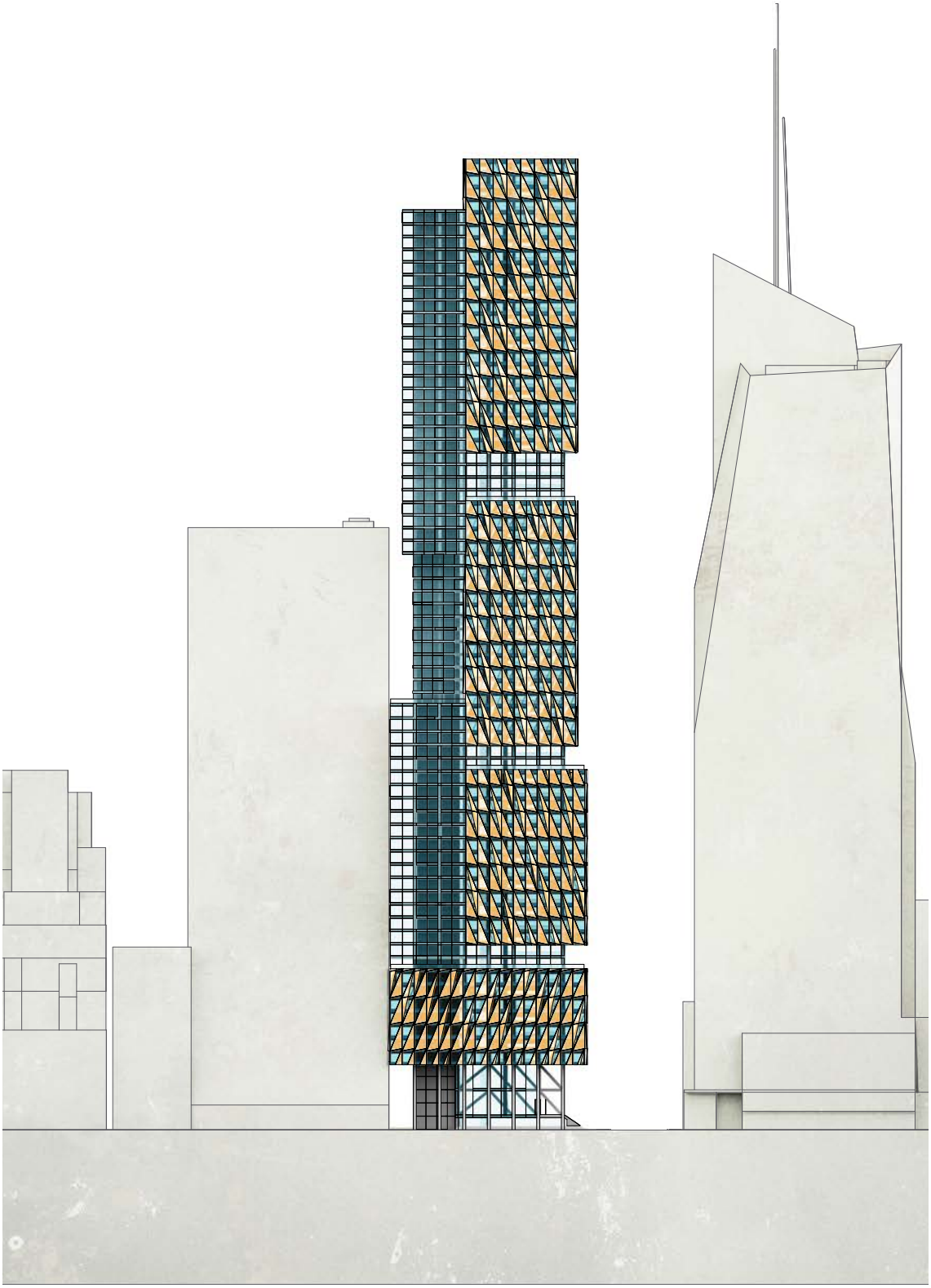
Leisure



ill. 110 - 27th Floor. Balcony and leisure floor.

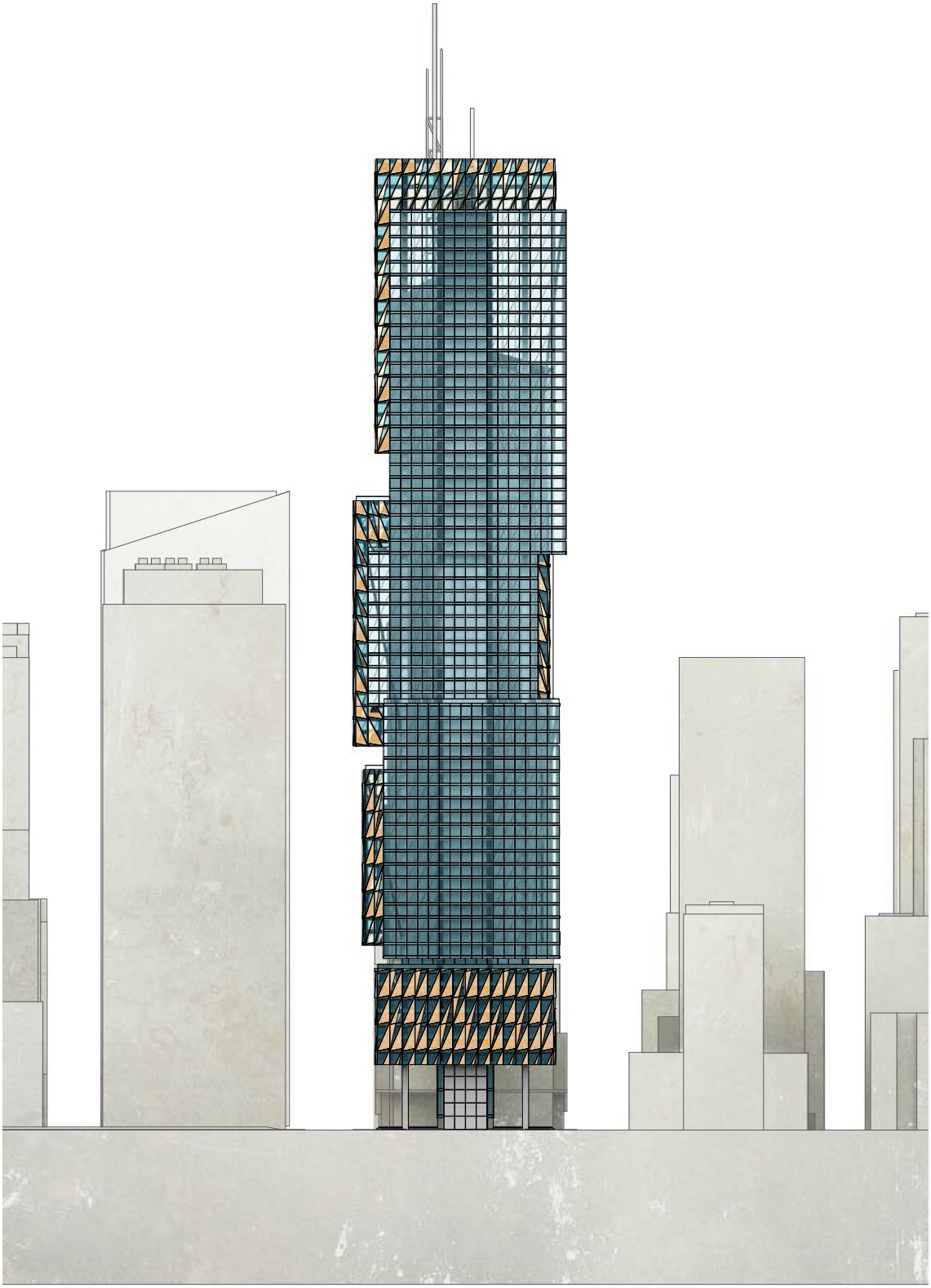
[PRESENTAT


ION]



