MASTER

Great living in high density
livable densification of the post-war neighborhood

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GREAT LIVING IN HIGH DENSITY

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INDEX

ABSTRACT

1. RISE OF THE CITY
   A changed society
   A changed landscape
   Wanted: Affordable housing
   Densification as an answer?
   Density and livability
   Approach

2. WHERE TO DENSIFY?
   Amsterdam and Helsinki
   The post-war city

3. BUITENVELDERT
   A modern ideology
   Analysis: district
   Analysis: typology
   Analysis: building
   Vision

index
4. HOW TO DENSIFY?  
Calculating density  
Livable densification  
Mass studies

5. URBAN DESIGN  

6. ARCHITECTURAL DESIGN  
Material and structure concept  
Impressions  
190 new homes

CONCLUSION

REFERENCES
European capitals like Amsterdam and Helsinki are getting more and more popularity for living, working and recreation. The population in these regions has been growing in the past years and this is expected to continue. Until recently, most new housing developments took place on the edge of the city or at satellite cities, but, especially in the Netherlands, the natural landscape becomes scarce if we continue to develop like this. Besides this, the distance to the city center becomes so high, that these places do practically not provide the benefits of living in the city anymore. The municipalities of Amsterdam and Helsinki therefore have the strategy to densify within existing urban land, but they also want to guarantee a good livability.

But what is livability exactly and how ‘much’ of it do we actually need? Which building morphologies can provide the most dense neighborhoods and can they be livable? And at last: how can these morphologies fit in an existing neighborhood?

In this project, post-war district Buitenveldert in Amsterdam is analyzed on its livability as well as its heritage value. Mass studies are performed to investigate possibilities for densification. These analyses together lead to a design proposal for Buitenveldert, which treats its history respectfully, is livable and above all: dense.

The design forms an example of dealing with density in post-war neighborhoods. In addition, it shows that this specific district can be of great importance to Amsterdam’s densification task.
1. RISE OF THE CITY

European capitals like Amsterdam and Helsinki are getting more and more popularity for living, working and recreation. They outperform other parts of the country economically and form competitive centers for employment, innovation, education, science and culture. (*Eurostat, 2016*)

The percentage of inhabitants that live in the capital city has grown in almost every European country between 2004 and 2014 (*figure 1.2*). Most metropolitan regions in Europe grow (including Amsterdam and Helsinki), with the exception of several regions in East-Europe and West-Germany (*figure 1.1*).

The population in these regions has been growing in the past years and this is expected to continue. In the Netherlands for example, 75% of the population growth will take place in cities until 2030. (*CBS, 2016*)

But why are cities growing? And how should be dealt with this growth? This chapter gives an explanation of the city’s success, as well as the complications that accompany it.
Figure 1.1: Population change, by metropolitan region, 2004-2014
(Eurostat, 2016)

Figure 1.2: Population of capital city metropolitan region in relation to the national population, 2004 and 2014 (Eurostat, 2016)
A changed society

Amsterdam and Helsinki have experienced periods of strong growth before, but they also experienced a period of decline. (figure 1.3) The first half of the twentieth century was the time of urbanization; European cities have grown strongly during this time. People moved from the countryside to the city, hoping for work and a better life. After the 1960’s, a period of suburbanisation started; there was a decline in population due to the outdated housing stock, the rise of the car and deconcentration policies. In the 1980’s, Inner cities got refurbished and became attractive again as a place to live. Since then, the population in cities has been growing again (OIS Amsterdam’)

This relatively high population growth in cities compared to suburban and rural locations can be called re-urbanization. Apart from the refurbishments since the 1980’s, there are also demographic and societal changes that cause this trend. (Haase et al. 2009)

Figure 1.3 Population of Amsterdam and Helsinki 1900-2015 (OIS Amsterdam’), (City of Helsinki Urban Facts, 2016)
The first explanation is the enormous increase of students in recent decades: they come to cities from other municipalities, but also from abroad. Another trend is that young people choose to have children later, if at all, marry later and therefore settle later. These people have no reason to leave the city and stay longer. (PBL, 2015)

After completing their studies, most of the students will work and here too cities play an important role. Cities now function as centers of the knowledge economy. This can mainly be explained by the importance of so-called agglomeration benefits: companies can benefit economically from urban clustering. Most cities have a specialized labour market, often with high-educated people. Proximity is an important condition for knowledge workers to have face-to-face contact. (PBL, 2015)

Not only has the number of settlers increased, but also the outflow of families to the suburban area became smaller. The number of people in their thirties leaving the city has declined and the number of urban families has increased. The city used to be mainly occupied by low-income families, due to the availability of cheap rental housing, but now there are also more and more middle-class families that choose to stay in the city. The choice to have children in a city is explained by the possibility to combine work, living and leisure in one place. The factor of time plays an important role in this: both parents often have a paid job and they want to spend as little time as possible on commuting between home and work. Another important reason is the emergence of family-friendly neighborhoods close to the city center. In addition, there is often an aversion to suburban living, whereby couples see urban living as a part of their identity. (PBL, 2015)
Besides the population growth, there is also a major change in household composition. The attraction of young people leads to an increase of one-person households and the nuclear family loses importance. The process of individualizing and emancipation affect household formation and dissolution. This means that there are more diverse household types now: single households, house sharers, married couples, non-married couples and divorced singles, with or without children. (PBL, 2015) Figure 1.5 shows recent distribution of households in Amsterdam and Helsinki: it is remarkable that the share of single-households is very high in both cities.

**Figure 1.5 Household distribution of Amsterdam and Helsinki, 2014 (CBS Statline’), (City of Helsinki Urban Facts, 2016)**

![Household distribution of Amsterdam and Helsinki, 2014](image)

**A CHANGED LANDSCAPE**

The demographic changes have an impact on the physical form of the city. Figure 1.6 shows how Amsterdam and Helsinki have had an explosive expansion.

Amsterdam for example has grown last century from 15 square kilometers in 1900 to 110 square kilometers of built space in 2017 (220 square kilometers in total) (OIS Amsterdam²) But population growth is not the main cause for this: the built space has become seven times larger, while the population only increased with a factor of 1.5. This means that the land-use per person has become more than 4 times larger.

