STACKING STORIES TO UPGRADE THE CITY

THE ROLE OF HIGH-RISE BUILDINGS IN ROTTERDAM

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ABSTRACT

With the exponential growth of high-rise buildings in Rotterdam over the past decades the city is now the 10th highest city in Europe. The role that high-rise plays in the city of Rotterdam has been developing throughout the years and started becoming more important. Through literature and municipal archival research, the significance of high-rise buildings and their role have been explored through three different aspects: cultural physical and economical. High-rise buildings emerged from the culture of congestion but were merely used as a tool for the densification of the city after World War II. While the early urban planning did not address high-rise buildings it laid down the urban foundation for the designated high-rise zones in the city. With the exponential growth the municipality set up policies for high-rise buildings to keep the built environment in check. Because of the lack of historic city value of Rotterdam, the high-rise buildings and structures form the iconic image of the city. While high-rise buildings fulfil their role of accommodating people it also functions as a tool for city branding to not only promote the city but also revitalize the built environment However, high-rise buildings can also have a negative impact on the social wellbeing of its users. Both anonymity and the lack of connection with the public realm high-rise buildings can bring more harm than good to its users. Although the municipality is already addressing this problem in their most recent high-rise policy and urban planning it appears from this research that it is important to explore how high-rise buildings can sustain communities and the future generations.

keywords: High-rise buildings, Rotterdam, History, Urban planning and policies, City marketing

1 INTRODUCTION

In the past decades, the number of high-rise buildings has exponentially grown[1]. The Netherlands currently counts twenty-six residential towers of more than a hundred meters high[2]. Twelve of those residential towers are in Rotterdam, making it the highest city in the Netherlands and the 10th highest city in Europe[3]. With the number of high-rise projects that are currently under development, the number of high-rise buildings is expected to at least double in the Netherlands in the upcoming five years[2]. The rapid increase of high-rise buildings is often the answer to the increasing demand for housing in the bigger cities. Nowadays high-rise living is more common than ever before4. Throughout Europe about six million people live in high-rise buildings and another thirty-four million people live in large, prefabricated estates of at least 2500 dwelling which often comes in the form of high-rise blocks[5].

High-rise buildings have been defining the city of Rotterdam for the past decades. Throughout the centuries and especially after the bombing during World War II, the urban areas and their structures have been constantly changing to address the physical aspect of decay. Rotterdam has been using high-rise as a tool in their urban development resulting in Rotterdam being one of the leading high-rise cities in Europe. To understand the significance of high-rise buildings the role of high-rise buildings in Rotterdam will be explored through three aspects: cultural, physical and economical.

First, the cultural aspect of high-rise buildings in Rotterdam will be examined. In literature the term skyscraper is often used, this is because there is a distinct difference between high-rise and skyscrapers in the United States. However, to not confuse these two terms they will both be defined. Furthermore, to get a good understanding of the importance of high-rise buildings the history of high-rise buildings will be explored. To go more in depth about the history of high-rise buildings in both the Netherlands and Rotterdam, the export of high-rise to the Netherlands and the history of high-rise buildings in Rotterdam will be discussed. The significance of high-rise and its impact on the city will further be discussed by means of the book 'Delirious New York' which was written by Rem Koolhaas. The book discusses and analyses the history of Manhattan, a city known for its urban planning and integration of high-rise buildings. By discussing Delirious New York, the significance and the role of high-rise buildings in urban context can be related to Rotterdam and thus create an understanding of its importance to the city.

Secondly, it is important to understand the development of both the urban planning and high-rise buildings within Rotterdam. After World War II the city of Rotterdam had to be rebuilt. From there on out the development of what is not considered one of the largest harbour cities in the world started. To understand how the city came to be it is important to discuss how urban renewal is being used as a tool to develop the city. Urban renewal is a tool that the city of Rotterdam has been using since the 1970s to redevelop the city and address physical decay of neighbourhoods. Furthermore, both the development of Rotterdam's urban planning and its policies for high-rise will be explored. It is important to discuss the urban planning of Rotterdam to grasp the role of high-rise buildings in the development of the city. Although the city of Rotterdam stems back centuries ago this thesis will be focusing on the urban development since World War II. This was the significant turning point in the development of both the city and high-rise buildings. The first high-rise policy in Rotterdam stems back to 1993. Ever since then the policies have been rapidly developing due to the increasing interest in high-rise buildings. To understand how the role of high-rise buildings in Rotterdam have been changing over the past decades it is important to discuss these policies.

Finally, the economical aspect of high-rise buildings in Rotterdam will be discussed. High-rise buildings both solve and cause economical and social problems. A common process that causes and solves both economical and social problems is gentrification. To understand how high-rise buildings are being used as a tool in gentrification the definition of gentrification will be explained. Furthermore, the role of high-rise buildings in the gentrification process will be discussed. The role economical role high-rise buildings play in Rotterdam will further be discussed through exploring high-rise buildings as a city marketing tool. Iconic buildings have been playing an important role in the image of the city. With Rotterdam being known for its city skyline the economical importance of high-rise buildings and their role in promoting the city will be explored.

2 CULTURAL
THE IMPACT OF HIGH-RISE BUIDLINGS IN THE CITY
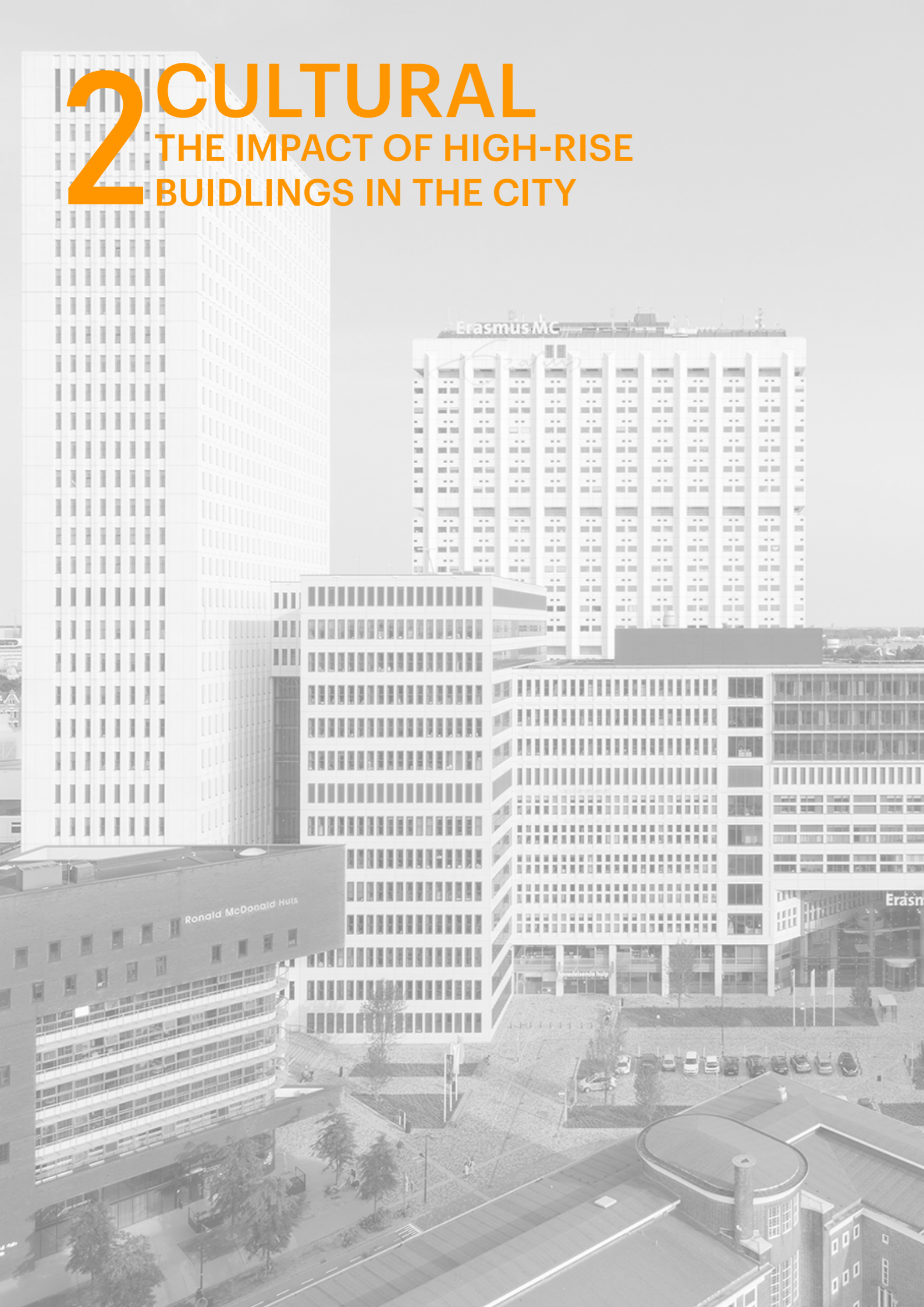
While high-rise buildings seem mere tall building structures, they have a big impact on different scales. Not only do high-rise buildings impact the urban structure and the skyline but also its users, the surrounding buildings, and public spaces and how the buildings interact on street level. To grasp the role of high-rise buildings in Rotterdam it is important to understand why high-rise buildings were built in the first place and how high-rise buildings have an impact on different scales.