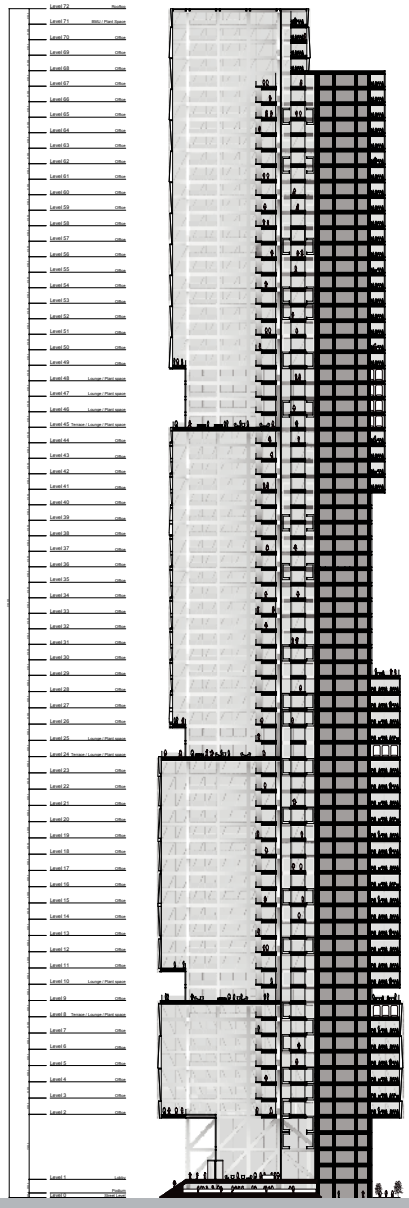
ill. 111 - North Elevation - 1:2000

ill. 112 - South Elevation - 1:2000

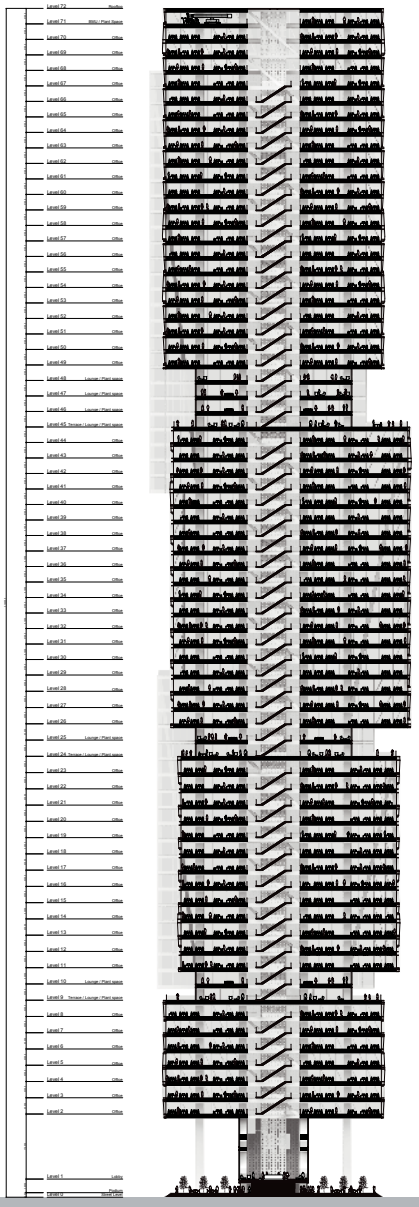


ill. 113 - East Elevation - 1:2000

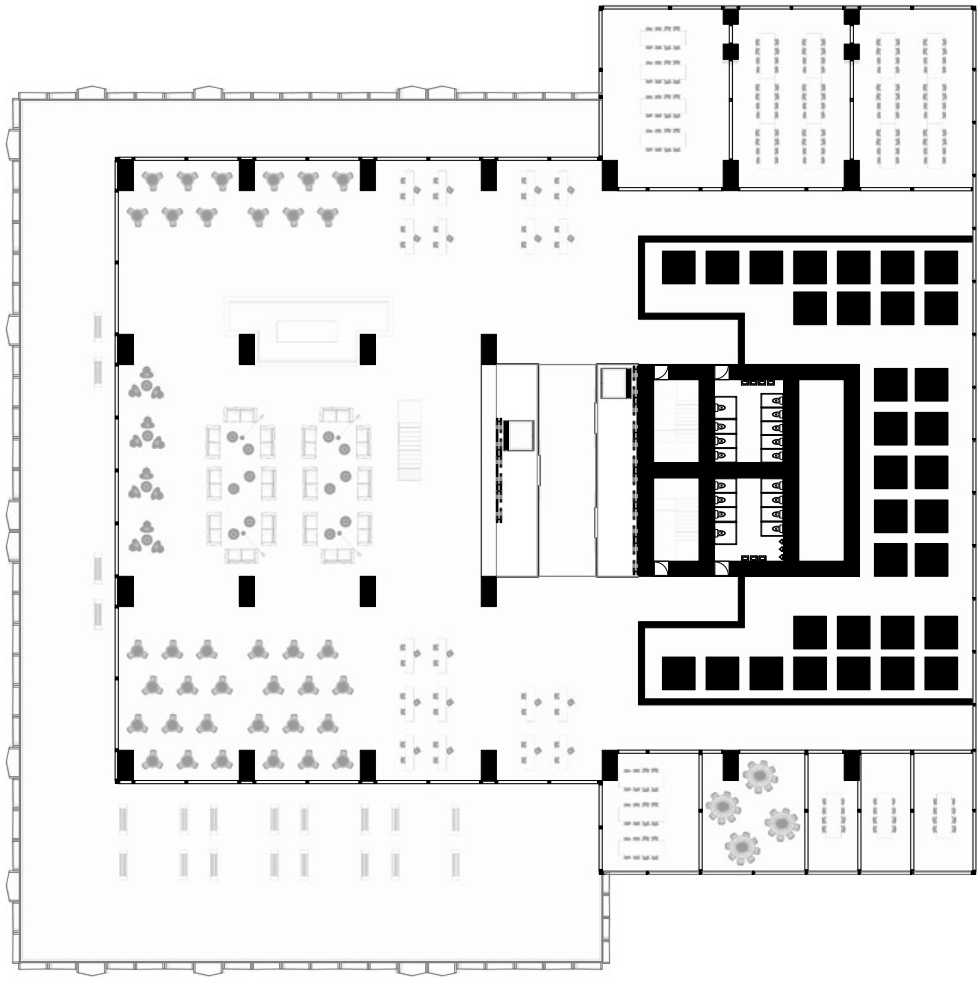
ill. 114 - West Elevation - 1:2000