People live in larger houses, while households have become smaller. But also the way of urban planning and the planning of infrastructure takes more land than before. Rudy Uytenhaak claims in his book ‘Cities full of space’ that on national level, the land use in the Netherlands even increased with a factor of 12 last century.
For the housing task facing cities, physical expansion does not seem to be the answer anymore. When developing new housing at the edges of the city, the distance to the city center becomes very high and the new residences will not have the advantages of living in the city anymore. Besides this, the natural landscape will be affected, which has already become scarce in the west of the Netherlands. Even in Helsinki, where there is a lot of nature in and around the city, inhabitants as well as the municipality prefer to keep it. (City of Helsinki, 2013)
**WANTED: AFFORDABLE HOUSING**

Stopping development of housing in cities like Amsterdam and Helsinki is no option, as housing has become a pressing issue for many Europeans. This is particularly true among those living in cities, where the gap between supply and demand is often most noticeable: a lack of housing may result in rising property prices, both for the rental market and properties that are for sale. *(Eurostat, 2016)*

As shown in figure 1.7, housing prices have become higher in Amsterdam and Helsinki compared to the rest of the country. This trend is expected to continue. *(PBL, 2015)*

The high demand for housing causes a serious shortage in affordable housing for low and middle incomes. This means that the city will not be accessible anymore for a lot of important occupational groups. *(Towers, 2005)*

To meet the housing demand, and stay accessible for every income group, cities have to build a lot of extra affordable houses. But the question is: where?

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**Figure 1.7 Housing price index of Amsterdam and Helsinki, compared to the Netherlands and Finland. (CBS Statline²), (Findikator)***

![Graph showing housing price index](https://via.placeholder.com/150)

*Amsterdam
The Netherlands
Greater Helsinki
Finland*
DENSIFICATION AS AN ANSWER?

Densification of the existing urban land is a way to keep developing housing, but still prevent the city from expanding. Apart from giving more people the opportunity to live in the city and keeping the natural landscape, densification has more benefits. These benefits are related to what a city basically is: an agglomeration of people. When people live close to each other, there can be many shops and other facilities, which make it an attractive place to live. It also applies to public transport, which can be very efficient in dense areas. This efficiency also brings environmental benefits. Particularly in the field of transport, a large reduction in energy demand can be achieved. In dense areas, it is possible to have a job and all other daily activities within a short distance, which means that more trips can be done by foot or on the bicycle. Other trips can be made by public transport. Besides that, dwellings are also likely to be more energy efficient in dense areas; row housing and stacked housing are adjacent to each other and provide mutual insulation. (Towers, 2005)

And as explained before, high-density cities are also attractive for companies and stimulating for the economy, as they can profit from agglomeration effects.

Figure 1.8 Advantages of high-density

- Large supply of facilities
- Preservation landscape
- Environmental benefits
- Economical benefits
DENSITY AND LIVABILITY

Densification has a lot of advantages, especially for the city as a whole. But yet, it is usually seen as something negative, as something not livable.

Livability is the appreciation of an individual for his or her living environment. It is a subjective term, which makes it hard to define what aspects are exactly important for it. Livability indices are most commonly used to measure livability. They are appropriate to judge existing neighborhoods, but they can unfortunately not identify the main causes in a proper way. In the Dutch livability index (de leefbaarometer), density has statistically turned out to be the most negative factor for livability. The denser an area is, the more people answered they are unsatisfied with their living environment. (Leidelmeijer et al. 2015)

This has to do with the fact that density can eliminate individual needs. It is helpful to distinguish the social and physical impacts of density. Physical impacts can be influenced by spatial design while social subjects can only be partially affected by spatial interventions; they are also subject to policy in many cases. (van Dorst, 2005) The social factor concerns too many people living too close to each other, which goes along with noise, lack of privacy, pollution, anonymity and crowding. The physical implication concerns the form of the built environment and its impact on livability; this involves the lack of daylight, sunlight, green space and human-scale.

Figure 1.9 Artist Michael Wolf photographs extreme dense living conditions in Hong Kong. (standard.co.uk)
But a dense environment is not equal to an unlivable environment. ‘*the pure statistical ratio of people per unit area does not seem to be the most important factor in determining how people feel about living in high-density cities. It is what is in these places and how space is designed that matters. It is much more a matter of design than of statistics.*’ (Lawson, 2010)

While increased density makes it more difficult to design a livable environment, it may not in itself be the main causal factor. (Lawson, 2010)

In literature, there are many advises for designers to cope with density. Privacy plays by far the most important role in this. Many authors state that the ability for a person to moderate his or her contact with other people is a basic need which is more important than square meters. The way to implement this in a design is the creation of graded spaces from private through semi-private and semi-public to the public domain. (Montgomery, 2013), (van Dorst, 2005), (Lawson, 2010), (van de Wal et al. 2016)

These domains are also helpful to create social control, an important factor to support safety. For social control, it is also important to design clear spaces with windows facing them. (van de Wal et al. 2016) (van Dorst, 2005)

Besides this, the provision of open space with nature, as well as large windows, enough daylight and providing at least one room per person are mentioned as fundamental positive factors. (Lawson, 2010), (Montgomery, 2013)

**APPROACH**

The advices from different authors are helpful to take into account. However, the elaboration can take many different forms. How can these requirements be implemented in a design for an existing neighborhood, and what is the relation between density and livability? The main question answered in this project is:

*How could an existing neighborhood be densified, while improving its livability?*

Firstly, appropriate locations in Amsterdam and Helsinki will be investigated. Then, one location will be chosen to make a design proposal. This location is analyzed on its current livability, and what could be improved. Thereafter, it is investigated which livability factors are in danger by densification, and how these factors can be taken into account while making the design. This is done with the help of mass studies. Finally, these mass studies will be reviewed and form the base for the final design.
2. WHERE TO DENSIFY?

The need to densify within the urban fabric is recognized by the municipalities of Amsterdam and Helsinki, and they also want to guarantee a good livability:

“The city of the future is a city of humanity. We meet the housing needs, maintain the economic dynamics and keep the green countryside. Because the space in the city is scarce, we have to densify. But densification is not an end in itself, it should not compromise the quality of living and the living environment.” (Gemeente Amsterdam, 2011)

“The Helsinki of tomorrow will be a denser city than it is today. The City Plan aims to ensure that as it grows and becomes denser, Helsinki will remain a pleasant maritime city that is close to nature, a city that provides good conditions for business activity and has a thriving urban culture.” (Helsinki city planning department, 2016)

The first step for densification is finding appropriate locations. But Amsterdam and Helsinki need different strategies, as they have different physical forms.