2.1 High-rise buildings and Skyscrapers

According to the Cambridge dictionary, high-rise is "a tall modern building with many floors". A tall building can be described as a multi-story structure in which most occupants depend on elevators to reach their destination[6]. In most countries the most prominent tall buildings are considered high-rise buildings. There is however no definite definition internationally. Some consider flat buildings high-rise and others consider the tallest of tallest buildings as high-rise. Nonetheless, high-rise buildings can be defined as follow: According to Section 202 of the 2018 International Building Code (IBC), a building is considered high-rise when there is an 'occupied floor' more than 75 (23 meters) feet above the lowest level of fire department vehicle access (figure 1)[7]. This definition is important to keep in mind for safety reasons and requirements.

A skyscraper is not defined by the IBC or any sort of building code, it is simply a tall structure. The online dictionary[8] defines a skyscraper as 'a building of exceptional height completely supported by a framework, as of girders, from which the walls are suspended, as opposed to a building supported by load-bearing walls.' In the Dutch building code, there is no mentioning of 'skyscrapers', this is a term mainly used in the United States where there is a distinct difference between a high-rise building and a skyscraper.

The term 'high-rise' is relative and is highly dependent on the environment in which is being built. In Europe, twelve-story buildings are considered high-rise buildings, while In New York, a sixty-story building is barely defined as high-rise[9]. The exact height of what is deemed high-rise is specified by fire and building codes for the country, region, state, or city where the building is located. In the Netherlands a high-rise building is defined in the Dutch building code, section 2.14[10], as a building with an occupied floor at

70 meters above ground level.

What is now considered high-rise was, back when tall structures were being developed for the first time, called skyscrapers. To define the nowadays high-rise buildings in its form, function, and aesthetics the history of the skyscraper will be explored.
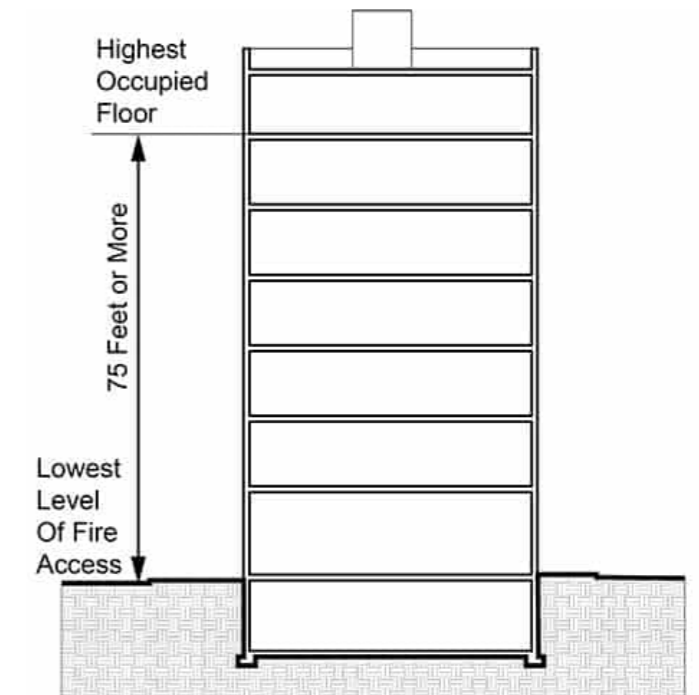

Figure 1. Defintion of high-rise buildings according to the IBC.[1]

2.2 History of high-rise buildings

The construction of buildings that were considered tall dates to the Roman Empire. During the reign of Julius Cesar, the Roman Empire rapidly grew resulting in the city of Rome becoming the site of many hastily constructed apartment buildings[11]. Because these apartment buildings were hastily constructed to considerable heights buildings collapsed due to structural failure. To avoid these buildings from collapsing laws were passed that limited the heights of buildings, first to 21 meters and later to 18 meters. Throughout history other tall structures were erected such as pyramids, cathedrals and towers. However, it was not until the end of the 19th century that the term 'skyscraper' was used. According to the Oxford English Dictionary the word skyscraper got its architectural detonation in the early 1880s in several articles in journals and newspapers[12]. The term 'skyscraper' was being used for buildings that would exceed six to seven stories and had a minimum height of 35 meters. Although there already

were structures that exceeded this height, such as cathedrals, the significance was that these buildings had multiple accessible and useable stories unlike cathedrals that reached these heights because of their high ceiling chapels and towers. Additionally, there were also other buildings that exceeded the height of 35 meters such as warehouses. However, these buildings were used to store goods and not accommodate people, this is how skyscrapers and tall buildings were different from each other. What is noticeable is that the first buildings that were considered skyscrapers were all office buildings, with the Home Insurance Building (1885), built in Chicago (figure 2), being the very first one. As a result of the economic growth after the Civil War (1861-1865), the financial organization of American businesses rapidly grew, demanding more office spaces. In combination with the increased land prices in the financial district the demand for tall office buildings rose resulting in skyscrapers that would function solely as office buildings.[12]

It was not only the demand for tall office buildings that made the first skyscrapers emerge, but there were also two main developments that led to the existence of the skyscraper. The first being the invention of the elevator, invented by Elisha Graves Otis in 1853 (figure 3). With the invention of the elevator people were able to travel upwards more safely, quicker and with less effort than walking up the stairs. The second invention, which was arguably even more important for skyscrapers was the process to mass produce steel. Around the 1870s builders started using steel because it's strong qualities and its cost efficiency. Before the introduction of the steel structure walls would function as the construction, which were made from cast iron and wood and in order to carry the weight of more floors the walls had to be stronger and thus thicker. With the introduction of the steel frames the structure was able to carry the weight of the floors and walls simply became cladding for the purpose of aesthetics and insulation. The demand for these high-rise buildings was a response to the industrialization take took place in the late 1800s. Industrialization had driven both the land prices and the densification of the population, making high-rise buildings more cost-effective because of the smaller plot[13]. From here on out skyscraper started to emerge, especially in Chicago and New York. In the early 20th century, the record for world's tallest building was broken six times, all these buildings were established in New York[13].With the constant development of steel structures and the new possibilities it soon reached

Europe. However, it took a while for the Netherlands to adapt high-rise buildings in the urban fabric of the cities.

Figure 2. Home Insurance Building, Chicago, 1885.[a]

Figure 3. Invention of the elevator by Otis, 1853.[3]

2.3 The export of high-rise buildings to the Netherlands

It took a while before Europe started importing steel structures to building high-rise structures. There was a lot less space to erect new modern high-rise buildings in Europe compared to the United States and Asia. This was mainly because cities in Europe grew over a longer period and thus having a richer architectural history and a denser inner city. For this reason, a lot of buildings in European cities are considered cultural heritage and are unlikely to be destroyed and replaced with modern buildings[14]. The first high-rise building, that could accommodate people, that emerged in Europe was 'het Witte Huis' (figure 4) , a ten stories office building built in Rotterdam in 1898. In 1932 'De Wolkenkrabber' (figure 5) was built, a 12 stories residential high-rise building designed by J.F. Staal. The building was originally designed in 1927, however because the Dutch building code only allowed a maximum of four stories for residential buildings the building was not allowed to be built. Because of serval proposals for tall residential buildings and the increasing housing demand between the two wars the building code changed allowing taller residential buildings. What was very interesting was the fact that while in the United States the first high-rise buildings were offices, the first high-rise buildings in the Netherlands functioned as residential buildings. While in the United States there was a need for office spaces due to the economical growth[12] the Netherlands demanded more residency with the increasing population growth and the demand for housing after World War II. When de Wolkennkrabber was realised, there was not a lot of interest due to the economic crisis making the rent for this new type of building unpayable for most people. It wasn't until the 1960s that the interest for high-rise residential buildings in the Netherlands significantly increased. Large modernist residential estates were built on the outskirt of the bigger cities, a small-scale project with residential high-rise buildings that were separated by green public spaces[15]. A good example is 'De Bijlmermeer' (1960-1969) a neighbourhood (figure 6) designed by G.A. Nassuth who based his design on the 'modern city', an idea of Le Corbusier. The design was supposed to portray the future of the city. The Bijlmerplan emphasized collectivity16 which would compensate for the limitations of high-rise living. However, because of the high rents and the lack of facilities, which were not realized because there was no money to finance, there was a huge vacancy in the buildings. This vacancy was

Figure 4. Het Witte Huis, Rotterdam, 1898.[4]

Figure 5. De Wolkenkrabber, Amsterdam, 1932.[5]

counteracted by the reception of the immigration flow of Surinamese[16] resulting in a mix of culture and 'the first black town in the Netherlands'. The lack of safety and the rising problems that formed around the Bijlmermeer gave these high-rise buildings a negative imago. The municipality of Amsterdam later decided to demolish a part of Bijlmermeer and replace high-rise buildings with low-rise buildings and implement facilities. After the rise of post war high-rise buildings in the 1960s and 1960s, which is considered 'the first wave of high-rise', all there was left was a negative image about high-rise building. In the upcoming years, during the early 1980s, there were no high-

rise buildings built that exceeded 70 meters. It was not until the late 1980s that the image of high-rise buildings started to change in the Netherlands[17]. This is when the second high-rise wave started in the Netherlands which would feature very tall high-rise buildings, especially in Rotterdam. The growing attention and interest for high-rise buildings resulted in an explosive growth of high-rise projects[18], in the 1990s ten high-rise buildings were constructed in just Rotterdam marking a new era for tall building in the Netherlands.