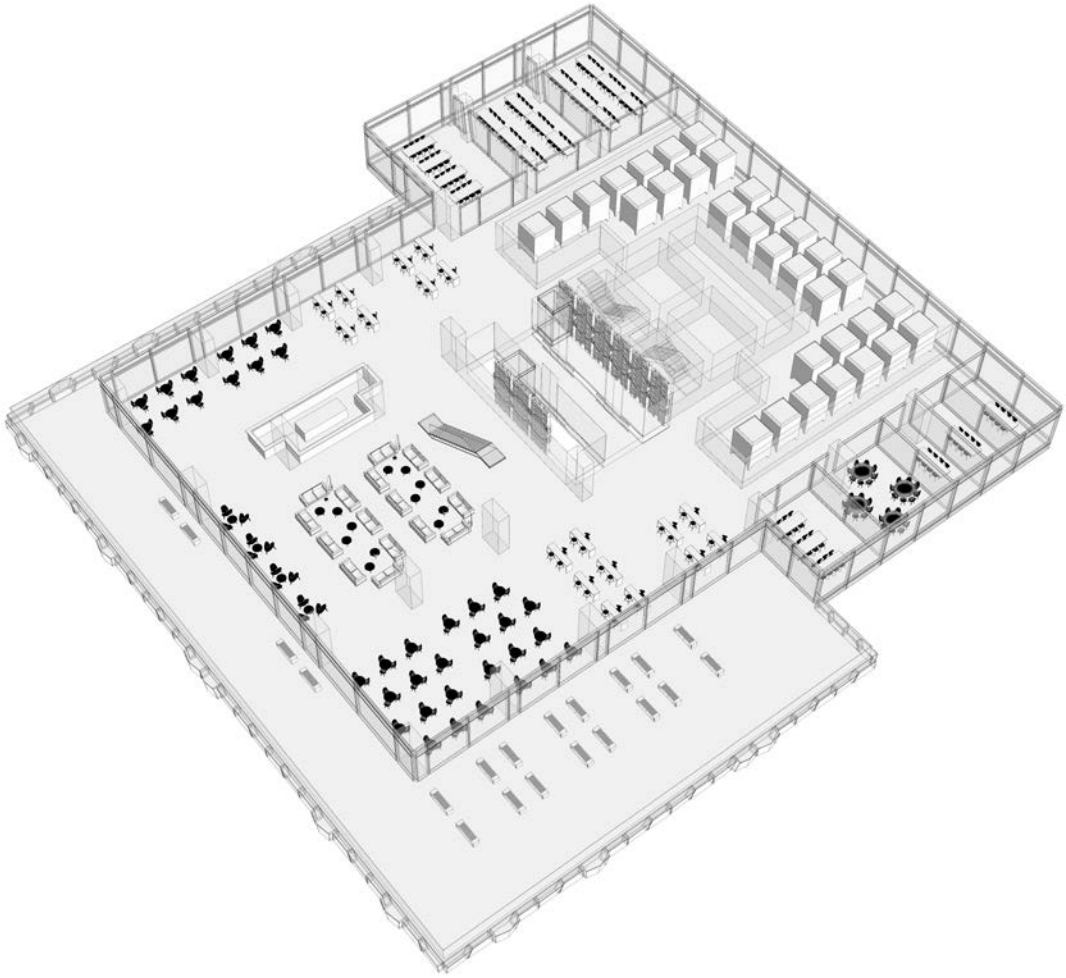
ill. 115 - Cross Section North/South 1:2000



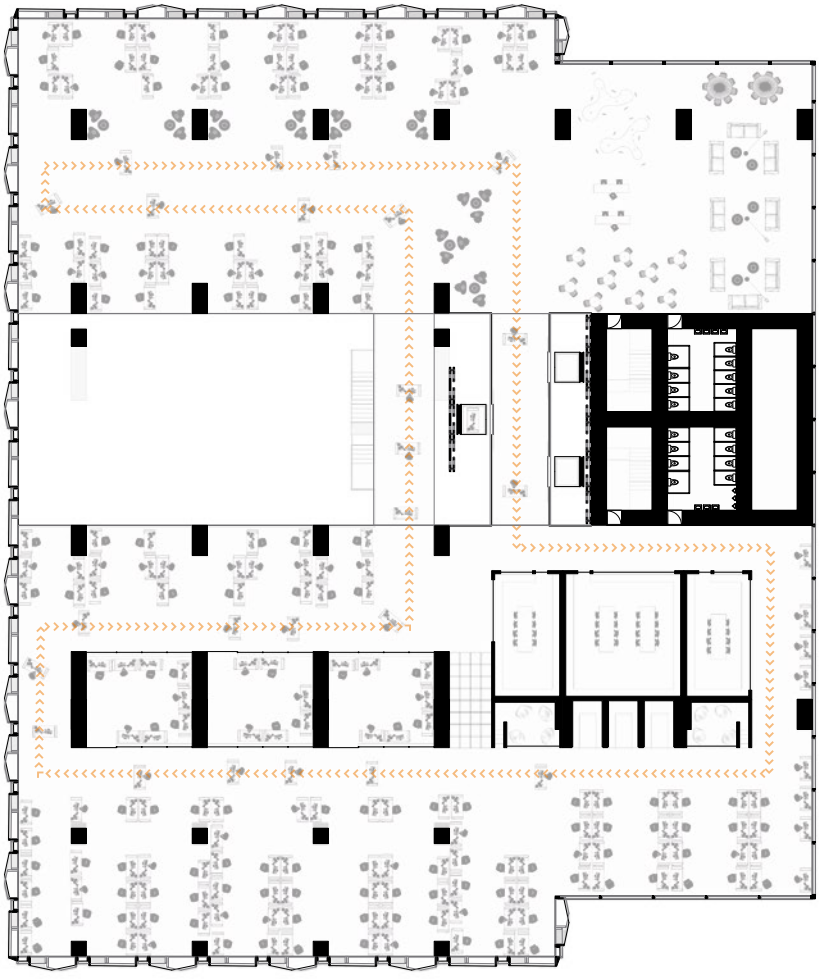
ill. 116 - Cross Section East/West 1:2000



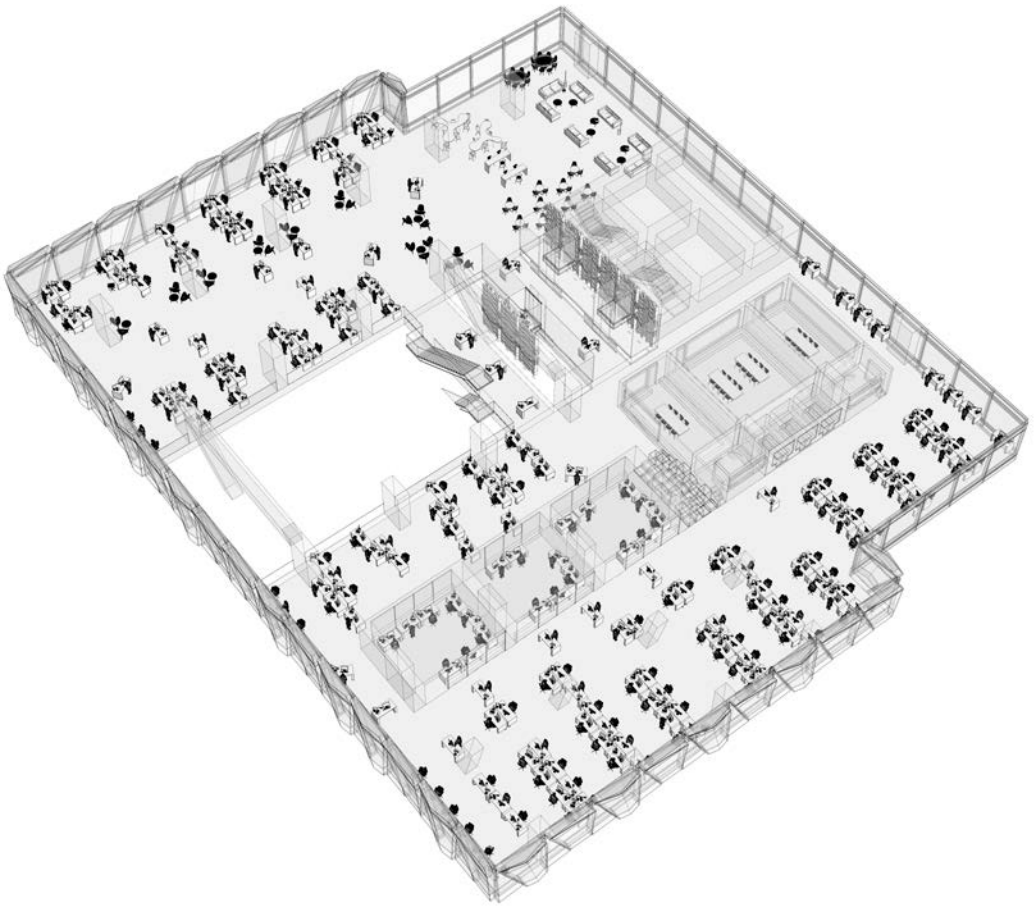
ill. 117 - Floor Plan 1:500 - 27th Floor



