The Compact Garden City: Creating a Framework for a Comtemporary Garden City

Source: Van Eesteren Museum

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Introduction

In the cities we live in today, we are faced with numerous challenges. As the environment is changing, cities around the world are getting hotter and rain events are getting more extreme (Carter, 2011). The urbanization trend that started more than a century ago is still ongoing, resulting in a never-ending need for more housing.

Cities, however, have always been places faced with challenges. One man who chose to make an effort to address some of the big issues cities of his time were facing, was Ebenezer Howard. Born in 1850 in the United Kingdom, the cities of his time faced challenges that were consequences of the industrial revolution. People formerly living in the countryside moved into the cities in large numbers to find work. As a result of this, cities were becoming ever more crowded, congested, and unhealthy places (Richert & Lapping, 1998). Ebenezer Howard came up with a radical new idea, that of the Garden City. Combining elements of the city with that of the country, he proposed a spacious, green city in which the sense of community would be very important.

The challenges of cities today are different, but the principles around which Howard based his Garden City are still relevant. The importance of good social cohesion within neighbourhoods is broadly recognized among researchers and policymakers, with observed positive effects ranging from better well-being for the older generation to positive effect on health for younger generations (Cramm et al., 2013; Cradock et al., 2009). Green spaces are also considered as very important for the well-being of citizens and as natural way to reduce climate related problems such as extreme heat (Wolch, Byrne & Newell, 2014). Thus, social cohesion is seen as essential to a good neighbourhood and green spaces are deemed increasingly relevant to keep cities liveable in a changing world. It is therefore interesting to see whether the principles of the Garden Cities can be applied to modern-day cities. One city that is facing many of the aforementioned challenges is the city of Amsterdam. With an expected growth of 21% by 2050 the city is gearing up its efforts to make room for this steep growth (Gemeente Amsterdam, n.d. -a). To see whether the garden city principles can be balanced with the needs of this modern-day city the following research question will be answered:

What would implementing the Garden Cities principles mean for the balance between densification, high rise building, and urban green for future developments in Amsterdam?

The paper starts off with a method section discussing how this research question was approached. The literature review after that is focussed on the concepts of the garden city and the compact city. After that a results chapter discusses the possibility of combining elements of combing elements of the compact city concept with that of the ideals of the garden city. Lastly the results will be implemented in the case of the Zaanstraat emplacement, a marshalling yard in Amsterdam that will be developed from 2025 onwards (Gemeente Amsterdam, n.d.-c).

Methodology

Problem statement and research question

Amsterdam has to deal with two conflicting planning policies with opposite goals. One the one side, the municipality has to deal with housing shortages and a lack of space to build. On the other side, the space has to be green and livable for the future resident, but also for resident living near the area already. Therefore, the municipality has to find a balance between these two conflicting policies, which is not an easy task. In order to find out what this balance could look like, the following research question has been formulated by Museum Het Schip:

What would implementing the Garden Cities principles mean for the balance between densification, high rise building, and urban green for future developments in Amsterdam?

Academic and societal relevance

The research was suggested by our client Museum 't Schip, who pre-formulated the main question as well. Museum 't Schip is located in the Spaarndammerbuurt in Amsterdam. Answering the research question is important, since the municipality has plans for developing a new neighborhood called the Haven-stad which is, just like the Spaarndammerbuurt, located in the area Westpoort. As already explained, more houses need to be built in order to resolve the housing crisis in Amsterdam as a whole. But while doing that, planners and policy-makers have to take into account a lot of different norms and values from a number of stakeholders. Next to that, the current climate crisis makes it even more complex. Therefore, doing research on the balance between the Garden City principles and the Compact City principles has a high social and academic relevance. A lot of stakeholders are involved in the process of developing the new neighborhood located at the marshalling yard next to the Zaanstraat. It is therefore crucial that research is done on how to balance green space with high rise building and densification.

Two sections

In order to answer the main research question, a literature review has been done and interviews were conducted. Theresearch was divided into two sections. In the first section an answer is given to the first three sub questions, based on planning literature. Insights that came out after analyzing the interview results, were used in the second section of the research. The second section was the case study. The aim of this was to connect the planning literature regarding the Garden City and the Compact City principles with planning practises.