Figure 6. Plan Bijlmermeer, 1966.[6]

2.4 High-rise in Rotterdam

Over the years the skyline of Rotterdam has become the predominant feature when talking about the city. However, the architectural history of the city is not its strongest point1. Only a few buildings were left standing after the bombardment in 1940. The city had to be rebuilt leaving architects with the opportunity to experiment with new modern buildings. Tall buildings were not really accepted by the public in the Netherlands yet due to historic city centres[1]. Because there was not much of a historic city centre left in Rotterdam it became one of the first cities in the Netherlands with high-rise like buildings. The history of high-rise in Rotterdam can be defined in

three waves (figure 7); the pre-wave, first wave and second wave.[1,19]

The pre-wave illustrates the taller buildings pre-war such as the 42-meter Witte Huis, that was built in 1898. After the war there was no focus on building tall buildings but rather reconstruct the city as soon as possible. The first wave of tall building construction began in the early 1970s and the second wave in the late 1980s early 1990s. What is noticeable from the scatter plot is that the building height during the first wave did not exceed a height of 100 meters.
It was only during the second wave that buildings with the heights of 120, 160 and even 200 meters tall were being constructed. The second wave is not only

defined by the increasing height of high-rise buildings but also the qualitative differences relating to architectural design, building policy and the functional use of high-rise buildings[19]. This was because of the high-rise policy that was first published in 1993 by the city council of Rotterdam. Before these policies that did not only regulate height but also architectural qualities the high-rise buildings were dominated using mirrored glass facades. The use of mirrored glass for the facades was commonly used in the United States. However, the municipality of Rotterdam wanted to create a more diverse city image and skyline and got rid of the monotonous façade designs. Not only did the architectural qualities of high-rise buildings change but also the use of these buildings. Before 1990 the tallest buildings in Rotterdam were occupied by offices or university facilities. During the second wave most of the high-rise proposals were planned for residential use[20]. With the rapid development of high-rise buildings and the shift from office space to accommodating residency these tall structures soon started to not only have influence on the urban fabric but also on its users and how these buildings were being used.

Figure 7. Scatter plot of height and the year of completion of Rotterdam's high-rise buildings.[7]

2.5 Delirious Rotterdam

In 1978 Dutch architect Rem Koolhaas published his book 'Delirious New York'[21], a "retroactive manifesto" for Manhattan where he explores and documents the relationship between its metropolitan culture and the architecture to which it gave rise[21]. Koolhaas maps the history of Manhattan and how both the grid and its architecture became an example for the world. When Koolhaas speaks about Manhattan and its skyscrapers he says that metropolitan culture does not generate architecture, but the architecture often generates the culture. Before the introduction of the elevator, it was not possible to accommodate residency above the fifth floor. With the introduction of the technological invention, it was possible to build vertically and shape a new face for the city. In his book Koolhaas writes this about the invention of the elevator:

'The elevator is the ultimate self-fulfilling prophecy: the further it goes up, the more undesirable circumstances it leaves behind.' [21]

The elevator was seen as the invention to accommodate a utopian device where different functions could be stacked vertically. The 1909 theorem (figure 8) shows the ideal skyscraper where every floor is a virgin piece of land that has no relation to what is below or above, except for the elevator that connects all the stories. The idea that is portrayed in this theorem is that the layers can be vertically repeated, yet each layer remains unique and remain independent from one another. However, what seems conflicting is that all the layers are independent, yet they form a whole in the form of a high-rise building. This suggests that a plot in the city could no longer be matched with a concrete function and purpose[21]. According to Koolhaas this marked the beginning of unknowable urbanism, something which he illustrated with high-rise buildings being seperated from ground level (figure 9). Plots with high-rise buildings had its own program, a program that was out of reach for the architect. The unknowable urbanism refers to a new type of urbanism where the architect can't design a high-rise building for a specific function thus losing its architectural value to the buildings function[21]. The high-rise buildings in Rotterdam can be acknowledge as the outcome of unknowable urbanism. High-rise buildings are often programmed with housing, yet they also have a mixed program of other functions such as commercial spaces or public gyms. High-rise does not express function but only adds to the skyline
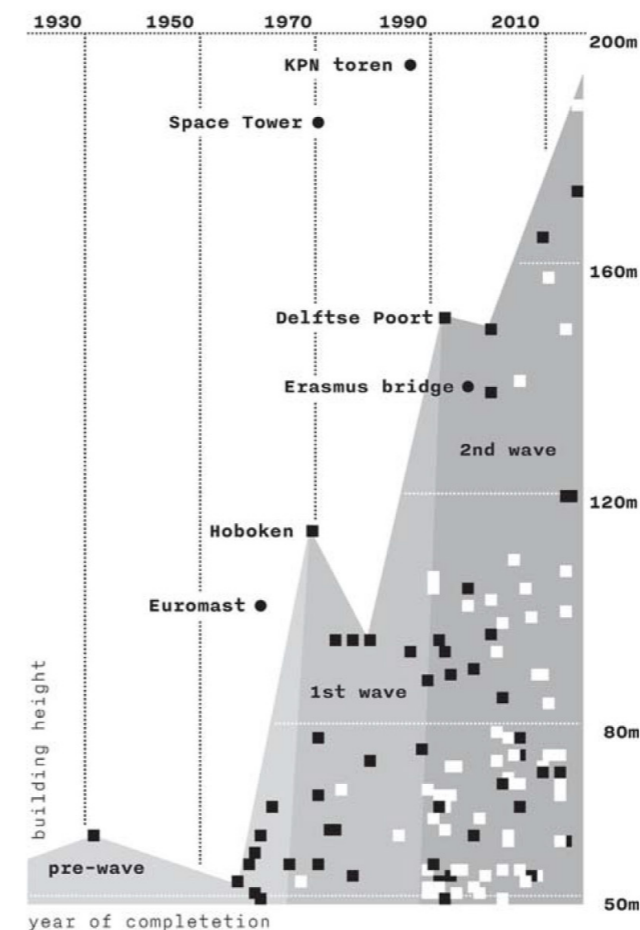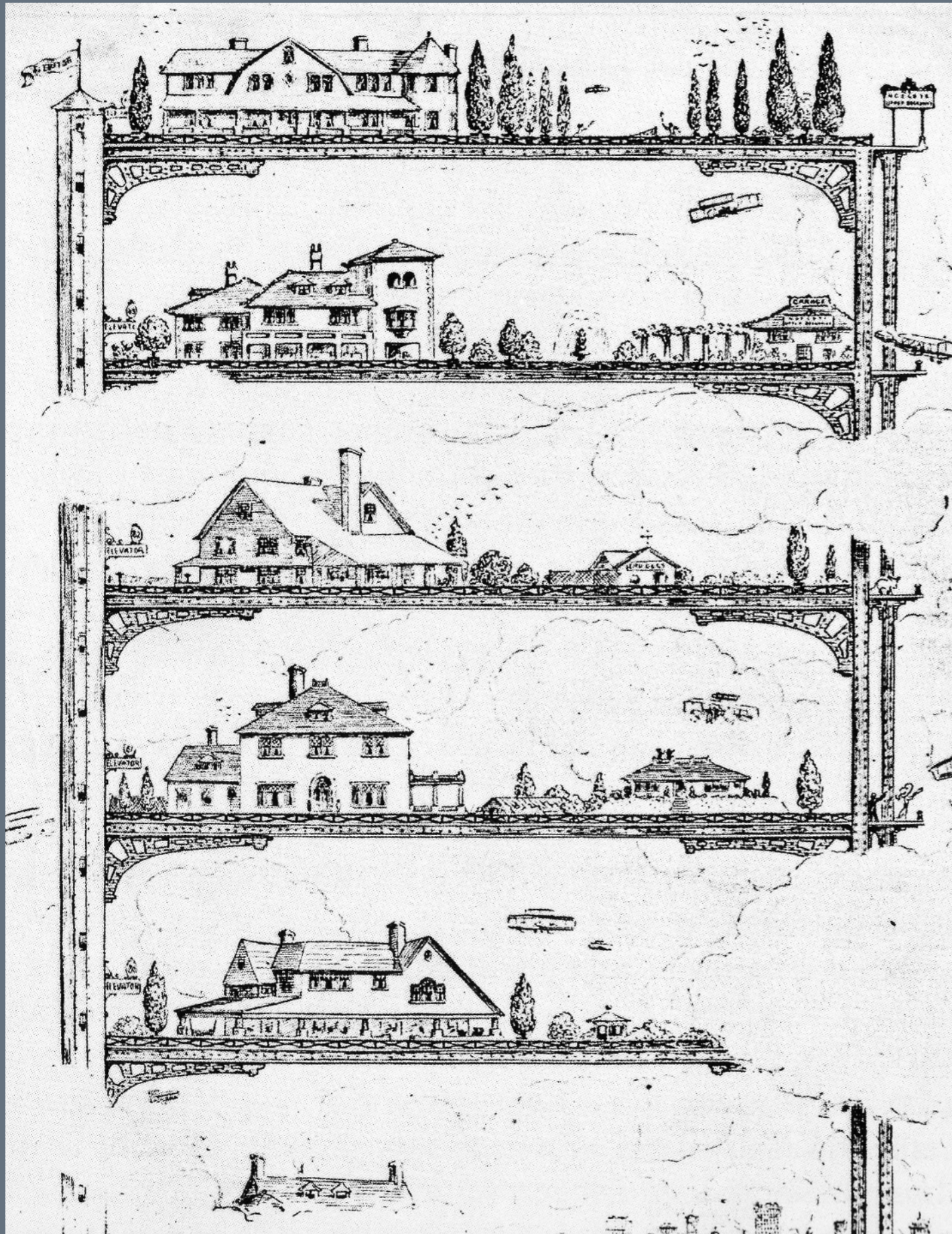
Figure 8. Theorem, 1909.[8]

of Rotterdam with different materials, forms and its height. Although every high-rise building is unique, they could all host the exact same functions, it does not portray residency such as the typical Dutch housing do.