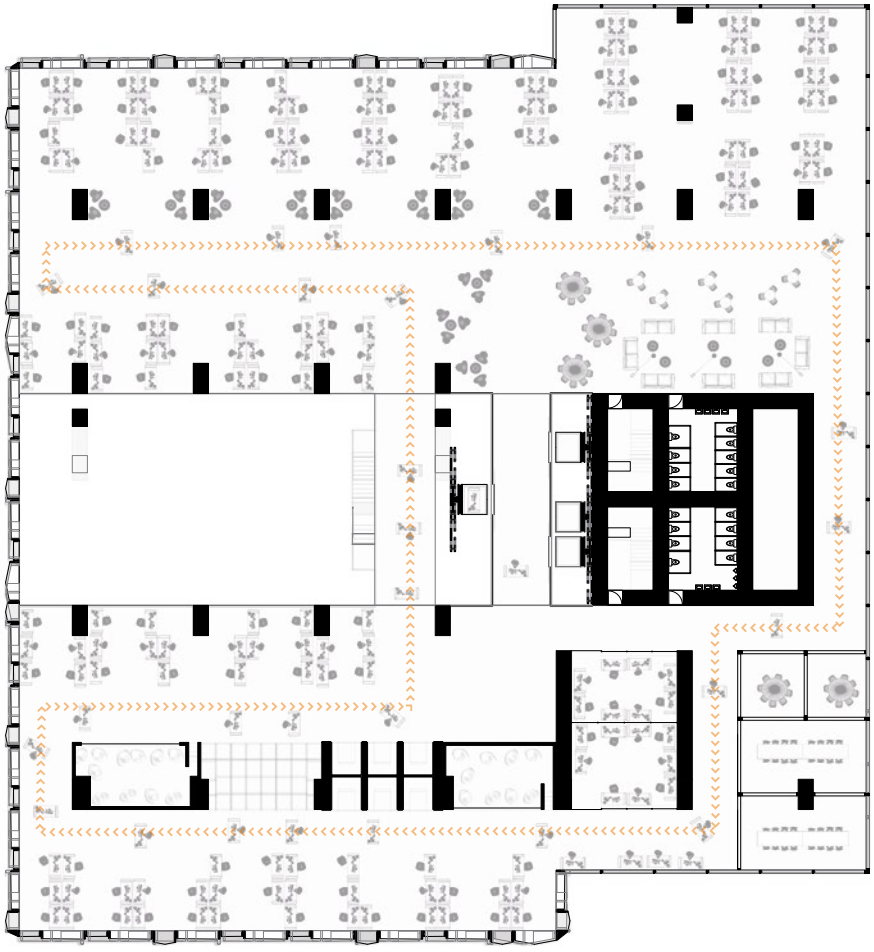
ill. 118 - Floor Plan Perspective - 27th Floor



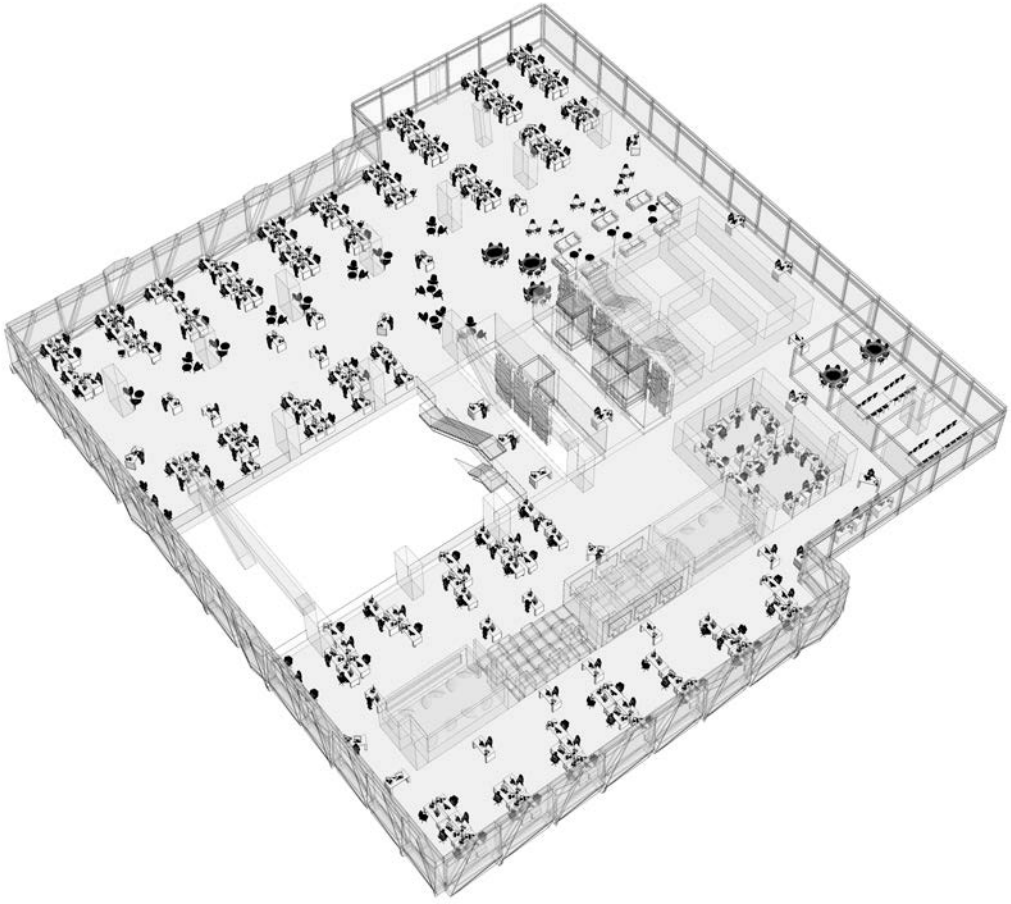
ill. 119 - Floor Plan 1:500 - 38th Floor