First section: Literature study

Firstly, a literature review has been done to get an understanding of the principles of the Garden City and the Compact City. These are two opposing policies are the two main subjects in the research question, and therefore it was important to elaborate on the characteristics. To structure the

literature review, our research question was subdivided into five questions. The first three were answered in the literature, which were the following:

1. *What are the garden city principles?*
2. *What are the compact city principles?*
3. *How do the garden city principles conflict with compact city policies?*

To begin with, these two conflicting policies have been analyzed and put into two separate frameworks. The framework used was based on the article written by Kain et al. (2022). In their article Kain et al. described how the characteristics of a compact city could be in put into a framework. The same framework was used to organize the garden city principles.

The third sub question was answered by merging the two frameworks into one inclusive 'Compact Garden City'-framework.

Second section: Interviews and Case study

In the second section of the research, a case has been studied and the following sub question was answered:

4. *What are the thoughts of local residents regarding high rising building and densification?*

Qualitative data was collected by conducting interviews with residents. A list of current local residents who were willing to participate in the research was provided by the client. The respondents were all residents of the Spaarndammerbuurt and lived next to the area used for the case study in this of the research. The respondents were asked a set of questions during a semi-structured interview held at their home or online through Microsoft Teams. Interviews were conducted in order to understand what the local residents think about the future plans for the new neighbourhood.

To link theory with practice, the outcomes of the interviews were used for developing a broad vision for the development of a new neighbourhood at the Zaanstraat emplacement. Therefore, the last sub question was answered:

5. *How could this balance between densification, high rise building and urban green look like in practice?*

The Havenstad, even more specific the marshalling yard next to the Zaanstraat, was chosen as case, because the municipality of Amsterdam has designated it as target area for a new neighborhood. Also, the Museum 't Schip had provided us with a lot of information on the area, since the marshalling yard is next to the Spaarndammerbuurt.

Combined with the interview results, the compact garden city framework was put into practice to see if it was workable in making a broad vision for the development of a new neighbourhood at the Zaanstraat emplacement. Based on the compact garden city framework and the interviews, decisions were made on how a balance could be created between high-rise buildings, density and urban green.

Literature Review

This literature review is centred around two concepts, that of the garden city and the compact city. These concepts are both examined with the use of already available literature. After that, the differences and similarities between these two concepts are discussed.

Introduction to the concept of Garden Cities

Over 100 years ago Ebenezer Howard wrote his book 'Garden cities of to-morrow – The peaceful path to reform' setting out principles for a new way of living in the city (Howard, 1898). It was written in a time when people came together and had proven to be capable of building their own institutions (Ross, 2015). This has led to building the first garden city in the world: 'Letchworth Garden City'. Aiming for a new way of community, combining the advantages of both the city and rural towns (Gatarić et al., 2019). During this time industrial cities were becoming crowded, polluted and unhealthy places to live at (Richert & Lapping, 1998). Howard started the garden city movement to protect people from these disadvantages of living in the city. It made a new kind of settlements possible that combined the benefits of the city with those of the rural countryside, whilst providing high quality socially inclusive housing (de Morais Salles, Noordermeer, de Oliveira Soares & Warren, 2022). These new garden towns would be built because it was a just thing to do and not because of paternalism or charity (Ross, 2015).

Howard set up his ideas for the garden cities under the influence of the geographer Kropotkin and economist Marshall´s ideas (Gatarić et al., 2019). Howard suggested the creation of a new city type to remove the differences between rural and urban using their ideas, on the impact of electricity, the development of communication technology and ways to slow down the increase in social costs caused by industry. He wanted to accomplish decentralization of the major cities by creating green cities around towns. In order to prevent cities ruining themselves by population growth, traffic congestion and inaccessibility to important establishments in the city Howard developed his concept of garden cities. Garden cities needed to be planned to suit its citizens needs and should be able to stand as an independent community (Gatarić et al., 2019). Originally a garden city should have around 32,000 inhabitants on a site of 6000 acres (Howard, 1898). 30.000 of these inhabitants live in the garden city in an area of 1000 acres and 2,000 inhabitants should live in a green or agricultural area of 5000 acres as can be seen in figure 1 (Howard, 1898; Richert & Lapping, 1998; Gatarić et al., 2019). This in order to combine the best aspects of both the town and country (Ross, 2015). When a garden city reached its maximum capacity a new garden city needed to be built on the outskirts of the city. By doing this it can be prevented that the population growth within the garden city would produce the same problems as was the case in the older cities.