The independence of the different layers in high-rise buildings is in contrast with why high-rise buildings were built in the first place argues Koolhaas. According to Koolhaas the culture of congestion is one of the reasons for the emergence of high-rise buildings[21]. The culture of congestion implicated a context where a high-rise building is a device that was used for intensifying specific forms of human interaction. When applying this information to Rotterdam and its high-rise buildings it seems contradicting. High-rise buildings in Rotterdam are often programmed with housing or office spaces. The only public space that these high-rise buildings host are commercial spaces or lobby's which are semi-public and do not often stimulate social cohesion. The 1909 theorem that portrayed high-rise dwelling seems like an idealist dream but, high-rise dwelling can have a negative impact on the social wellbeing of the occupants[22]. A key factor in this problem is the anonymity in high-rise dwelling. A low level of social interaction with other occupants can lead to social isolation[23]. High-rise occupants have a weaker sense of community because of the lack of public space and especially outdoor public space where social cohesion is often stimulated. This problem of high-rise buildings not hosting public spaces was also addressed in the 'Hoogbouwvisie Rotterdam 2019'[24]. This policy stated that high-rise buildings should also function as groundscapers; have a public plinth that hosts public functions and stimulate social interaction between occupants. This is now one of the key factors that need to be integrated in the design and development of high-rise buildings.
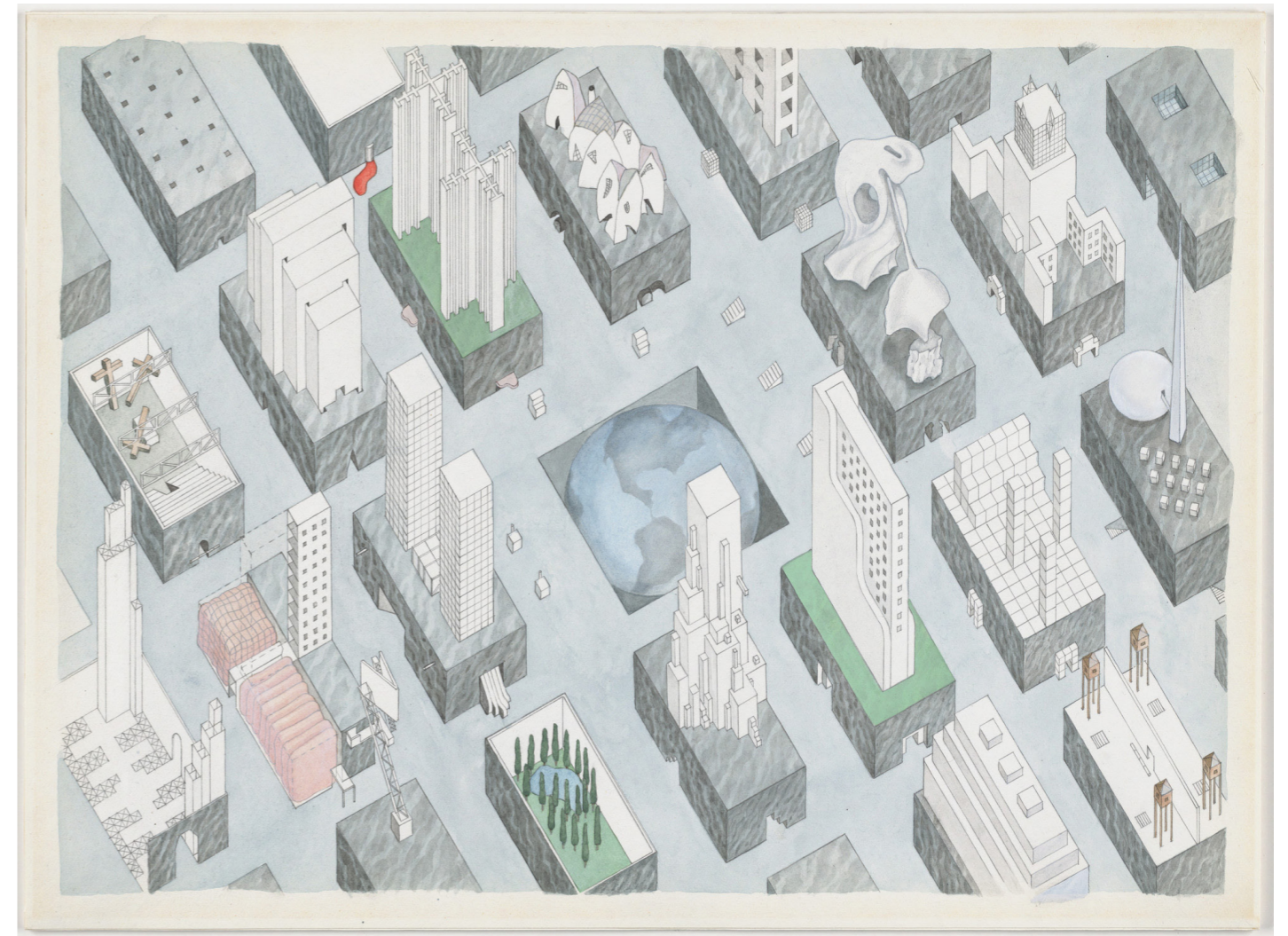

Figure 9. The City of the Captive Globe Project, New York, 1972.[9]

3 PHYSICAL
THE ROLE OF HIGH-RISE BUILDINGS IN THE URBAN FABRIC

The history of urban planning and policies of Rotterdam played a big role in the development and history of high-rise buildings in the city. Changing regulations, requirements and urban plan shaped the positioning and the impact that high-rise buildings have on the city. In the Netherlands architectural regulations are addresses in the building decree which addresses many of a society's most important concerns such as safety, environment, and public health. A building decree establishes a building's quality, safety and appearance. In the Netherlands the last building code was published in 2012. For urban plans and anything not technical related the regulations are addresses in the building code. The building code addresses regulations on the course of municipal procedures and regulations regarding the influence of the building on the surroundings. However, it was not just policies and plans that formed the city. With the physical decay of neighbourhoods, the city of Rotterdam also used different tools to develop the city, one of them being the tool of urban renewal.

3.1 Rotterdam's urban renewal

According to the Cambridge dictionary[25] the definition of urban renewal is:

'The improvement and sometimes replacement of buildings in a city, especially of whole neighbourhoods of housing'

The phenomenon that is urban renewal has been present for decades now. Urban renewal deals with the urban changing environment in a city[26]. Although it seems straight forward in reality it is a complex matter. Over the past decades the policies for urban renewal have become more complex due to unemployment, housing qualities, poverty, and the low quality of public space[27]. For Rotterdam urban renewal was first promoted in the 1970s as 'building for neighbourhood' where the focus was on the values of existing neighbourhoods and how to restructure them. Urban renewal policies often revolve around the stock of housing[28] and the diversification of housing typologies and the social mix of people. However, it has been debated if the effects of urban renewal have a negative influence on the social wellbeing of residents. Urban renewal has been associated with social problems such as displacement of vulnerable groups. With more people moving towards the city there is also a demand for expanding the city centre, resulting in possible gentrification[29]. By improving the physical appeal of areas, it is most likely that house

and rent prices will rise which can put pressure on the poorer communities[30]. The municipality of Rotterdam has presented demolition plans in the housing vision, replacing the cheaper housing with middle segment housing to attract more wealth into the city[31]. One of the tools they have been using is the implementation of high-rise buildings. With its multifunctional use it tackles the housing demand and offers more public space to the city. However, because of the high ground prices and the high construction costs of high-rise buildings it often only offers a place to people within the higher income segment. Although high-rise buildings have been a good tool to tackle architectural physical decay it does stimulate gentrification. Especially with the urban planning that Rotterdam has been doing the city expands the high-rise zones and thus pushes out the poorer community to the suburbs of Rotterdam.

3.2 Urban planning of Rotterdam

World War II was one of the most devastating events that left not only the people in Rotterdam scarred but also, it's architecture. The bombardment of Rotterdam destroyed 25.479 homes, 31 department stores, 2320 smaller shops, 31 factories, 1319 workshops, 675 warehouses, 1437 offices, 13 banks, 19 consulates, 69 school, 13 hospitals, 24 churches, 10 charitable institutions, 25 city and state buildings, 4 stations, 4 newspaper headquarters, 2 museums, 517 cafes and restaurants, 22 party venues, 12 cinemas, 2 theatres and 184 other commercial buildings and leaving about 80.000 people homeless[32]. Four days after the bombardment the city council appointed Witteveen, who was Rotterdam's city architect, to design a plan for a new city centre for Rotterdam.

1940 – Reconstruction Plan by Witteveen

After Witteveen was appointed as head architect for the reconstruction of Rotterdam he came up with a design within weeks. The main focal point of Witteveen was to rebuild the characteristically inner city. By moving out factories and appointing an industrial neighbourhood outside of the city centre Witteveen wanted to achieve a commercial inner city[33]. The traffic circulation around the inner city was also an important aspect of Witteveen's plan. These roads were the mediator between the inner city and the residential neighbourhoods on which offices should be built. While there was no talk about high-rise buildings, simply because they were not popular in the Netherlands yet, Witteveen did suggest an

office building typology around the city centre. These office buildings were often taller structures to accommodate a lot of people. In the current urban fabric, the appointed plots for office buildings are now accommodating high-rise buildings. With these office buildings on the edge of the city centre he created a structure where people would use the inner city for their errands and jobs and have the residential neighbourhoods around the city centre. Witteveen's plan (figure 10) for the reconstruction of Rotterdam was official adopted in 1941[33].