ill. 120 - Floor Plan Perspective - 38th Floor



ill. 121 - Floor Plan 1:500 - 56th Floor

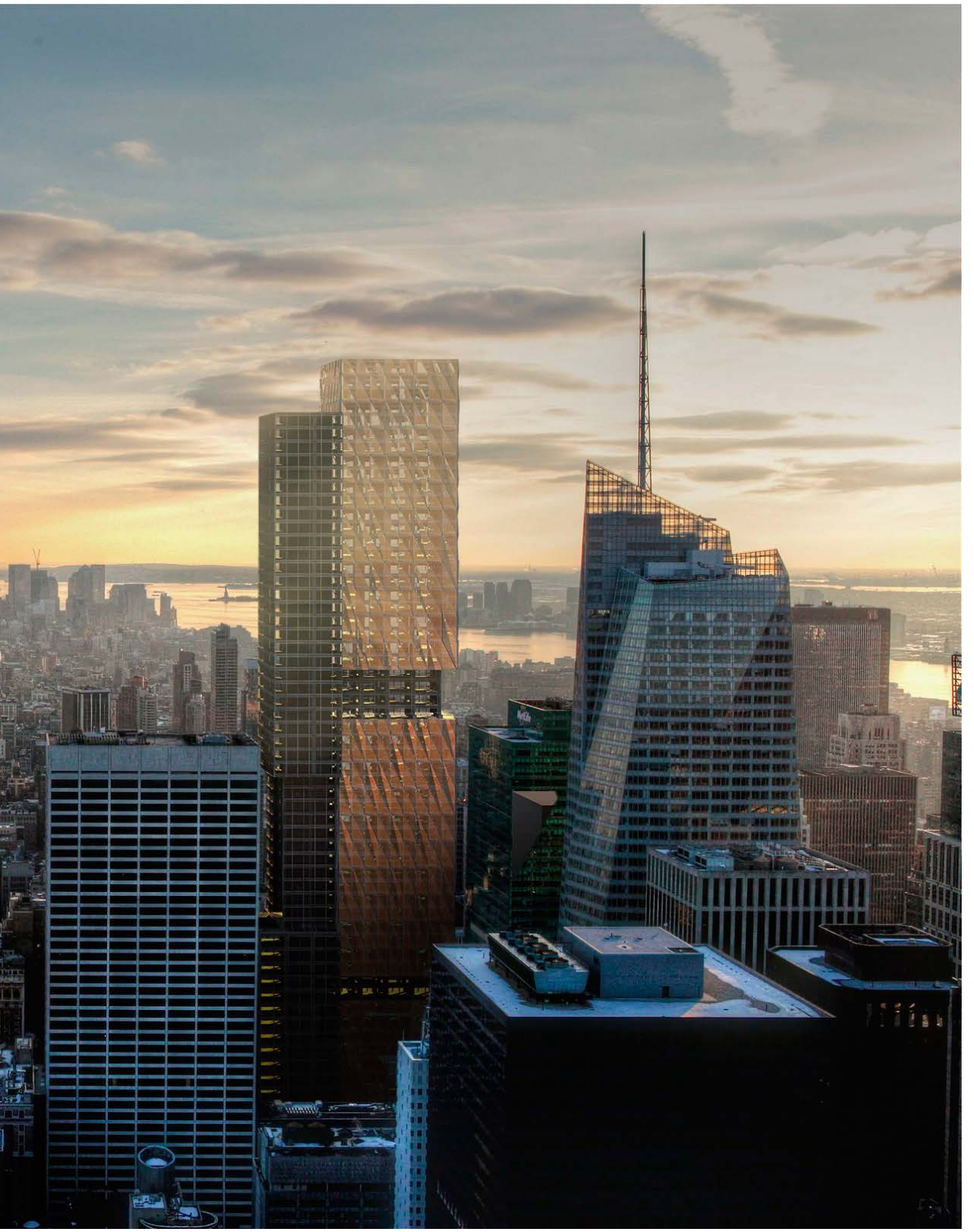


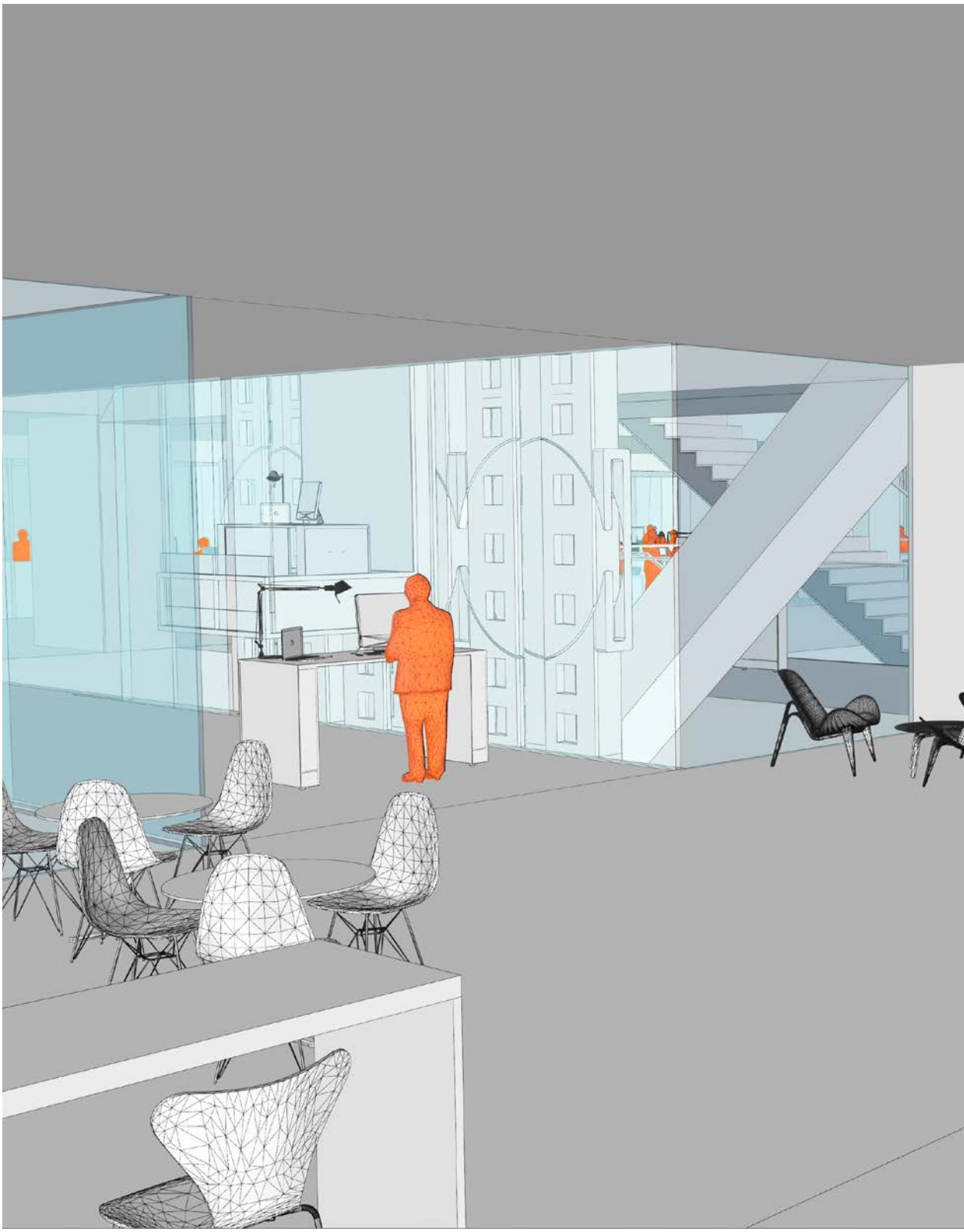
ill. 122 - Floor Plan Perspective - 56th Floor