The city center of Amsterdam is at the core of the city and density is also concentrated around the city core. (figure 2.1) The edges of the city are interspersed with suburban residential areas, industrial areas and green wedges that provide easy access to nature. The strategy of the city of Amsterdam is to densify the borders of the core, so new developments will be concentrated relatively close to the city center. (Gemeente Amsterdam, 2011)
The city center of Helsinki is located at the edge of the city, at the sea. This makes the distance from the other edge quite long. There are some concentrations of density, but they are spread across the city. Instead of green wedges, Helsinki has so called green fingers, a more longitude form of the green wedge, reaching the center of the city. For the city of Helsinki, the expansion of the city core is also part of the strategy, but it is less important. The main focus is a rail transport network city with dense centers around the rail stations. The network nodes will also be connected by city streets with mixed transport, public program and associated new buildings. (City of Helsinki, 2013)
THE POST-WAR CITY

Both in Amsterdam and Helsinki, new developments are mainly planned at old industrial sites (like the harbors), business parks and post-war neighborhoods. The first two categories are questions of transformation, while intervening in the post-war neighborhood is a question of densification of the current use.

The interesting thing is that a very large amount of the existing building stock consists of post-war buildings (built between 1950 and 1970), but these buildings are made for a society that does not exist anymore. They are outdated and need to be renovated. The question is not if these neighborhoods need to be renewed, but how, for whom and by whom. Just demolishing and rebuilding it would mean a massive capital destruction. (Hereijgers & van Velzen, 2001)

These neighborhoods are very suitable for densification. They are extensive and situated at strategic locations in regional context, between the historical centers and newer districts. There are relatively many possibilities for change; they often get little appreciation and the open urban morphology seems to provide opportunities for densification. (Hereijgers & van Velzen, 2001)

Figure 2.2 Post-war locations at Amsterdam (gemeente Amsterdam, 2010)

Figure 2.3 Historical morphologies. The post-war neighborhood has a very open morphology. (Waag Society, 2015)
In Amsterdam, post-war districts are part of one large expansion plan designed by van Eesteren: het Algemeen UitbreidingsPlan (general expansion plan). Some post-war neighborhoods are already renewed, mainly at Amsterdam-west (figure 2.4). In most cases, the original buildings are completely demolished and new buildings came in its place. These neighborhoods are densified, but not rigorously. The main purpose was to change the population composition and attract more wealthy residents. (Hellinga, 2005)

The architecture of the new buildings references to post-war buildings: residential blocks have long forms and uniform facades. Although it is decently executed, the history of this place is not really recognizable anymore. Furthermore, the places have become fragmented.

For this project, Buitenveldert is an interesting district as it is not renewed yet. It is located between the Zuidas and Amstelveen, as shown in figure 2.2. The Zuidas is an important international business center and is currently under development. A lot of housing is added and the train station will be renewed; it will become one of the most important public transport nodes in the Netherlands. (Gemeente Amsterdam, 2011) Buitenveldert could profit from the new public transport station, especially when the new metro line directly to the city center opens (noord-zuidlijn). The district is also close enough to the city center to reach it by bike: it will take 20 minutes. Buitenveldert is on the densification agenda of the municipality of Amsterdam, but not investigated yet.
Helsinki uses other strategies for densification than Amsterdam. New developments are not built within the structure of the existing neighborhood, but more often at the edges of neighborhoods or on infrastructure space. Figure 2.6 shows the plan for Itäkeskus; a lot of new developments are planned at space that is currently a highway, which will be transformed into a city street. Other buildings are also planned at the edges of streets or at the edges of the neighborhood.

The strategies are different because the urban designs and building typologies are different too. Figure 2.7 shows the most common building typology of Itäkeskus. Most post-war buildings in Helsinki are high-rises situated in green space. In Amsterdam, the housing blocks are mostly low to mid-rise, while housing blocks in Helsinki are mostly high-rise. Morphologies in Amsterdam fit within street grids, while morphologies in Helsinki consist of loose buildings in green space. It is therefore logical to build next to or in between existing buildings in Helsinki, as there is enough space. In Amsterdam, this is not possible. For these morphologies, the existing building stock needs to be demolished or adjusted.
When talking with employees of the municipalities of Amsterdam and Helsinki, it turns out that intervening in existing neighborhoods can be very complicated. Current inhabitants are not enthusiastic about the idea of densification. Besides this, the land is owned by different actors: the municipality, different housing corporations and sometimes private owners. It also became clear that in both cities, the idea of densification within existing neighborhoods is still in its infancy. For now, building at former industrial sites has more priority. Design solutions have not yet been investigated, while they can give a good insight in the strategic significance of those neighborhoods. Only then it becomes clear how many dwellings can be added and what kind of living environments it generates. The design can frame a clear vision for the municipality, housing corporations and other investors. Housing corporations get the opportunity to build more housing, while the municipality can work on the densification task.

In this project, a design will be made for Buitenveldert, as it seems more challenging to densify this district and to seek an alternative for demolishing the existing buildings. Because the differences between Amsterdam and Helsinki are quite large, it seems undesirable to find a ‘one size fits all’ solution.
3. BUITENVELDERT

Buitenveldert was the final part of the Algemeen UitbreidingsPlan (general expansion plan), designed by van Eesteren. The district was intended for the higher rental classes and formed a luxurious living in a green environment. Located between two green wedges, the Amsteloovers and the Amsterdamse Bos, it was a weapon against wealthy people moving away from Amsterdam. Buitenveldert has a much lower density than other districts of the AUP and there are many family homes and villas. As the need for social rent increased in the late 1950s, there is also a part with social housing in the north of Buitenveldert. Van Eesteren was very satisfied with this district, as his ideal of the 'organic clean city' took shape most strikingly here. (Steenhuis et al. 2017)
A MODERN IDEOLOGY

Ideology was a crucial aspect for the AUP, which was the largest expansion plan for Amsterdam of the 20th century. It formed a complete new vision on the functioning of the modern city. It was designed according to a presumed way of living; the post-war neighborhood can be seen as a symbol of the welfare state. (Agricola et al. 2013)

The post-war city is tailored to the family with two children, in which mother stayed home and father worked within biking distance to the house. The program was calculated on this basis too; in the post-war city, the ‘wijkgedachte’ formed the ideal for a district. (Hereijgers & van Velzen, 2001)

This idea had to counterbalance centralization in the government by stimulating community spirit and individual responsibility of each citizen. (Amsterdam University Press, 2005) Small-scale collective spaces had to fulfil this role. Figure 3.2 illustrates another important aspect of the ‘wijkgedachte’: The nuclear family forms the core of an urban community and has access to everyday needs within the neighborhood. There is a clear hierarchical structure from neighborhood, to district, to city.