1946 - Basic Plan by van Traa

During the war and the reconstruction of Rotterdam the plan of Witteveen received a lot of criticism by Rotterdam businessman who cared more about the economic aspects of the basic plan rather than the aesthetical aspects. Witteveen became disillusioned and was replaced by his assistant van Traa. Van Traa designed a new urban plan for the reconstruction of Rotterdam which was a radically functional plan which he named the Basic Plan (Basisplan). The main focal points of Witteveen's plan were visible in the new Basic Plan. The main difference was the urban architectural aspect of the plan and the vision of the inner city and the centre as part of the entire city[34]. Whereas Witteveen planned for the upcoming decades van Traa kept his Basic Plan rather flexible, leaving a lot of room of future developments. By expanding the width of the main axis; Coolsingel and implement a well-organized traffic circle at Hofplein van Traa prepared the inner city for an exponential growth. One of the most important interventions, which could also be seen in Witteveen's plan was the separations of areas for living, working and recreation, something that is still visible in today's city centre. What is noticeable in the basic plan regarding high-rise buildings is the main city axis that was established and the separations of areas. Later, the main axis in the city would function as high-rise zones. The Basic Plan was adopted by the city council in 1946.

1978 – Structural plan Rotterdam

During the 70's there was a need for a spatial structural framework within which the urban renewal process could proceed optimally. The noticeable aspect about this structural plan was the problem-oriented approach. It was not a structural plan passed on the vision of urban planners and the municipality, but a plan based on urban problems that were experienced within the city[34]. The structural plan focused on what problems were more urgent to be solved and what problem needed more attention. With the increasing population and the decreasing quality of housing the focus was to strengthen the residential function in the city. Social housing for the lower income population was essential for urban renewal; not driving out current residents and improve housing. Another key aspect in this structural plan was the focus on giving slow transportation (public transport, cycling, walking) priority over car transportation. While high-rise projects, such as the Bergpolderflat (1934) in Rotterdam and Bijlmermeer in Amsterdam there were still no concrete rules for these buildings. Two reasons for no policies regarding high-rise buildings in Rotterdam were: very tall buildings such as the Erasmus Medical Centre (1968) were buildings that did not accommodate residency and the second reason being that there still was no high-rise trend going on.

1985 – Inner city Plan

In 1984 the municipality reviewed the Basic Plan 1946 and made the needed adjustments. The focus of the 1985 inner city plan[35] was to improve the city centre to the rest of Rotterdam. The inner city was quite well developed while adjacent neighbourhoods, and especially the south of Rotterdam was underdeveloped. One of the biggest additions to this plan relative to the basic plan was the addition of residency in the inner city, making the city centre also a place to be at night time. It was not until the 1990s that high-rise buildings started trending in Rotterdam. However, the 1985 inner city plan did create the basis for the first high-rise policies that
were later introduced in 1993[36]. One of the most important aspects that formed the basis for high-rise urban planning was the functions of buildings in the inner city. The municipality decided that the inner city would function as a high-quality space for offices, has the highest concentration of urban amenities, is an attractive recreational environment but now also partly functions as a residential area. Adding residency to the inner city was a new step towards urban densification relative to the Basic Plan from 1946. This densification of office spaces and dwelling in the inner city led to the development of high-rise buildings because of urban densification.

1987 – Plan Kop van Zuid

The plan for Kop van Zuid (figure 12) by Riek Bakker

Figure 10. Reconstruction plan by Witteveen,1941.[10]

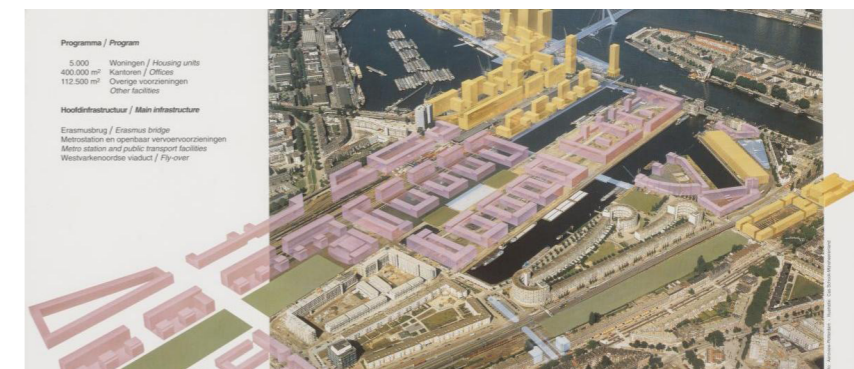*Figure 11. Basic Plan by van Traa, 1946.[10]*

Figure 12. Plan Kop van Zuid, Koolhaas, 1985.[11]

and Teun Koolhaas was one of the most important plans regarding high-rise buildings in Rotterdam. Kop van Zuid was an old harbour district that was not being used anymore due to the move of the harbour activities down the river. The plan was the first big urban plan across the river consisting of 50.000 houses, 380.000 squared meter office space, 50.000 square meter recreational and cultural facilities and 3500 square meter commercial space[37]. With regards to this plan both national and international submission for buildings across the river came in. The Wilhelminapier, which is now known for its unique high-rise buildings was the appointed district for these new high-rise buildings that would define Rotterdam's skyline, hench the name 'Manhattan at the river'[38]. In 1991 the plan for Kop van Zuid was accepted by the municipality and the construction began at the end of the 90's.

1993 – Inner city Plan 1993-2000

The inner city plan from 1993 was the first plan that included policies regarding high-rise buildings because of the major increase of developed and proposed high-rise buildings. The main aspects of this inner city plan were[36]:

- *Realisation of clusters*: programmatic intensification of the city through clusters Schouwburgplein, Beursplein, Oudehaven, Vrije Entrepot and Wileminaplier.
- *Zoning of high-rise buildings*: zoning high-rise on the main axis of the city.
- *Arrangement of outdoor spaces*: the improvement of visual qualities and the development of safety, clean and intact.
- *Intensification of dwelling*: expanding the residential function

With the development of the south of Rotterdam the municipality decided on clustering not just in the city centre but also on the south side of the river with the intention to create two city centres along the river. This decision was crucial for the future development of high-rise buildings because the later policies regarding high-rise buildings were appointed to both city centres.

2001 – Inner city Plan 2000-2010

The main goal from the 2000 inner city plan was 'making more city': the further development of densification of dwelling, work and recreation. The

biggest point of criticism on the inner city plans was that the centre was not yet sufficient unified and had insufficient 'critical mass' to fully generate the attractiveness of a vital city. To reach this goal, the municipality set vision on different aspect of the city[39]:

City centre as a residential environment: The combining of residency with different functions in the inner city; combining the function of living with working, recreation, etc. High-rise buildings can accomodate this mix of use.

- *City centre as recreational environment*: Densifying the attractive commercial functions; redevelop the plinth to be flexible and to the recreational needs of the city.
- *City centre as business environment*:
The densification and development of high-rise projects that accommodate offices and working spaces.
- *Quality of stay and outdoor space*: Improving the qualities of outdoor spaces by connecting them to each other and connecting outdoor spaces to the plinth.
- *Accessibility*: Increase the accessibility for all types of mobility and functions.

With the increase of developed high-rise projects the city needed to change itself towards these buildings. The outdoor spaces play an important role because they are connected to the plinth of these buildings, the place which plays the most predominant role in the functionality of high-rise buildings.

2008 – Inner city Plan 2008-2020

The most recent urban plan for Rotterdam is the inner city plan from 2008[40]. This urban plan focused on the inner city as a city lounge with high-rise buildings play an important role. High-rise buildings had been forming the skyline of the city for a decade at the expense of the street level. The emphasis regarding the built environment was on the groundscaper; the plinth of high-rise buildings that connect the skyline to street level. The municipality noted that the city was experience through its skyline through which the high-rise buildings disconnected itself from the city, it was not the height that was the main topic but the experience on street level. These so called groundscapers had to be flexible to the current interest of the city and should connect to the adjoining public space. The inner city plan also included how high-rise buildings should not disrupt the city but continue

the urban fabric through visual quality, zoning, and the volume of the building.

The urban plans of Rotterdam developed over time and slowly formed the city and thus the basis for high-rise planning. While high-rise policies were first adapted in the inner city plans of Rotterdam they later were adapted in a separate policy because of its rapid development. These policies are now the guideline for the design and development of high-rise buildings.

3.3 Rotterdam's high-rise policies

When it comes to constructing and developing high-rise buildings, especially in a dense city as Rotterdam, there are a lot of rules and policies that need to be enforced. Before the first policies regarding high-rise buildings Rotterdam already had quite some tall buildings such as the GEB tower (1931), Euromast (1960), The Erasmus Medical Centre (1969) and the Delfste Poort (1992). The first policy was integrated in the strategic urban plan for the city centre to steer the development of high-rise buildings in the city. The early high-rise building's architectural qualities resembled the typical New York skyscrapers: mirrored glass facades, which the municipality wanted to avoid as much as possible[1]. The last mirrored glass façade building that was developed was the Delfstepoort in 1992 (figure 13), a year before the initiation of the first high-rise building policy[36]. The first policies regarding high-rise buildings were quite restrictive. High-rise buildings were only allowed to be built along the city's main urban axes formed by the Coolsingel, Weena Boulevard, the Erasmus bridge, Schiedamsedijk and the Wilhelminapier at the Kop van Zuid. Because of the limitations that were set for the development of high-rise building the city soon ran out of available plots along these main urban axes, limiting the growth of high-rise buildings. At the same time there were a lot of proposals for high-rise buildings that exceeded the maximum height.