ill. 123 - Site Plan 1:2000

ill. 124 - Exterior Rendering South Facade

ill. 125 - Exterior Rendering North Facade

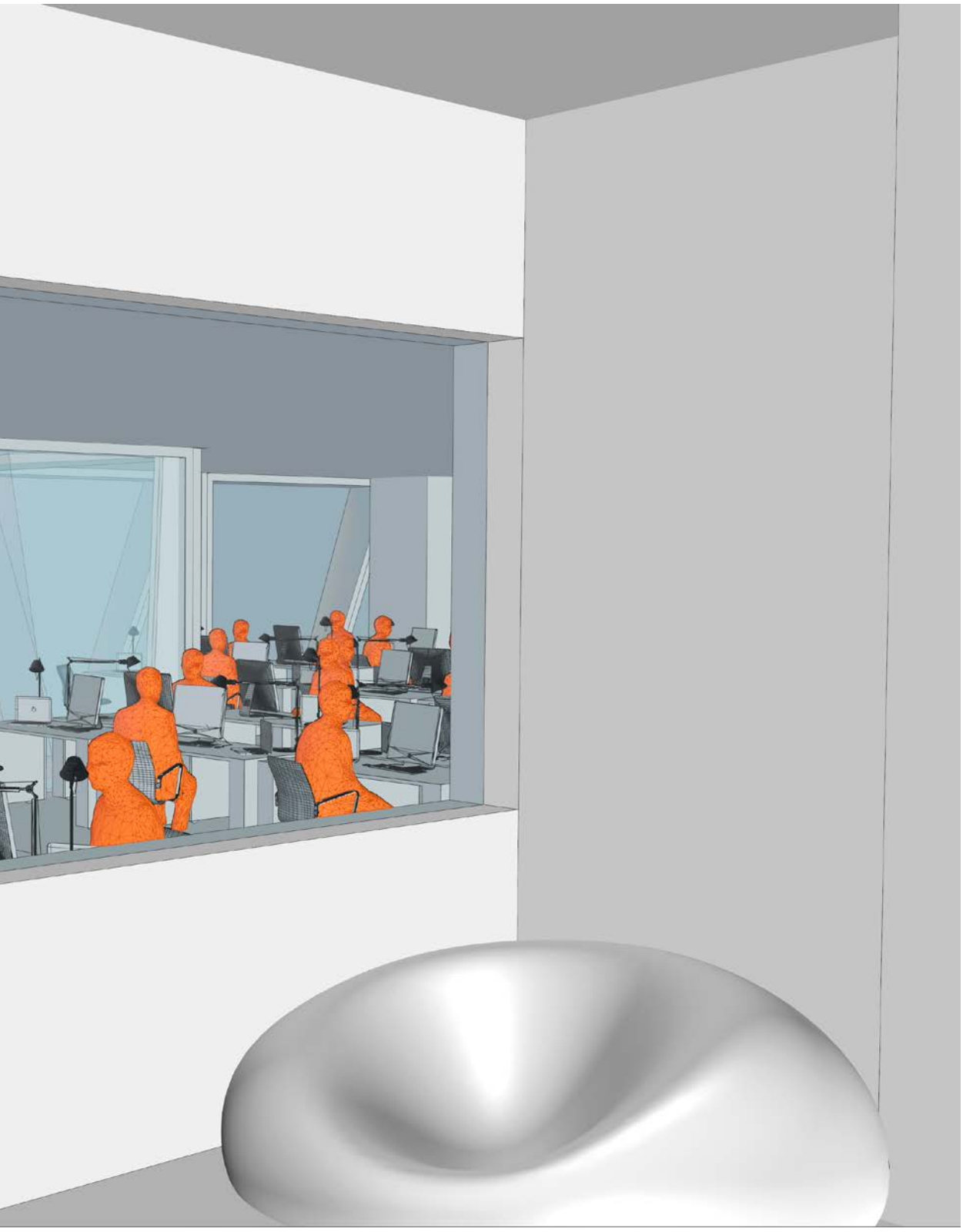




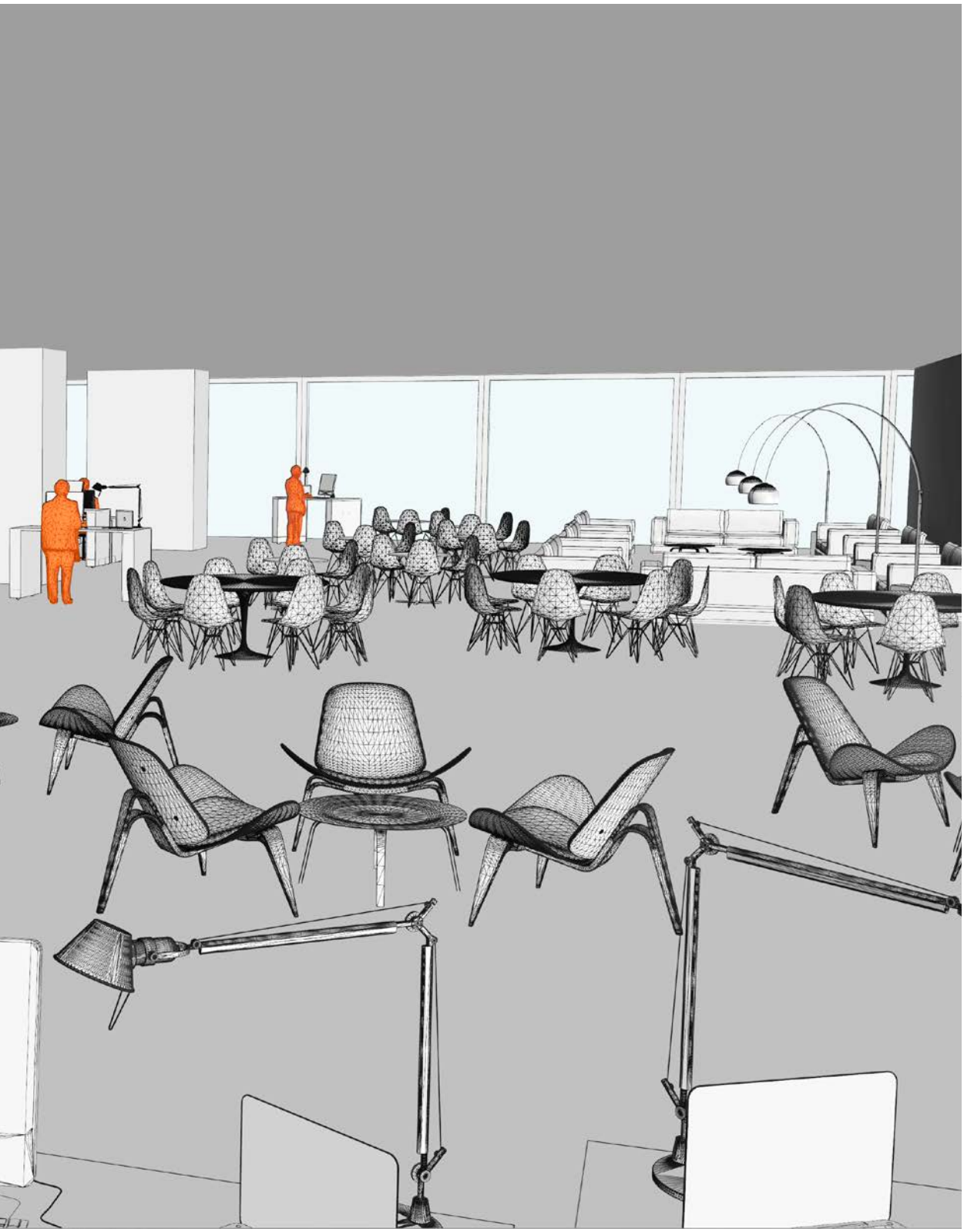
ill. 126 - Interior Rendering Leisure Area 38th Floor

ill. 127 - Interior Rendering Open Workspaces & Secluded Workspaces 38th Floor

ill. 128 - Interior Rendering Secluded Workspace 38th Floor



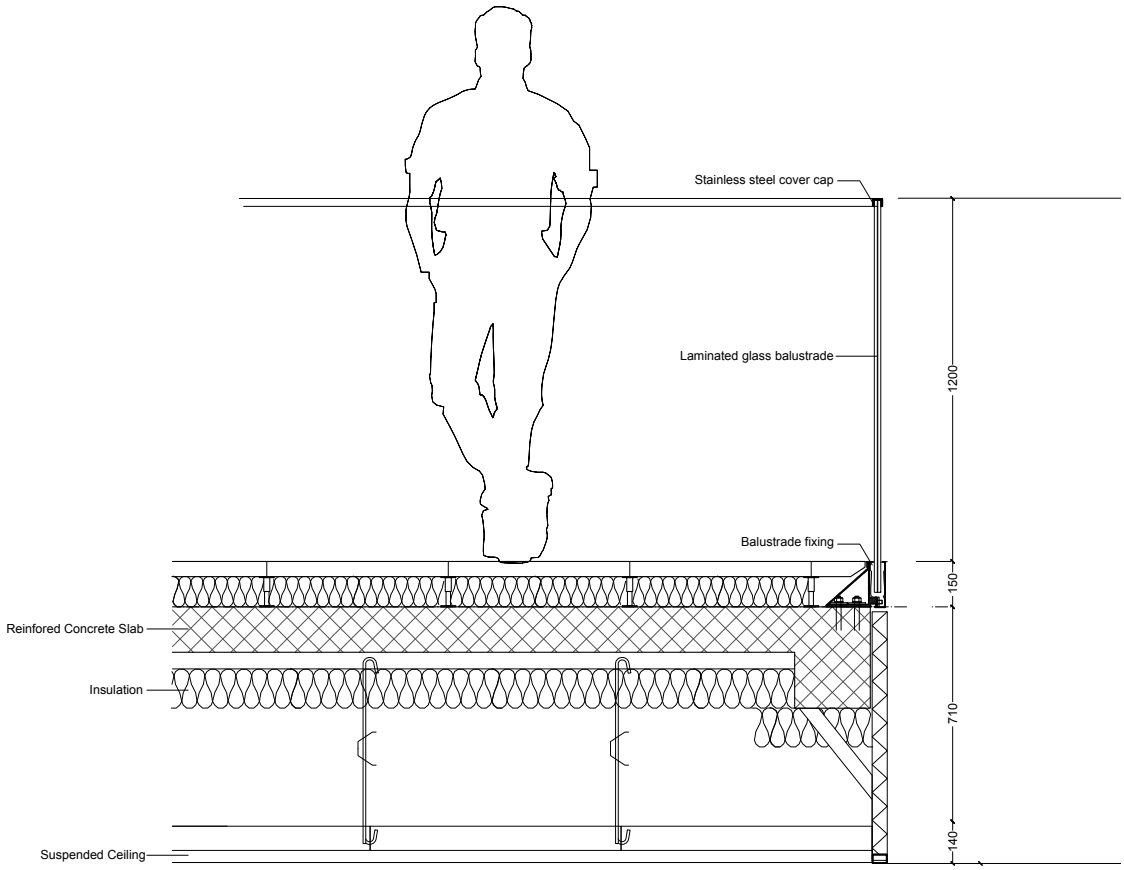
ill. 129 - Interior Rendering Leisure Area & Open Workspaces 56th Floor