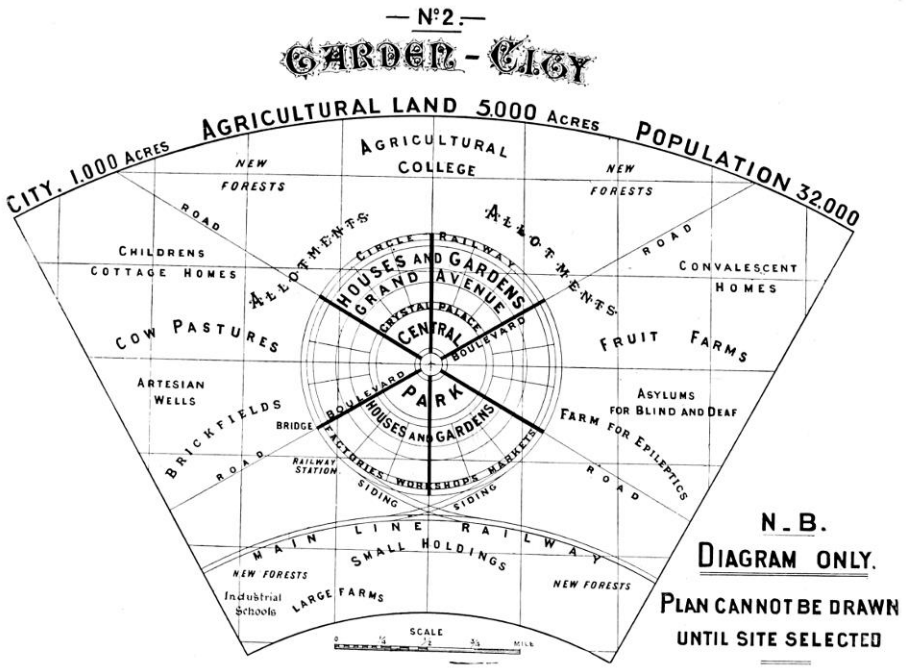

Figure 1: Garden city plan according to Howard (Howard, 1898)

Howard's system with the garden cities consisted of the three Magnets: Town, Country and Town-Country (Figure 2) (Howard, 1898). Highlighting the differences in pull and push factors between cities and villages affecting the migration of population (Gatarić et al., 2019). All three magnets are pulling and pushing citizens towards and away from them. First, the Town magnet consists of high wages, more economic activities and a rich and diverse social life. However, the magnet also has disadvantages that push people away from the magnet. These disadvantages of the town magnet are high costs of living, more overtimes at work, work on distance, lack of community, pollution and poor neighborhoods (Gatarić et al., 2019). second, the country has other attractive points, where the town is polluted, the country can offer a healthy environment and low rental costs. However, there are less economic opportunities in the country, the income is low and there is a lack of social life compared to the town (Gatarić et al., 2019). Both the town and the country have their strengths and flaws and therefore cannot provide a harmonized life. By combining these two and creating a new ´magnet´ called Town-Country a more harmonious society and nature can be created (Howard, 1898). Therefore, making these garden cities attract more inhabitants than the other two magnets.