With the increasing demand for more tall structures the policy for high-rise buildings was reassessed in 2000[39] addressing both quantitative and qualitive criteria. One of the focal points was the Rotterdam Central mobility hub near the Weena because this was the entry point to the city and thus a very important node. The municipality expanded the tall building zones (figure 14) in the city and defined three types of tall building zones, each with its own height regulations[39]:
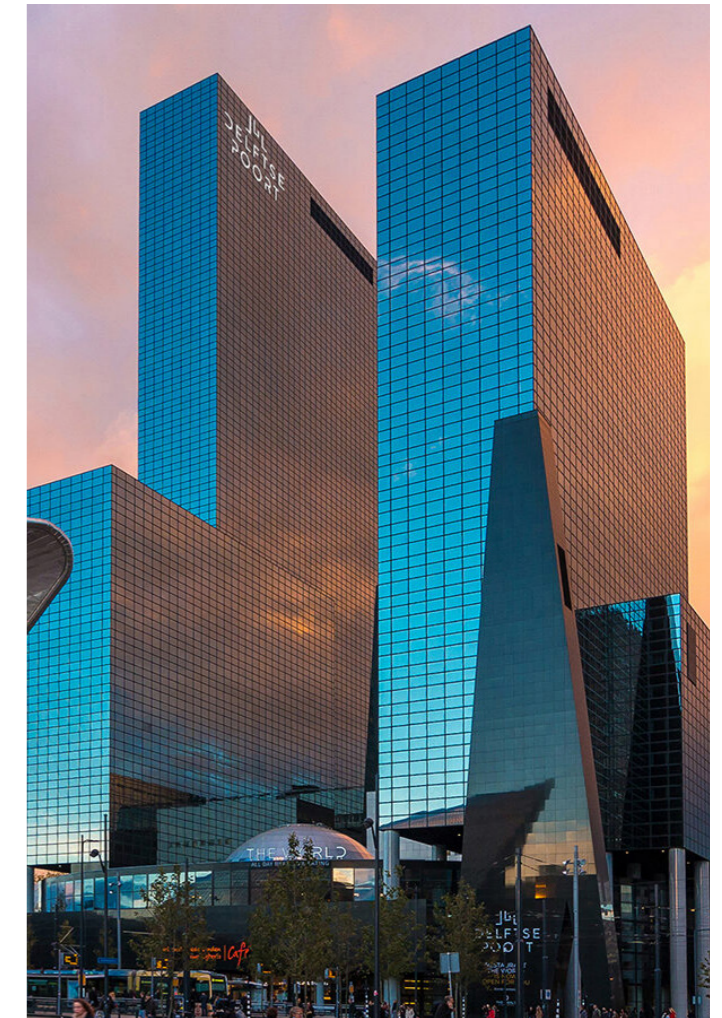

Figure 13. Delftse Port, 1992 [12]

Figure 14. Tall building zones and the location of tall building exceeding 50 meters.[7]

- Tall buildings zones without height restriction (Weena and Coolsingel)
- Tall buildings zones suitable for buildings between 70 and 150 meters tall
- Transition zones adjoining to the other two tall building zones

The tall building zones without height restriction were focused along the axes of Rotterdam Central Station, also with the redevelopment of the station in mind. This zone would function as the entrance of Rotterdam and the city centre when arriving with public transport. Although there were no high restrictions there was a theoretical height restriction of 200 meters. This was still unthinkable because of the poor soil quality of Rotterdam, preventing from buildings with these heights being built. The tall building zones that were suitable for buildings between 70 and 150 meters were focused on the other main urban axes such as Schiedamsedijk and around the Erasmus bridge. Also, Parkstad, now formally known as Feyenoord City was a new zone for high-rise buildings. This new zone would connect the city centre with the new city centre in the south through high-rise structures. The transition zones enforced the permeability of the city by creating low-rise to prevent a forest of high-rise buildings in the city centre.

In 2011 the third iteration of high-rise policies was issued. This was the first time that the high-rise policy had his own publication and was not part of an urban plan. Throughout the years high-rise mainly acted to join the two city halves and shape Rotterdam's skyline. The new iteration put the emphasis on the 'City Lounge' where high-rise buildings should add to the experience of the cities and the quality of its public spaces[41][40]. With the increase of high-rise buildings and high-rise building proposals it was important to assess qualitative criteria to the suitability of high-rise buildings according to how they relate to the public spaces, the design of their plinth, the cultural historic value, sunlight, shadows and wind, their visual appearance and sustainability. With the new policy the municipality reduced the numbers of tall building zones from three to two. One of them being a 'comfort zone' where the maximum building height can't exceed 150 meters and a 'super tall building zone' (figure 15) where there is no height restriction However, when this new policy was implemented, there was still a theoretical maximum building height of 200 meters. The municipality stated that the maximum height is a dynamic limited which grows with the city, so although there is no maximum height the

municipality takes the height of the current buildings in consideration when approving a proposal. During this time the chances that a proposal for a high-rise building that would exceed 200 meters would pass the municipalities approval was very small, hence the no maximum height policy. The municipality appointed two zones as super tall zones, one located near the Rotterdam Central public transport hub and the other at the Wilheminapier at Kop van Zuid.

The most recent high-rise building policy was published in 2019[24]. This policy puts emphasis on how high-rise buildings should relate to street level, other buildings and how they should function in the city. The municipality developed five perspectives that are leading with the development of the city regarding high-rise buildings[24]:

1. The circular city – High-rise should be able to generate sustainable energy. There must also be a waste system within high-rise buildings that contributes to the circular economy objectives of the city.
2. The compact city – High-rise buildings are allowed to be developed near high-quality public transport. In this way the municipality encourages the use of public transport. With the ability to stack programs in

Figure 15. Mapping high-rise zones in Rotterdam, 2011.[13]

a suitable place high-rise buildings should play a role in the compact city; a good mix of programs and a multifunctional use of the roof is necessary.
3. The healthy city – High-rise buildings should contribute to a healthy city by considering wind nuisance and insolation in the public spaces. High-rise buildings should also contribute to the climatic aspects in the city.
4. The inclusive city – High-rise buildings should stimulate social cohesion and should accommodate building communities.
5. The productive city – High-rise buildings should accommodate a variety of functions and the plinth should be flexible in order to change to the needs of the city. The municipality emphasises the program in the plinth and how it relates to street level.

The plinth should contribute to the urban dynamics and the continuity of the cityscape. The municipality also wants to add the 'Rotterdam story'; the first fifteen to twenty meters of a high-rise building should connect to the surrounding buildings.

These perspectives are a guideline for both the municipality, architects and developers for the development of high-rise buildings. The municipality developed these perspectives to tackle problems such as anonymity in high-rise buildings, vacancy, lack of sustainability and having an impact on social wellbeing.

With the growing population the municipality demands 50.000 more housing in the upcoming twenty years. In order to meet this housing, demand the municipality added three new high-rise zones: Alexanderknoop, Hart van Zuid and Feyenoord City. Also, the border of

the high-rise zone in the city centre is being pushed back allowing more high-rise buildings in the city centre. The municipality states that they don't want the maximum height to be a constraint for high-rise but in order to have a guideline for the upcoming years the new policy allows a theoretical maximum height of 250 meters for high-rise buildings on in the super tall building zones. The other high-rise zones only allow a maximum height of 150 meters. It is however expected that the theoretical height of 250 meters will soon be exceeded, especially when looking at the exponential growth of high-rise building heights over the past century (figure 16). With new plans, as for example 'Rise', a 250 (potentially 280) meter residential high-rise building proposed by Powerhouse (figure 17) it is inevitable that we will see the average height of high-rise buidlings grow. However, to keep a balance in the city the municipality only wants to accentuate these heights in the two city centres and maintain the more 'low-rise' structure around these centres.
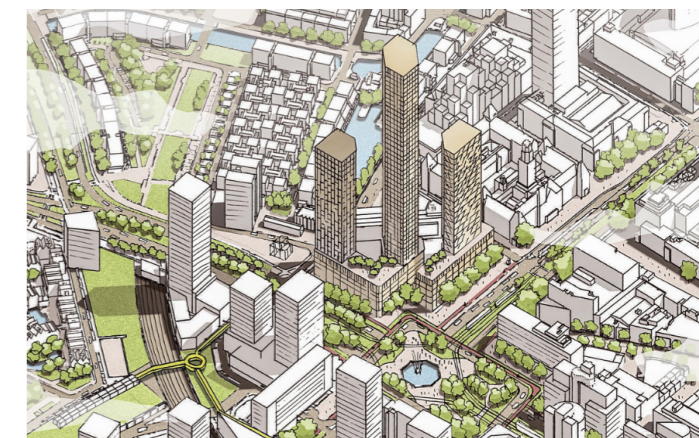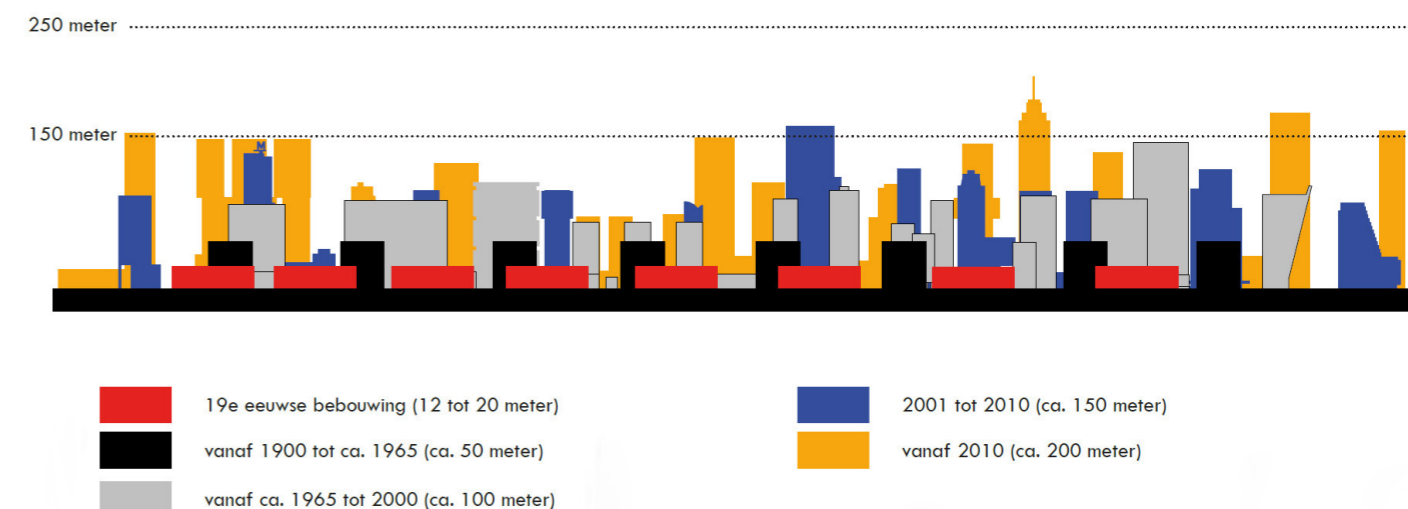