The ideology’s translation can be seen in the neighborhoods design as the post-war city differs from older parts of the city. The classical city has obvious borders between city and landscape; the street was a place of traffic and representation. In the modern city, the urban block surrounded by streets is replaced by separate buildings surrounded by nature. The modern city forms an alternative for the old city: ‘open’ was a metaphor for freedom and equality. It was also a critique on the former fixation on individual buildings, architecture was no longer an art of facades, but an art of space. Buildings had simple geometric forms and were rhythmically repeated, while the space between buildings and its landscaping became more important. In the overall design, unity and hierarchy were very important. (Hereijgers & van Velzen, 2001)

The ideas of unity and hierarchy are present in all facets of Buitenveldert: the grid structure, the functional structure as well as the green structure.

Figure 3.1 De Wijkgedachte
(van Nunen, 2016)

Figure 3.2 Europaboulevard, wide row of plane trees
(zone2source.net)
Buitenveldert has got a grid structure in a rectangular shape, which is based on the former agricultural landscape. The main motorways form the most important lines in the composition of the district and are connected to the streets of surrounding districts. Main motorways and secondary roads divide the district into different zones with an own program: a certain housing type, shops or sport facilities. The main roads form an important design component: they are elaborated as wide and open lanes, mostly with large trees and guided by a repetition of high-rises as design accents (figure 3.4). The lanes are carefully designed and still have allure. (Hereijgers & van Velzen, 2001) (Steenhuis et al. 2017)

The only problem is that busy roads and long buildings sometimes enclose the district from its surroundings (figure 3.5).
The functional structure has a hierarchical approach too. The most important shops are located in a shopping center: Gelderlandplein, which is recently renewed. The shopping center is now one of the best rated shopping areas of Amsterdam. *(OIS Amsterdam³, 2016)*

Gelderlandplein is situated on the Arent Janszoon Ernststraat, where smaller shops are clustered too. Another important street with functions is the Kastelenstraat, where shops and primary schools are clustered in groups of courts, connected by the street.

Buitenveldert has a wealth of retirement homes, primary schools and (sport) associations. The west of Buitenveldert also has program of importance on city-scale: the VU University and VU Hospital. *(OIS Amsterdam³, 2016)*

The green structure of Buitenveldert consists of a park, het Gijsbrecht van Aemstelpark, which connects two large green wedges: Amsterdamse Bos and Amstelloevers. There are additional green areas along the streams of water, which also lead to the main green structure.
Figure 3.8 Gelderlandplein, interior - Figure 3.9 Kastelenstraat - Figure 3.10 Shop at Arent Janszoon Ernststraat

Figure 3.11 Gijsbrecht van Aemstelpark (wikiwand.com) - Figure 3.12 Playground at park - Figure 3.13 Green space along stream
Buitenveldert has got various housing typologies, which are all clustered in zones. The porch flat is the most common typology and consists mainly of social housing. Family houses and villas are situated in the west and the south of the district, while high-rises are situated along the main roads.
The Atlas of AUP areas developed a map with the heritage value of Buitenveldert. The historic significance is not so much in individual buildings, but in the composition of the urban design. The most significant features are the open morphologies and the ‘hook form’ of the porch-apartment blocks, as well as the rhythmic repetition of high buildings along the main roads.

The porch apartments in the north of Buitenveldert have less importance than the ones in the south. These apartments have more simple designs as they were built for the lowest rental classes. (Steenhuis et al. 2017)

The buildings at the elongated area east of the shopping center do not belong to the AUP, as they are developed later and its architecture differs from the rest of Buitenveldert. This area was reserved for a highway, but it was resisted by the environmental movement during the oil crisis. The highway has never been built and the area is now used for housing. (Steenhuis et al. 2017)

The supply of public transport is extensive in this district. Railway station Amsterdam-Zuid is close-by and is connected to the national railways as well as the metro network (soon supplemented with noord-zuidlijn). There is also a tramline and there are many bus stops.
ANALYSIS: TYPOLOGY

On the scale of the housing blocks, the typology of hook-shaped porch apartments is analyzed. Figure 3.24 shows the location of the performed analysis. This typology is the most common in Buitenveldert and is also characteristic for the post-war city. For the first time the idea of the closed building block was postponed and replaced by separate buildings, rhythmically repeated in green open spaces. (Hereijgers & van Velzen, 2001)

At first, it was the idea to develop housing in strips; all apartments would be placed in the same direction to take full advantage of the sunlight. But soon it got criticism for being too monotonous. The hook-shape was a variation to solve this problem. (Steenhuis et al. 2017)

This form may be better than facing all apartments in the same direction, but it still received criticism. As the blocks are open, it is not clear which spaces are public, private or something in between. Every outdoor space is accessible for everyone, making each space function as public or semi-public. As explained in chapter 1, a gradual transition from public to private is important for a neighborhood’s livability, but the transition is currently quite abruptly.

The hooks enclose large green spaces as well as parking squares. The green is directly accessible from every apartment, which was an important feature of the post-war city. These spaces also express the importance of collectivity. The green was every inhabitant’s property; it was a common responsibility to keep it tidy. But nowadays, the green is no-one’s possession, as society has become more individual, informal and heterogeneous. In addition, the budget for maintenance is reduced, which is also not very beneficial for these spaces. (Hereijgers & van Velzen, 2001) Inhabitants now assess the green as ‘boring’ and they would like it to have more uses. There is a will for urban farming and shared gardens, but this is not yet implemented. (OIS Amsterdam, 2016)

Here too, the transition from private to public plays a role, as the green spaces do not ‘feel’ as if they belong to a certain group of people. The ground floors of the buildings also discourage involvement in the common spaces, as they are mostly not inhabited; they are used for storage. Figure 3.22 shows that the ground floors mostly have blind facades.