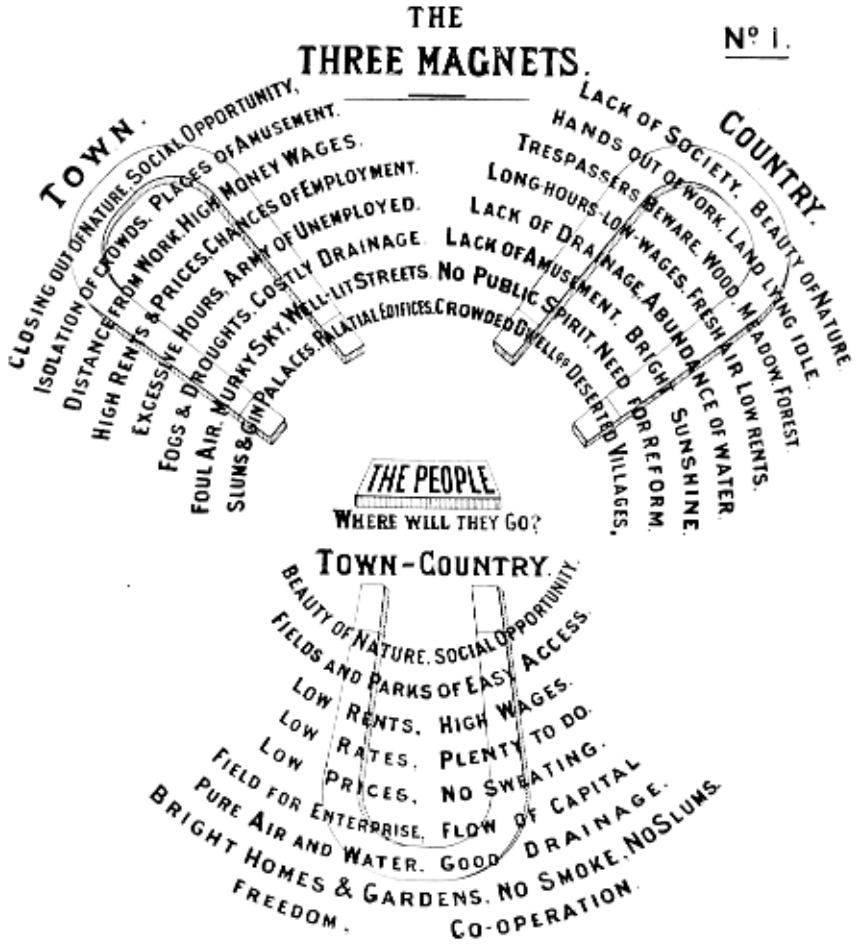

Figure 2: the three magnets of Howard (Howard, 1898)

A garden city, according to Howard´s ideas, needs to follow a couple principles and should always fit into the Town-country magnet. Therefore, it should aim at solving problems of isolation, overcrowding, ecological problems and unemployment in order to be more attractive than the other two magnets (Gatarić et al., 2019). Next to this a couple of principles have been set up that garden cities need to have. These principles include the following aspects (Korthals Altes, 2004; International garden cities institute, n.d.): A garden city should be self-sufficient and create enough local jobs for its citizens; there should be a mixture of homes and housing types that are affordable for ordinary people; community participation should be cooperative; there should be a lot of green space including gardens, utilities, ornamental green and community gardens; there should be a low housing density; no pollution should be present in the garden city and therefore everything needs to be electric; land value capture should be beneficial to the community; the garden city should have enough recreational opportunities and facilities and everything should be in walkable distance or integrated in accessible public transport systems.

Relevance of urban green space

One of the aforementioned principles of the garden city is that urban green spaces are very important to be present. This is important because urban green has various benefits for the city. Howard new this already and therefore stressed the importance to create a healthy neighbourhood (Gatarić et al., 2019). Cities were, as earlier mentioned, very polluted at that time and by creating enough urban green an attempt was made to change this in the garden cities.

There are multiple reasons why urban green is so important for the city. Which will be further explained inn this chapter. First of all, cities can deal with a lot of urban heat as a result of the Urban Heat Island effect (UHI) (Kleerekoper, van Esch & Salcedo, 2012). This can lead to heat stress and is expected to increase in the next years due to climate change (Heaviside, Macintyre & Vardoulakis, 2017). Heat stress can influence citizens in certain ways. First of all, vulnerable groups, especially elderly and infants, can be in danger because of heat stress and increase the heath related mortality (van der Hoeven & Wandl, 2015; Heaviside, Macintyre & Vardoulakis, 2017). When planning new neighbourhoods, one therefore needs to take the UHI effect into account. There are multiple ways to address the UHI effect in a neighbourhood, one can use air-conditioning to cool down buildings, this is an expensive solution however, and is not a possibility for everyone. Furthermore, this is a maladaptation strategy because it does not solve the problem but contributes to the problem. Therefore, mitigation would be a better strategy to implement here and to address the problem on a neighbourhood scale (Heaviside et al., 2017). One therefore needs to implement urban green into the neighbourhoods to capture more rain and cool down the neighbourhood (Aram, García, Solgi & Mansournia, 2019; Heaviside et al., 2017). Furthermore, it helps to battle the air polution and therefore increase the quality of life in the city (Heaviside et al., 2017). According to Dwivedi (2019) green roofs can help to reduce summer heating by 35-40% and therefore at least 50% of a city should be green, this includes green roofs and walls too.

Next to this role of urban green to battle the UHI effects, urban green spaces can have other beneficial effects on the neighbourhood too. According to Wolch, Byrne & Newell (2014) urban green also has mental and physical health benefits. And according to Lee & Mahaswaran (2011) the accessibility of green space has positive socioeconomic benefits as well, although they also found that poorer populations and inner-city residents are less likely to participate in outdoor recreation activities. It is therefore important to make sure that urban green is well distributed through the city and is easily accessible.