Figure 17. Proposal 'Rise' by Powerhouse Company, 2021. [15]

Figure 16. History of high-rise buildings heights in Rotterdam. [14]

4 ECONOMICAL
IMPACT OF HIGH-RISE BUILDINGS ON SOCIAL AND FINANCIAL ISSUES

While high-rise buildings play a key role in the current housing crisis and the urban planning of Rotterdam it also plays a big social-economical role. High-rise buildings were considered 'freak' buildings when they first emerged in Manhattan, buildings with the mere purpose of showing economical might[42]. Ever since then the sight of tall buildings in cities is very common. The rapid development of high-rise buildings in Rotterdam might have solved problems but it also caused new economical problems and challenges.

4.1 High-rise buildings and gentrification

Since World War II the population of Rotterdam has grown over 60% [43,44]. The growing population demands more housing. Because Rotterdam has been developing itself in a rapid tempo over the past decades the city centre is full, and the municipality tries to answer the housing demand by revitalizing the outskirts of the city. This often results in gentrification. Gentrification is the process by which a place especially part of a city, changes from being a poor to a richer one, where people from a higher social class live[45]. Gentrification happens when a neighbourhood has attractive qualities such as a good location or historical architecture but remains relatively low of value. By adding more value to a neighbourhood such as housing in the more expensive segment a neighbourhood becomes desirable for people with a higher income. The higher income residents are then able to outbid the lower income resident which forces them to live elsewhere[46]. Although revitalizing neighbourhoods by improving housing and the physical environment happens all the time it is not by definition gentrification. Gentrification happens when neighbourhoods change in such a way that long-time residents and businesses move out because the increased land prices[46]. These residents often move to the outskirts of the city where the only affordable housing is present.

In 2014 the municipality of Rotterdam decided to transform ten neighbourhoods to create an appeal for the above middle-class households[47]. Each of these neighbourhoods were located near the city centre and had the potential to be appealing to new wealthier residents in the city. However, what is happening is that the municipality revitalizes these neighbourhoods and make them more attractive by improving the streets (playground, more space for slow mobility) and adding cultural and food and beverage facilities is a tool used by the municipality to make neighbourhoods more attractive[47]. One of the biggest tools that the municipality uses is by making more attractable housing. With the rapid development of urban planning and urban densification happening there is little but no room to build in such a dense city. A solution for this problem is building high-rise buildings for the above middle class residents. A recent example are the plans for Katendrecht (figure 18) and Feyenoord City (figure 19). Both these neighbourhoods belonged to the poorest neighbourhoods of Rotterdam[48,49] and are now being revitalized to create new appealing neighbourhoods that are relatively close to the city centre. High-rise buildings play a big role in both plans. Not only do the accommodate housing but they also create a new point of interest within the city skyline of Rotterdam.

Figure 18. New proposal for Katendracht and the Rijnhaven.[16]

Figure 19. New proposal for Feyenoord City by OMA.[17]

High-rise buildings often have a luxurious appearance which is also reflected in the rental costs. The high-rise structures are built with the intent to fight the housing shortage, but the reality often shows expensive rental apartments that are only affordable for the wealthier people. What is remarkable is that there is a lot of vacancy in high-rise buildings in Rotterdam because of these high rental prices[50]. However, high-rise buildings do not directly cause gentrification. When a new high-rise building is delivered it has two effects. First is the supply-side effect; the high-rise building offers more residential space in a neighbourhood which causes the prices to slightly go down. However, high-rise buildings allow for a denser population within a neighbourhood which increases the demand for neighbourhood services, such as pubs, coffee shops, supermarkets. These services draw more people into a neighbourhood causing the real estate prices to rise[51]. This often results in displacement, where the lower income residents can't afford the new prices. However, there is also an upside to adding new high-rise buildings to a neighbourhood. The inflow of money is a good thing for the city in general. With money comes resources and amenities; older houses are renovated which increases the liveability of housing. Bigger store chains want to be a part of the neighbourhood which stimulates job opportunities. Also, the improvement of schools, reducing crime and stimulating infrastructure upgrades is a good result of gentrification[52]. With the current policies that for high-rise buildings that are implemented by the municipality new high-rise buildings do not only offer housing to neighbourhoods but also public functions. These added public plinths could add to the initial reasoning behind high-rise buildings according to Koolhaas[21]; the culture of congestion. High-rise buildings can play a role in social cohesion between the lower, middle, and higher classes of society. While high-rise buildings can play a part in the social and public aspect of the neighbourhood it also plays a bigger and commercial role in the city.

4.2 High-rise buildings as a city marketing tool

'In a world in which social, economic, and political value systems are defined by continual change and movement, individuals are forced to create their own identities and find ways of signalling their place in the world.' [53]

The same thing can be said about cities. Whereas people often purchase expensive brands to identify themselves cities hire well known architectural firms to develop iconic buildings for the same purpose[54]. Architecture is one of the tools within city marketing that helps towards the transformation of a city into a post-industrial centre of culture, tourism, and development[55]. City marketing is a shared and common strategy to reach economic development and welfare for inhabitants, visitors and companies within the city[56]. For a city to create more opportunities it must have the ability to attract more investment, business and visitor.

Over the past decades the skyline of Rotterdam has become the city's iconic image[17]. This skyline, which is formed by high-rise buildings and structures are 'urban icons' that make a local personality and support the historical and social uniqueness of the city. While most of the high-rise buildings function as offices or dwelling there are also high-rise structures that are arguably built for the iconic image of the city and the potential tourism it attracts. Since the 21st century it is very common that architects design high-rise 'objects' with the sole purpose to attract tourists[57]. Observation towers are often a high-rise structure that play the role of amusement. In Rotterdam one of these high-rise structures is the Euromast (figure 20). The Euromast is an observation tower that was designed by Hugh Maaskant and was constructed between 1958 and 1960[58]. The structure was officiality built for the 1960 Floriade; a horticultural exhibition and garden festival that was held in the park next to the Euromast. The building reaches a height of 185 meters and accommodates a restaurant and a panoramic tower with a vertical moving platform. This high-rise structure was also marked as a symbol for progressiveness[59]. It was a symbol to show how Rotterdam has been recovering after the World War II bombing. That is why the Euromast is still considered the most iconic building in Rotterdam.

It is not remarkable that Rotterdam uses high-rise buildings to form the iconic image of the city. After World War II there was nothing left of the historic city centre, leaving Rotterdam with a gaping hole in their historic narrative. By developing high-rise buildings, as one of the few cities in the Netherlands, it started to get recognized as the Dutch high-rise city and thus creating a narrative.

While the high-rise buildings in Rotterdam form its iconic image it is arguable if these buildings are innovative. What is currently observed is a 'homogenization' of architecture, whereby architects design high-rise buildings without considering local cultural characteristic but rather focus on the aesthetics of the building and how the building is being perceived [60]. One of the reasons for the municipality of Rotterdam to implement high-rise policies back in 1993 was because of the homogenization of high-rise buildings. The early high-rise buildings often reassembled the mirror glazed façade office district in New York, creating a distance between the city and the architecture.

Figure 20. Construction of the Euromast, 1959.[18]

5 CONCLUSION

Since the late 1900s high-rise buildings have been forming the city skyline of Rotterdam. Through the years high-rise buildings have become more dominant in the urban fabric while the average height of high-rise buildings in the city keeps rising. This research aimed to identify and explore the role of high-rise buildings in Rotterdam through three different aspects: cultural, physical and economical.