Figure 3.22 - 3.23 Ground floors with storages
This stems from an ideology of modern architecture: the buildings had to ‘float’ in space. Unfortunately, this space on the ground floor is often dirty and unused, while the ground floor could be very valuable for shops, but also for families, elderly and disabled people. (Towers, 2005)

Some of the ground floors do have a commercial function. They are located on the Arent Janszoon Ernststraat and form balconies for the apartments on the first floor.

The car streets go through the housing blocks and pass the green spaces as well as the parking lots. In addition to the parking spaces there are also garage boxes, as parking on the street was not desirable for aesthetic reasons. (Steenhuis et al. 2017)

In the meantime the number of cars has increased considerably: now there are also cars parked on the edges of the street.

The pedestrian paths run along the streets and through the green spaces; all outdoor space is accessible for pedestrians. Because of the hook-shape of the buildings, the end of the path is never visible. As a pedestrian, this place can feel like a maze.
The buildings contain various sizes of apartments: they have a surface of 60 to 130 square meters. The larger ones are divided in many small rooms and they are appropriate for larger households. The smaller apartments are appropriate for two to three persons. The floor plans are old-fashioned, as they have a separate kitchen and a small bathroom. This could be easily altered, as the living room provides enough space for a kitchen. Figure 3.33 shows two original floorplans and one altered floor plan. The access system is organized by porches, and this particular block is equipped with elevators (as well as the fellow three blocks in the south part). The first floor consists of garage boxes and storage rooms, accessed by a long corridor. The floor plans also show the building's structure; there are bearing walls every four meters and the porches provide stability.
The society for which Buitenveldert was designed, has changed. At this moment, there is still a relatively large proportion of the original inhabitants: these people are elderly now and many of them are above 80 years old. Under the influence of de Zuidas, the amount of young people is expected to grow strongly. The coming decades, this district will undergo a major transition. (OIS Amsterdam\(^3\), 2016)

But how can this place, in combination with the densification task, become future-proof?

This chapter showed that the post-war era is a remarkable part of history; completely new ideas about housing were introduced in this period. Nevertheless, most buildings in post-war neighborhoods are demolished these days. Alternatively, there can be learned from the parts that actually good about it.

Dealing with history respectfully has often paid off in the past. (Agricola \textit{et al}. 2013)

Large-scale demolition could even destroy existing communities and well-known urban environments; the social and economic life of a neighborhood is developing slowly and takes time. (Towers, 2005)

Besides the historical significance, a lot of building materials can be saved by choosing not to demolish. From the viewpoint of sustainability, it is better to refurbish the existing buildings. Also for current inhabitants it is important to re-use the existing buildings, so they can stay in their houses.

This does not mean that existing buildings should be seen as something holy that can not be changed at all, but the main ideas should stay recognizable. Instead of demolishing and rebuilding, adding a second layer is a preferred strategy.
The post-war housing is often called out-dated. This is partly true: these buildings do not meet today's standards anymore. The insulation level should be improved for example. The apartments are also quite small, but this could be seen as something positive. These apartments form an important stock of relatively affordable dwellings, which is exactly what Amsterdam needs. Small apartments are not only attractive to the lowest incomes: there are also middle-incomes that consciously choose for a smaller home. The tiny housing movement is an example of this emerging idea. The current apartments need to be refurbished, but not necessarily replaced. When densifying the neighborhood, the current stock can be supplemented with new types to create a mix that matches today’s demography of Amsterdam. This means: 50% single dwellings, 25% 2-person apartments and 25% family houses. As there are various groups of people moving to Amsterdam, the public space should be safe and attractive for all groups.

The green character of Buitenveldert is highly appreciated and should stay an important aspect. The idea of collective gardens is suitable for a denser neighborhood because it provides access to green space for every inhabitant. To apply this idea successfully, it is important that it gets clear which spaces are public and which are private. It is also important to have dwellers on the first floor, to get a better connection between the green space and the buildings. Furthermore, the green needs more various uses.

For transport modes, the city wants to focus more on public transport, walking and cycling than car transport. This fits the densification task; to prevent congestion and to move to a more sustainable transport system. It saves a lot of space, and the living environment will become safer and more calm. The public transport system is already extensive in this district. By upholding a low parking standard, inhabitants are encouraged to choose for public transport, bicycling or walking.

**Figure 3.34 Vision**

Preserve existing buildings as much as possible

Encourage sustainable transport modes

Maintain and improve the idea of shared, green space

On the large scale, the district functions quite well. The only problem is that large roads and large buildings close the district from its surroundings. As public transport becomes a very important transport mode, Buitenveldert needs a better connection to the Amsterdam Zuid station at de Zuidas, especially for pedestrians and cyclists. Figure 3.35 shows how slow-traffic routes provide a connection to the nearest stations and the inner-city for Buitenveldert-oost, where apartment-housing is concentrated. The large arrow forms a new route, which will connect to the present pedestrian and bicycle paths of de Zuidas. A bridge over the busy road will make the access to the station faster and more pleasant.
The areas to be densified are indicated in blue (figure 3.35). These areas have similar typologies and they are most suitable for densification, as they are mostly social rent and there are large open spaces between the buildings. In the south, there are also buildings with the same typology, but they have more heritage value and they are further away from the Amsterdam Zuid station.

Regarding the functional program, Gelderlandplein will stay the most important shopping center. Also the Arent Janszoon Erststraat will stay important as a shopping street and will be supplemented with additional program, as the demand will increase. The new route to the Amsterdam Zuid station will also have spaces for shops and small offices on the ground floors.
4. HOW TO DENSIFY?

The areas to be densified are determined, but the main question still needs to be answered: how to densify these areas? Knowing how to measure and calculate density is the first step.