Relevance of community gardens and social cohesion

Research on the benefits of community garden participation has shown that physical and mental health will increase when there is the ability to participate in outdoor activities (Ohmer et al., 2009). Ohmer et al. (2009) write about how community agriculture has positive effects on individual, social and community level. In particular in disadvantaged neighbourhoods, community gardening programs have often become part of current development strategies. According to their research, it increases social cohesion and sense of community, while at the same time conserving urban green space.

It was already in the time of the early Garden Cities that these positive effects were acknowledged. But at first, its purpose was more to produce food for the community, rather than addressing local

problems like crime. The production of local food was needed, because of the mass migration of people towards urban areas at the beginning of the twentieth century (Saldivar-Tanaka & Krasny, 2004). Especially for the poor residents, this was an opportunity to provide them with food.

Nowadays, development strategies that include community agriculture integrate social, economic and environmental concerns (Ohmer et al. 2009). Community gardening lets the people grow their own fresh food and encourages them to go outside in nature (Ohmer et al. 2009). For low-income groups this still provides them with local food supplies, lowering the prices. Another positive effect of community gardens is that it is creating 'meaningful places' (Ohmer et al., 2009). The community garden becomes a meeting place for residents, where social interaction takes place (Ohmer et al., 2009). But just placing trees and greenery on the streets has proved to have an increasing effect on the amount of social interaction in the neighbourhood (Kuo et al., 1998). Kuo et al. did research on the relation between the amount of public green space and social activities. Their conclusion was that public green space would lead to more social interactions and a feeling of belonging to the community. Next to that, they found that people were more likely to go outside when there were community gardens and other public green spaces. Community gardens have an even stronger effect on the social ties in the community, because they lead to more social interactions between residents apart from the gardening as well.

Case studies on the benefits of community gardens have also pointed out other benefits as well. Saldivar-Tanaka & Krasny (2004) found that in the case of New York, community gardens also served as a neighbourhood center and a place for educating the youth. Also, in New York, the existence of community garden has encouraged residents to actively participate and transform vacant lots into even more community gardens. This shows that community gardens have in many ways positive effects in the social dimension.

Introduction to the concept of Compact Cities

The compact city is a paradigm of city development which was triggered during the massive suburbanization after the second world war. This is in a similar way as the Garden Cities became popular during the 19th century when cities were overcrowded. Today the compact city is a leading paradigm for city development (Westerink et al. 2013). Therefore, many concepts of compact cities have become dominant over the years. As for example, both conventional development and compact city development favour similar qualities such as density and mixed-land uses. However, as both urban forms wish to reduce urban sprawl, compact city development is more focussed towards sustainable development by which it seeks to intensify activities in the neighbourhood, reduce resource use and preserve rural land (Jabareen, 2006).

The sustainability aspect of compact cities is often debated in articles. As for example, there is some evidence that higher density is associated with more sustainable transport use and lower energy consumption (Ahfeldt & Pietrostefani, 2017). On the contrary, compact cities are associated with loss of open green spaces (Ahfeldt & Pietrostefani, 2017), such practices have also been found in Amsterdam where compact city development policies have led to a decrease in green space (Giezen, Balikci & Arundel, 2018). Furthermore, there seems to be a limit towards energy and material efficiency in dense areas. As, extensive dense areas (such as skyscrapers) are more inefficient in terms of material and energy costs (Neuman, 2005). This report is to find out whether these reported disadvantaged can be solved by implementing garden city principles. However, it must be stated that one must be wary to associate everything with urban form or it's qualities. As it's also

questioned whether urban form itself does significantly cause these associated effects. It can be found in Neuman (2005), that choice and opportunities are more related to size and scale of a city. This means that for example, more options of sustainable transport can be more related to the size of cities than to its density. Other topics such as effects on health, criminality and innovations are also found to be more affected by size (Kain et al. 2022). Therefore, this report is wary that there might be more other factors than urban form which are responsible for certain effects.

The standard image of a compact city is a monocentric city (single city). However, not all urban areas can be categorised as ''monocentric'' or ''polycentric'' and countries such as the Netherlands incorporated polycentric planning initiatives such as the ''clustered deconcentration'' (Westerink et al. 2013). Another example is Seoul which despite having compact city characteristics such as density and mixed land uses also functions as a polycentric area by which there is a great number of commuting (Jun, 2020). It must be noted that if the distance becomes too great between areas in a polycentric form, the compact city will lose its advantages (Westerink et al. 2013). Furthermore, it seems that there needs to be a focus on transit development in the case of Seoul (Jun, 2020). Thus, compact cities have neither to be fully monocentric nor polycentric and these concepts should be applied as a spectrum in which there are other factors which enable different options such as the case in Seoul (the transit development allowed for a more polycentric functioning).