High-rise buildings are relative to the environment they are built in. While the IBC defines high-rise buildings as buildings with an occupied floor at the height of 23 meters the Netherlands considers high-rise as buildings that exceed 70 meters. While some of the construction of high-rise structures can be traced back to the Roman Empire the first official high-rise building that had multiple accessible and usable floors was built in the early 1880s in Chicago. As a result of the economical growth after the Civil War the American businesses demanded more office spaces in the city centres resulting in the first high-rise buildings to be multiple story office buildings. Apart from the economical growth the invention of the elevator and the mass production of steel made the rapid emergence of high-rise buildings possible. In the United States there was a lot of room for high-rise buildings because the cities grew over a short period of time leaving no real historical value. In the Netherlands however it took a while to adapt high-rise buildings, especially because cities in the Netherlands grew over a longer period and thus having a richer architectural history and a denser inner city The first official high-rise buildings that emerged in the Netherlands was an office building in Rotterdam. Because of the negative reactions it wasn't until 1932 that the first residential high-rise building was built in Amsterdam in 1927 following a very long silence in the development of high-rise buildings in the Netherlands. After the bombing of Rotterdam in 1940 most of the historic city centre was destroyed leaving Rotterdam with an opportunity to rebuild a modern city. The first wave of high-rise buildings began in the early 1970s and the second wave began in the late 1980s. Over a span of 20 years Rotterdam started developing high-rise buildings that reached to heights over 160 meters. Because of the rapid development the city of Rotterdam implemented the first policies for high-rise buildings in 1993. Mainly because of the housing shortage after World War II the high-rise buildings that emerged were residential buildings rather than office buildings. The city of Rotterdam is often compared to New York where high-rise buildings emerged as mushrooms. In the book Delirious New York that was published by Rem Koolhaas where he explores the history of New York the city of Rotterdam can be acknowledged. Just like New York, Rotterdam's high-rise buildings are an outcome of unknowable urbanism. While one of the initial reasons for the existence of high-rise buildings was the culture of congestion it is remarkable that high-rise buildings rather create anonymity and social isolation from the city.

High-rise buildings have been used as a tool in the urban renewal of Rotterdam. High-rise buildings play an important role in the image of the city and make areas within the city more appealing. While urban renewal tries to stimulate a social mix of people high-rise buildings often result in a homogenized user, often people with a high segment salary. Although high-rise buildings were not officially a part of Rotterdam's urban planning until 1993 the first urban plan after World War II already suggested the future development areas for high-rise buildings in the city centre. Both the Reconstruction Plan and the Basic Plan suggested main axis in the city and the separations of areas for living working and recreation with the function of working to be centred around the city centre. This resulted in the first high-rise buildings in the city centre to be developed around the main axis and accommodate living. The first urban plan that adopted high-rise buildings was the plan for Kop van Zuid in 1987. When the first high-rise policies were introduced in 1993 the urban plans put a lot more emphasis on high-rise buildings. With the rapid development of high-rise buildings, the municipality appointed high-rise building zones and throughout the years developed requirements for high-rise buildings. Not only should high-rise buildings accommodate dwelling and offices, but they should also be part of the city. The plinth of high-rise buildings plays an important part in the city. It should be flexible to change to the needs of the city and contribute to the urban dynamics and the continuity of the cityscape. With high-rise buildings being unknown urbanism, the municipality requires the first fifteen to twenty meters of a high-rise buildings to connect to the surrounding buildings.

Finally high-rise buildings are a tool in both the gentrification process and city marketing. To make a neighbourhood more attractive, especially for the above middle class, the municipality uses high-rise buildings as a revitalizing tool to attract new wealth. While high-rise buildings can cause current residentials to move because of the increasing house

prices it at the same time attracts more wealth. This results in stores wanting to move to these specific neighbourhoods and not only revitalize the area but also create new job opportunities. Furthermore, high-rise buildings have been forming the iconic skyline of Rotterdam which is the cities selling point. Apart from accommodating housing and offices high-rise buildings in Rotterdam have been a touristic attraction for the past decades. The only problem that is forming is homogenization of high-rise architecture whereas architects solely design from an aesthetic point of view rather than taking into account the characteristics of the city.

It can be concluded that high-rise buildings play a variety of roles in Rotterdam. Throughout the decades high-rise buildings started playing a bigger and more important role to the city. The main role of high-rise buildings is its use as a tool in the urban densification of the city. With the rising population and not a lot of room to expand the city high-rise buildings offer a solution to densify while maintaining the public realm on street level. This was also the initial purpose of high-rise buildings in not only Rotterdam but also in the United States. With the rapid development of high-rise buildings, the buildings started forming the iconic image of Rotterdam. From 1993 on out high-rise buildings did not only play a big role in densification but also the architectural aesthetics of the city adding to the iconic image of Rotterdam. Because of the missing historic value of the city high-rise buildings and structures also play an important role in the marketing of the city. While high-rise buildings seem to fulfil these roles, they also generate some negative side effects. While their role, as Koolhaas described them, was to bring people together high-rise buildings often have a negative impact on the social well being of the community that makes use of these buildings. The lack of connection with the city on street level is one of the factors that causes these negative impacts. The city of Rotterdam is already addressing this problem and stated in their most recent urban plan that high-rise buildings, especially their plinths, should play an important role and add to the surrounding public spaces.

From the research it can also be concluded that the development of high-rise buildings needs certain safety pins. It seems that the projects are often money driven and only pay attention to the financial aspect. To create 'good' high-rise buildings which will fulfil their role within the built environment they need to sustain communities. The city of Rotterdam

is already addressing this but for further research it would be interesting to explore how high-rise buildings can be developed to play a more public role and sustain communities within the city. It is hard to say what's next, but to sustain the growing high-rise culture within the city it is important to research how high-rise can be developed to also provide the needs for the future generations. Looking back Delirious New York it tried to teach us that high-rise buildings seem to be idealistic however, they generate a lot of social problems that are not taken into consideration. When researching the role of high-rise buildings in Rotterdam it can be said that developers and city planners should revise Delirious New York and try to grasp not only the positives of high-rise buildings but also the negatives.
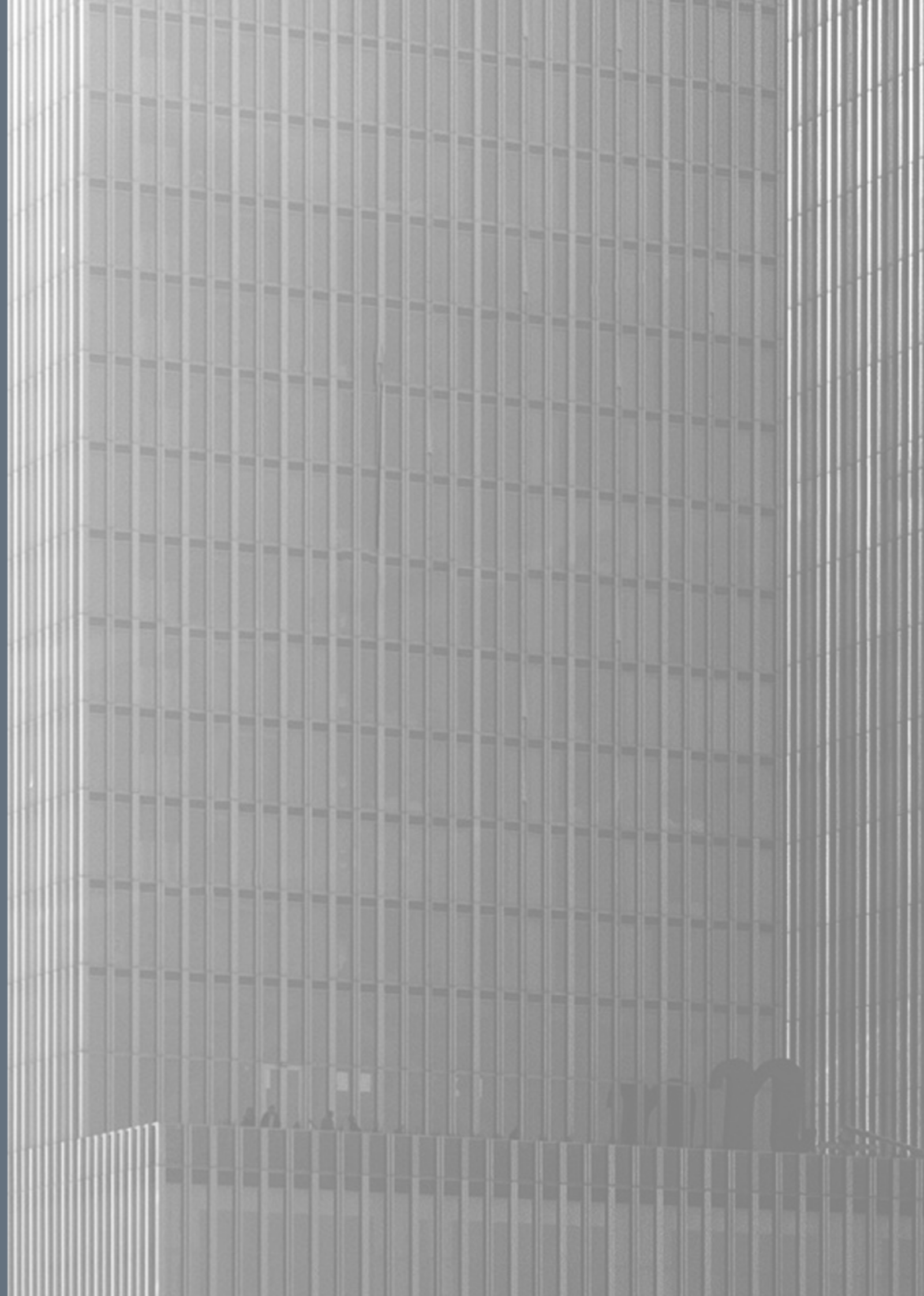
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