CALCULATING DENSITY

The most commonly used unit for density is the amount of dwellings per hectare. It is very suitable to get an idea of how dense an environment really is, but scientifically it is unfortunately not an ideal unit. The size of the dwellings and the amount of inhabitants per dwelling are for example not clear. A better way to express density is the FSI (floor space index). The FSI shows objectively if space is managed efficiently. It is a ratio that indicates what the realized amount of floor area is in relation to the ground surface. If we build the entire site with one floor, then the FSI is 1, as explained in figure 4.1. (Uytenhaak, 2008)

When using the floor space index, it is important to keep in mind that different scales cannot be compared. Net density is for example the scale of the building block; the ground surface of the building, parking spaces, streets and gardens have to be taken into account. Gross density is the scale of the district, where large motorways, public parks and public buildings must also be counted. (Uytenhaak, 2008)

In this study, net density is used, as the building typology is aimed to be modified. The book ‘Cities Full of Space’ by Rudy Uytenhaak already contains a study about reaching the highest possible density. A conclusion is that creating density can be achieved in three ways, or combinations of the three: stack, deepen and building narrow streets (figure 4.2).

Figure 4.2 Deepen, stack and building narrow streets
Figure 4.1 Floor Space Index (squareyards.com)

- **0.5**
  - 1 floor, entire lot area
  - 2 floors, 0.5 lot area
  - 4 floors, 0.25 lot area

- **1.0**
  - 1 floor, entire lot area
  - 2 floors, 0.5 lot area
  - 4 floors, 0.25 lot area

- **2.0**
  - 1 floor, entire lot area
  - 2 floors, 0.5 lot area
  - 4 floors, 0.25 lot area
Four simplified typologies are used for examining the effects of stacking and deepening on the FSI: block, row, tower and patio. To ensure enough daylight in the volumes, a daylight-angle of 45 degrees is maintained (figure 4.3) as well as a factor for the ratio between volume and facade. The daylight angle determines the street-width. The conclusion is that, in all cases, deepen more and stacking more always lead to a growing density. However, the growth is impaired. For example, by keeping the same daylight angle and increasing the height, density will grow. But when the buildings get higher and higher, density will grow more slowly. Figure 4.5 and 4.6 show how these parameters influence each other. (Uytenhaak, 2008)

**Figure 4.3 Daylight angle:** (angle between the bottom of the building and the top of the opposite building)

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**Figure 4.4 Example:** density increases impaired when height increases. The width stays constant to guarantee enough daylight within the building.

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**Figure 4.5 FSI by stacking** (Uytenhaak, 2008)

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**Figure 4.6 FSI by deepening** (Uytenhaak, 2008)
Another conclusion is that towers placed in a strategic way form the most efficient typology, as can be seen in figure 4.7. (Uytenhaak, 2008) For the calculation, the only livability factor that is accounted is daylight. There is no optimal use of the ground floor, there is no qualitative public space, the setup is not optimal for social control, the edge between private and public is sharp and so on and so on. The calculations are informative and it provides insight into how density works, but it does not offer livable solutions.

In addition to calculations, the book provides examples of density in practice, like the Olympic quarter in Amsterdam and the Malaparte dwellings on Borneo island, Amsterdam. (figure 4.8) Unfortunately, all of those examples are not applicable to Buitenveldert, as they are highly dependent on their location and functional program. These projects are for example both located on the water and the Olympic quarter has got a large amount of public program. The examples are helpful, but they are too specific.
LIVABLE DENSIFICATION

To set up a method to work with, the calculations will be supplemented with livability rules. The composition of buildings does not have impact on all livability aspects. Some factors have a direct relation with density, while others are a product of other design decisions. For the aspects having a direct relation to density, rules are needed to determine how dense the composition of buildings may be. These aspects are: daylight, view, privacy and human scale.

Daylight is an obvious factor, which was already included in the existing method.

Spatial quality is to a great extent determined by daylight performance. The daylight performance is dependent on the size of the windows, the floor the apartment is on, and the daylight angle. (Uytenhaak, 2008)

Construction regulations of municipalities (bouwverordening) contain rules for the daylight angle: in Amsterdam, there are different maximum daylight angles for different parts of the city: 55 degrees for the city center, 45 degrees for the rest of the inner city and 33 degrees in the suburban neighborhoods. (decentrale.regelgeving.overheid.nl)

This means, that if Buitenveldert has to be transformed from suburban to urban, a daylight angle of 45 degrees is plausible.

The depth of the building must also be determined to guarantee enough daylight within the building. Building narrow, long apartments delivers the highest density. The minimal width for an apartment is around 4 to 5 meters. Self-executed design studies pointed out that apartments deeper than 15 meters are very difficult to organize and get too little daylight in the middle of the volume. Choosing for back-to-back homes does not provide any benefit; the building volume can still not exceed 15 meters. Narrow apartments with views on both sides have more living quality and can achieve the same density.

Having a view is also important in a high-density living environment, especially when the dwelling is small.

Having a view on an open space makes people more likely to feel as they have enough room, regardless of the square meters they occupy. (Montgomery, 2013)

Having no sight on the sky can lead to a feeling of distress. A diverse view, on minimal two sides of the dwelling is preferable. (Uytenhaak, 2008)

Leaving some more space around one side of every building provides direct sunlight, a sight on the sky and it ensures enough open space. It also provides the opportunity to sit outside the house and having enough privacy from neighbors on the other side.

Approximately twenty-five meters could be an appropriate measure to guarantee enough distance for privacy, as people are not able to recognize each other from this distance. (Gehl, 2010)

In the book ‘cities for people’, Jan Gehl emphasizes the importance of human scale. For density, it is profitable to stack as high as possible. When the daylight angle is taken into account, an environment will arise with gigantic buildings in very large open spaces. But those dimensions will not create spaces in which humans feel comfortable. Above approximately six floors, the connection between apartments and public space will be lost. (Gehl, 2010)

High-rises can only be used in combination with buildings of maximum six floors, to guarantee a human scale on street level.

The set up rules are visualized in figure 4.9, those will be used to perform mass studies.
Rules for livable densification are applied to an empty, non-existent area to investigate how much density could be reached when existing buildings are not taken into account. This way, it becomes clear what density different typologies deliver and the kind of environments it generates. Figure 4.10 shows the results of this study. A conclusion is that a base of six floors, supplemented with towers give good results for density.