ill. 130 - Interior Rendering Secluded Workspace & Active Workspaces 38th Floor

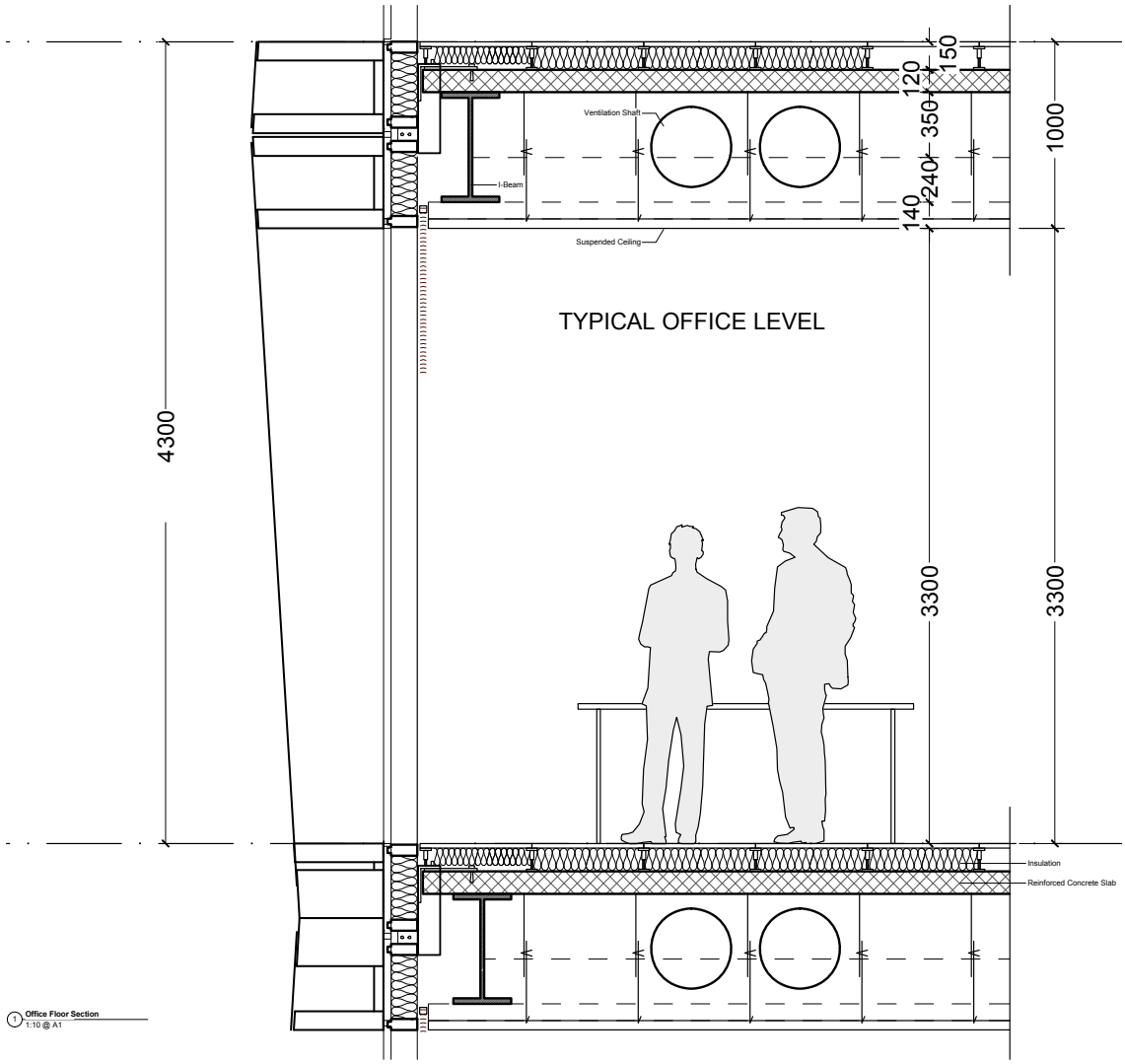
ill. 131 - Interior Rendering Open Workspace 38th Floor

[DETAILING]

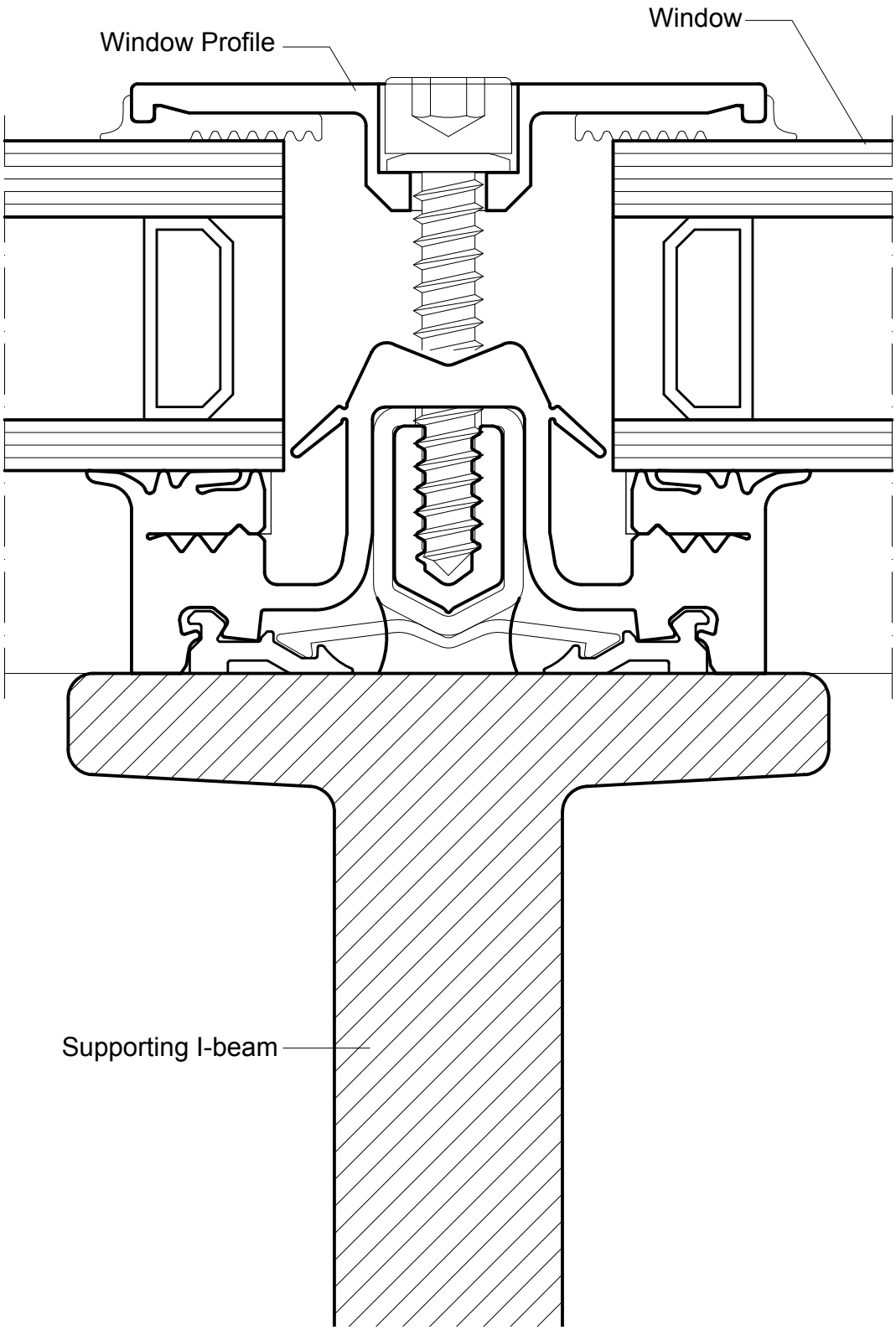


2 **Balcony Detail**
1:10 @ A2

ill. 132 - Balcony Section 1:25



ill. 133 - Office Floor Section 1:40



ill. 134 - Skylight Detail 1:1

[EPILOGUE]