**Figure 4.10 Mass studies applied to an empty area**

**Figure 4.9 Rules for livable densification**
Figure 4.11 shows the result of the mass studies applied to the analyzed part of Buitenveldert. Densities of these studies are lower than the ones applied to an empty area. This means that density will become approximately two times higher instead of three times higher when choosing to keep the existing buildings. Nevertheless, the choice is made to fit the new design into the existing structure, because densification by a factor of two is still a good result and history as well as re-use are important arguments for preservation of the current building stock.

The FSI-results for these studies are very close to each other, from this viewpoint it does not matter which variant will be chosen. But the rules used in the mass studies do not guarantee livability for a hundred percent, as the rules were only concerning livability factors that have a direct negative relation to density. Other factors that still need to be taken into account are: regulated privacy, quality of open space and clear streets.

As stated in chapter 1, privacy is the most important factor for livability in dense areas.
In chapter 3, it became clear that privacy is currently not regulated optimally, as every outdoor space has got a public character. With variant B, the privacy structure has not changed for example. But most mass studies (variant D,E,F,G) solve this problem by forming clear (semi-) enclosed building blocks.

As discussed in chapter 3, the current street structure is not very clear and could feel like a maze. In variant B and C, no buildings are demolished and this problem could therefore not be solved. In variant D, E, F and G, some buildings are demolished to be able to make clear streets.

It must also be checked whether the history remains recognizable and whether the variants are easy to build. In variant D, the hook-form of the existing buildings is not recognizable anymore, and it is neither easy to build, as small parts of buildings need to be demolished. Variants C, E and G have a structure with narrow streets, which make the hook-shape also less recognizable.

The table below shows ratings for each mass study; variant F got the most positive rating. This one will be the base for the urban design, because the open space is still freely accessible, while privacy is regulated too. This variant is also easy to combine with variant E; this makes it easy to regulate the amount of public space and to have various types of building blocks.

<table>
<thead>
<tr>
<th>Variant</th>
<th>private / public</th>
<th>Clear streets</th>
<th>Quality open space</th>
<th>Easy to build</th>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
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<tr>
<td>C</td>
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</tr>
</tbody>
</table>
Figure 4.11 Mass studies applied to the analyzed part of Buitenveldert
The urban design is made for the west part of the area that should be densified, as indicated in figure 4.12. This part is closest to the Zuidas and the design can also form the basis for the eastern part, as it has the same building typologies.

Instead of creating a structure of streets and blocks, the openness of the public space is embraced. The spaces with the greatest quality are not situated within the blocks, but on the outside. These spaces are free-accessible and provide places to stay for all inhabitants, which is especially valuable for people living on higher floors.

This idea is elaborated in different ways, as the existing building fabric exists of different strips. In the south-part for example, the hook-form of the original buildings is the starting point for the block design. These hooks are namely supplemented with a smaller hook. Sometimes placed in the same direction and sometimes placed in the opposite direction to create variation (figure 4.11). This results in typologies with different sizes of courtyards which will attract various groups of people.

The buildings' entrances are located within the blocks; this space functions as access space as well as meeting space. Terraces and balconies are on the other hand located on the outside and provide a view on the open, green spaces.

Most of the original buildings are preserved, as shown in figure 4.13, but few are demolished to enable a flowing green space, with continuous paths. The routing is clear now and the spaces are more welcoming for neighbors from other blocks to have a walk.

Several green spaces will become the property of a neighborhood association to give varying functions to the green space and to transfer maintenance partly to inhabitants. These spaces can be used for urban farming, playgrounds, sports and other community activities.
The urban design still contains the existing grid, formed by the most important roads. Different zones are enclosed by buildings and distinguish the public streets from the green neighborhood spaces. Only the way to the Zuidas station goes right through the north section of the grid. A bridge crossing the busy Boelelaan provides a fast and pleasant trip to the Amsterdam Zuid station for pedestrians and bicyclists. The bridge forms a seamless connection with the south square of the Zuidas. The functional program will be concentrated in the ground floors along this street as well as the Arent Janszoon Ernststraat.

The car roads are still in the grid, but removed from the zones within the grid. The zones will be car-free and therefore more safe and quiet, which is especially valuable for families with children. Parking is situated in underground garages below the courtyards, which can be accessed via the larger roads. Additional parking spaces, for visitors and shared cars are present along the main streets.

Figure 4.11 Impression of street towards de Zuidas
Figure 4.11
Social domains
- Private
- Block
- Neighborhood
- Public

Figure 4.11
Car & parking
- Car roads
- Parking garage
- Parking on street

Figure 4.11
Functional program
- Functional program
- Housing
For the elaboration of the block, three main strategies are used to add density: new buildings on ground-level, two extra storeys on the existing buildings and a tower.

The new buildings on ground level close the block and make an intimate space within the large open field. Underneath these buildings, there is a parking garage that lifts the courtyard a few steps above ground level. It gives a signal that one enters a more private space. The garage is used for car parking, as well as bicycle parking. There are also two spiral staircases from the parking garage to the courtyard; they form a nice way to enter the parking garage and bring some natural light and ventilation too.

The two extra storeys on the existing buildings are a literal translation of adding a layer to history. They are accessed by a spacious deck, which gives a kind of feeling of living in a house, instead of an apartment. Other advantages of a deck are its affordability and accessibility for disabled people.

The decks are placed face-to-face and are only accessible for inhabitants to guarantee social control. They are two to three meters wide; inhabitants can pass each other comfortably this way and there is space for small benches and planters. (van der Wal et al.)

In between the houses, there are some open spaces with planters to relax or to meet.

The outdoor space has got a lot of different uses. A spacious, smooth path connected to the rest of the neighborhood goes through and is appropriate to have a walk, go running or even skate.

The neighborhood association’s space is in the middle, bordered by hedges. It can be completed according to their own wishes; this particular space is designed for urban farming.

In between the path and the terraces of the ground floors’ dwellers, there are several planters and grass fields to create distance between private and public parts. The planters give some shelter, downscale the space, and form places to sit. Grass fields provide space to play in front of the house. Across the neighborhood, on strategic places, some playground elements can be placed on the grass fields for the children in the neighborhood.
Figure 6.4: floor plans
The concept of three different layers is emphasized in the material use of the buildings. There is a clear difference between the old and the new buildings. The old buildings have a masonry facade, which is plain, but sleekly designed. As explained in chapter 3, this is typical for post-war architecture: buildings were interpreted as volumes, while the landscape design could be more distinctive. The new buildings’s facades are made of white stucco and fit this idea.

On top of that, there is a different world of small wooden houses. An important reason to choose wood is its weight. The existing buildings have to carry two extra stories, therefore it is important that the top layer is light-weight. To make the building process as fast as possible, pre-fabricated units in a steel frame can be put on the roof with a crane. The units are resting on weight distributors that are placed above every bearing wall. The weight distributors also provide space for pipes. There are many examples of similar systems for similar building typologies. For this project, the endis system is used as an example. (endis.nl)

To unify the facade rhythms of the old and new buildings, the steel structure is on the outside. The steel columns are flush with the bearing walls of the existing building, as can be seen in figure 6.5. This means that that the finishing and insulation needs to be installed on the inside. Wooden panels are resting on the floor beams, which are placed within the steel profiles.
Figure 6.7 Structure top layer
190 NEW HOMES

The last way to increase density is to design small dwellings. As explained in the first chapter, it is important that there is at least one room per person. The housing block contains various dwelling types for one up to five-person households. They are modest, but have everything one needs.

The housing mix is based on the demographics of Amsterdam, as shown in figure 6.8. It is assumed that half of the households want to live in a dwelling with 1 room per person, and that the other half wants to have an extra room. For example: 50% of the households is single; there are approximately 25% 1-room apartments and 25% 2-room apartments reserved for this group.

The existing buildings contain a lot of apartments appropriate for families of four persons. The new buildings have maisonettes for five persons on the ground floor, and apartments for two to three persons on the second and third floor. The wooden houses on top are reserved for 2-room apartments and the tower consists of tiny-apartments for single households. The tower also has common space on the ground floor and a café on the level of the deck.

Now that the buildings have been equipped with apartments, it is clear how many dwellings have been added exactly. This particular block, including the demolished building, contained 84 dwellings in the old situation. 24 apartments are demolished and as many as 190 new homes are added to the block. This makes a new total of 250 apartments. The parking garage has got 94 spots for cars (0.38 per household) and 650 spots for bicycles (2.6 per household).

Figure 6.8 Distribution of apartments
Figure 6.9 Family maisonette (ground floor new building)

Figure 6.10 Two-room dwelling (top layer)

Figure 6.11 Tiny apartment (tower)
With the aid of a design, the research question is answered: *How could an existing neighborhood be densified, while improving its livability?*

At first it should be acknowledged that the possibilities for densification are highly dependent on its location and its program. Often, it is not desired to demolish an existing neighborhood, because of heritage value, material value and the fact that the social and economic life of a neighborhood need time to develop. Consequently, additional buildings for densification need to be fitted in the existing structure of a neighborhood.

As a design strategy, it is useful to apply FSI (floor space index) calculations to mass studies, in combination with livability. This method can be generally used and it guarantees a certain level of livability. The rules are related to aspects at which density and livability are each other’s direct opposites. These rules are: a daylight angle of 45 degrees, a view of 25 meters, a building depth of 15 meters and a common building height of 6 floors or lower. It should be mentioned that these exact numbers are only guidelines and they could deviate.

This method is appropriate to design with, but it needs to be followed by an evaluation of livability factors that have no direct relation with density: privacy zoning, clear routing and the quality of the open space.

The method is unfortunately not applicable to all kinds of typologies. It is applicable to post-war porch flats, but it is for example not optimal for the high rises in Helsinki. However, the same livability aspects could be evaluated.

The design forms an example of how density, livability and heritage come together. It does not only show that high density could go together with a livable environment, it also shows the importance of Buitenveldert for the densification task.
But what can Buitenveldert mean for the municipality’s densification task? On the basis of the design, a rough estimate is made for all blocks and towers of the urban design: the result is that approximately 3800 homes can be added in the indicated areas (figure 7.1).

The municipality plans to build 50,000 homes before 2025, of which 12,000 within the existing urban land. (van Unen, 2016)

This is only a quarter, which means that still 38,000 homes need to be built somewhere else. It is remarkable that the estimation for this project’s design already counts 3800 homes for just one of the many locations that are indicated in figure 7.2. Probably, much larger numbers are possible within Amsterdam’s urban land. Therefore, the statement has to be made that Amsterdam could be far more ambitious regarding the densification task.

Figure 7.1 Potential Buitenveldert

Figure 7.2 Densification locations (van Unen, 2016)
1. RISE OF THE CITY


CBS Statline¹ (2017) Huishoudens; samenstelling, grootte, regio, 1 januari

City of Helsinki urban facts (2016) Statistical yearbook of Helsinki


OIS Amsterdam² (2013) Jaarboek 2013: hoofdstuk 8: Openbare ruimte en groen
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Graham Towers (2005) At Home in the City: an introduction to urban housing design. Elsevier

CBS Statline² (2017) Bestaande koopwoningen; regio; verkoopprijzen prijsindex
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publication/?DM=SLNL&PA=81885NED&D1=0,6&D2=0,17&D3=29,34,39,44,49,54,59 ,64,69,74,79,84,89,94,99,104,109&HDR=T,G1&STB=G2&VW=T

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2. WHERE TO DENSIFY?


Helsinki city planning department (2016) Helsinki city plan. Helsinki is growing sustainably


Ad Hereijgers, Endry van Velzen (2001) De naoorlogse stad: een hedendaagse ontwerpopgave. NAi

3. BUITENVELDERT


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Graham Towers (2005) At Home in the City: an introduction to urban housing design. Elsevier

IMAGES:


zone2source.net, retrieved from: http://zone2source.net/nl/in-between-twee-parken/

vaneesterenmuseum.nl retrieved from: http://vaneesterenmuseum.nl/nl/ontmoet-van-eesteren-buitenveldert/

wikiwand.com, retrieved from: http://www.wikiwand.com/nl/Buitenveldert

Stadsdeel Zuid, Amsterdam. received e-mail from municipal service
4. HOW TO DENSIFY?


IMAGES:


6. ARCHITECTURAL DESIGN


CONCLUSION

van Unen (2016) Op deze locaties wil Amsterdam 12.000 nieuwe woningen bouwen. Het Parool