[CONCLUSION]

Alan Kay famously stated that "the best way to predict the future is to invent it". This statement holds true for people across all disciplines and fields, but especially for architects, designers, engineers and scientists. It should be in their nature to illustrate potential solutions and approaches to current problems, without fearing ridicule from the majority of late adopters in the population.

The overall vision for the project has been to propose an office design that challenges the sedentary work style of the modern office worker of the information age, with a healthier more physical active and more productive scheme, that meets most of our physiological needs.

Proposing a scheme that allows for a circular flow within the workspace and combining it with a truly mobile workstation, opens up for new levels of physical activity through the means of walking while working, for a group of people who were previously forced to do sedentary work. The scheme will increase well-being and productivity along with a decrease in life-style diseases among the most crucial group of workers of the future.

The mobile desk, the novel elevator system and the open floor plans permits for new levels of in house flexibility for the employees and the teams alike. A flexibility that will be a source of increased levels of collaboration and transparency, while enhancing the company culture for the users of the building.

The open and flexible floor slabs will be combined with various secluded workspace and conference rooms to accommodate the needs for focus intensive work, formal- and informal meetings, and external communication and collaboration.

The approach to sustainability was based on urban density and space efficiency, by using a data driven evolutionary approach to optimize the number of quality square meters on the site. Combining this with an efficient core layout and the flexibility of the workspace scheme, leads to a high level floor space utilization and efficiency, an efficiency that is essential to reduce the transportation needs and make denser and more sustainable urban habitats.

[REFLECTIONS]

One could argue that the proposed design is indeed somewhat similar to that of many other office buildings built today. Aside from the circular flow made possible by the layout and other minor differences, the point may be valid. Given the scale of projects, the economical investment and the expected lifespan of most large scale projects within the field of architecture doesn't allow for the luxury of radicalism or game changing design.

The long lifespan of projects within the field calls for more general purpose design schemes that can host many potential functions in the future. Whereas a smart phone only needs to "predict" the user needs a few years ahead, architect have to "guess" 100-200 years ahead.

Another aspect that hampers radical innovation within the architectural field is property investors. They have little to no desire to pay for a radical design scheme which may or may not be successful, as they would run a huge risk with for a relative little reward. As design schemes are next to impossible to protect, and would easily be imitated by competitors.

These aspects shouldn’t however influence this “imaginary” project, as it doesn’t adhere to these constraints. The reason for the less radical proposed scheme should be found in the outcome of the evolutionary computational studies. The hypothesis was that the inclined floor slabs would provide a better daylight factor for the workspaces, with a scheme that would have been based around an inclined floor slap with ramp based path for the mobile work stations. The results was however ambiguous and most of the better performing iterations had horizontal or close to horizontal slabs, which caused the proposed design to be less radical.

Given the scale of the project and the limited time frame some aspect of the project are not as well documented as expected. These aspects include; street level synergy and design, material choices, innovative solutions, technology integration and detailing of secluded work spaces. These aspects will be covered more thoroughly at the final presentation, whereas other aspects such as MEP and indoor climate calculations will disregarded due to the limited time frame.

[REFERENCES]

Alker, J., 2014. Office buildings are key to workers' health, wellbeing and productivity. The Guardian.

Avner Ben-Ner, D. J. H. G. K. C. U. M. J. L., 2014. Treadmill Workstations: The Effects of Walking while Working on Physical Activity and Work Performance. PLOS ONE - UNiversity of Minnesota.

Bernstein, E., 2014. The Transparency Trap. Harvard Businees Review, Volume October.

Bourke, M. W. C. T., 2013. It's (almost) all about me. Workplace 2030: Built for us. Deloitte, Volume Deloitte Australia.

Bray, G. A., 2014. Handbook of Obesity - Epidemiology, Etiology and Physiopathology. 3rd ed. Boca Raton: CRC Press.

Bressi, 1993. Planning and Zoning New York City, New Jersey: Rutgers, the State University of New Jersey.

Cashman, A., 2012. Megatrends shaping the future of workspace: Bene Trend Report. DeskMag.

CBRE, 2014. Premier Properties Report for AMP, Sydney: CBRE.

Chen, J., 2015. Form Follows Finance, Copenhagen: Council on Tall Buildings and Urban Habitat.

Congfon, F. a. R., 2014. Balancing "We" and "Me": The Best Collaborative Spaces Also Support Solitude. Harvard Business Review, Issue October.

Ferro, 2013. This is Waht an Urban Heat Island Looks Like. Popular Science.

Ferro, S., 2013. 7 Ways Sitting Will Kill You. Popular Science.

Gehl, 2008. World Class Streets: Remaking New York City's Public Realm, New York: DOT and Gehl.

Gehl, G. K. &. S., 2006. Det Nye Byliv. 1. udgave ed. København: Arkitektens Forlag.

Grush, 2015. Magnetically levitating elevators could reshape skylines. Popular Science.

Harrison, G., 2015. What Does Productivity Sound Like?. Wired.

Hoffmann, T., 2015. 30 minutters gåtur kan redde din arbejdsdag. Videnskab.dk.

Hsu, 2012. New York City Local Law 84 Benchmarking Report, New York: plaNYC.

Khan, 2004. Engineering Pioneer of Modern Architecture. Leigh Univerity.

LBNL, 2015. Impacts of Indoor Environments on Human Performance and Productivity. Lawrence Berkley National Laboratory.

Lehnerer, 2013. Design Rules and Design With Rules!. ETH Zürich, p. http://www.plansandpolitics.com/rules/.

McAuliffe, K., 2009. They Don't Make Homo Sapiens Like They Used To. Discover Magazine - Science For The Curious.

Nat, 2012. National Geographic Magazine. National Geographic Magazine.

Nilsson, 2013. A presentation of Parans. Göteborg, Parans.

Otis, 2009. Daylighting Rules of Thumb. Harvard Graduate School of Design.

Ouye, A., 2011. Five Trends that Are Dramatically Changing Work and the Workplace. Knoll Workplace Research.

Pedersen, P. B., 2009. Sustainable Compact City. Copenhagen: ARKITEKTSKOLENS FORLAG.

Pontzer, H., 2012. Debunking the Hunter-Gatherer Work-out. New York Times.

Schierenbeck, 2014. MULTI. Essen, Thyssen Krupp.

Shontell, A., 2014. The Truth About 'Working' On A Treadmill Desk. Business Insider.

Sung, 2012. Four very fresh ideas about air conditioning. TED.

Tarleton, 2014. What is Zoning?. Urban Omnibus, pp.

Wabler, M. L., 2014. Workspaces That Move People. Harvard Business Review, Volume October.

Watts, 2010. Tall Buildings in Numbers. Council on tall buildings and urban habitat, p. www.ctbuh.org.

Wright, 2003. Daylighting Resources - Productivity. Lighting Research Center.

[APPENDIX]