At last, Neuman (2005) stresses that the compact city has no universal definition and often density alone is used as the independent variable. This is evident in research, when comparing the 2 frameworks of Ahfeldt & Pietrostefani (2017) and Kain et al. (2022). As the framework of Ahfeldt & Pietrostefani (2017) is far more specific and describes compact cities at the account of 3 characteristics: economic density, morphological density and mixed land use. On the contrary, Kain et al (2022) has a more general approach and categorises compact cities on 4 characteristics: intensity, diversity, access and form. Furthermore, Kain et al. (2022) with this general approach puts more emphasis on ecosystems and urban nature. Therefore, this report will make use of the approach of Kain et al. (2022) as it covers more topics which are related to our research topics (density, high rise and greenery). The framework of Kain et al. (2022) is based on the DPSIR framework of EEA (1999) but includes only ''States'' and ''Impacts''. The thought behind is that different states of ''People'', ''Built structures'' and ''Nature'' produce certain impacts. Combined with the earlier stated 4 categories it can be thought as following: a certain Intensity (category) of People (state) produce an environmental impact. Furthermore, Kain et al. (2022) divides impact in first and second impacts. However, due to time constraints this project can't do a full literature review where certain impacts can be ascribed in a same manner as Kain et al. (2022) did. However, some impacts will be mentioned in text, the main objective of the use of this framework is to compare the states of Compact cities and Garden cities. After which, the project produces characteristics of states which can be ascribed to ''Compact Garden cities''.

The states ''People'', ''Built structures'' and ''Nature'' used in Kain et al. (2022) are relatively simple to understand but comprehensive in nature. For people, it refers to mostly residents. Built structures refer to all kinds of buildings such as houses and infrastructure. Nature refers to urban nature in general and can include all kinds of nature such as open green spaces or just small patches. The categories are more difficult to understand and therefore will be explained in the next section.

The main categories

Intensity

Intensity is described by Kain et al. (2022) as either a quantitative or qualitative measure. As a quantitative measure it includes a certain feature given in a certain area which is defined either by km^2 or hectare but can also refer to a building or region in general. Examples of such features are green space, building volume or residential population (Kain et al. 2022). As a qualitative measure, it can refer to how intensely an urban area is used (Kain et al. 2022) This draws upon the work of Westerink (2022) who iterates that intensity shouldn't be used as a synonym of density. Here it's stated that intensity also refers to increased use of existing sites. As for example, this can best be seen in Kain et al. (2022) by looking at ''Built structures''. Here, essentially multi-family homes are more intense use of a site than in comparison with single-family homes. All in all, intensity is associated with density but also includes other aspects such as intensive usage of an area.

Diversity

Diversity is seen by Kain et al (2022) in 2 ways. First, diversity is seen as a component of mixed land uses in which a variety of facilities and services lead to local self-sufficiency. Secondly, diversity can also be seen as complexity arising from interactions between activities, associations, facilities and institutions. The first argument refers to mixed land uses, this means that land has multiple functional uses such as residential, recreational, industrial and commercial. This reduces the need for travel of residents and reduces social segregation as more services and facilities are also accessible for disadvantaged groups (Jabareen, 2006; Burton, 2000). The second argument is expressed in for example the complexity of mixed land uses. This draws upon the work of Burton (2002) who states that mixed land uses are expressed horizontally or vertically. Mixed land uses can be created horizontally which refers to creating mixed land uses within a neighbourhood or street. Vertically created mixed land uses refer to mixed land uses within a single building. Thus, diversity must be seen as a component of mixed uses and mixed functions while there is also some level of complexity in those components.

Access

Access is mostly marked by the element of short distance and works with other categories such as ''Diversity'' which in combination can improve accessibility to services and facilities (Kain et al. 2022). As for example, a diverse urban area has many mixed lands uses which shortens the distance of services, activities and facilities for residents. Also, other characteristics such as gender, opening hours, vehicle ownership, income and educational level are linked with accessibility (Kain et al. 2022).

Form

Form as explained by Kain et al. (2022) refers to the specific urban form, green structures or urban network structures. Urban form especially includes things such as monocentric, polycentric or clustered deconcentration (Kain et al., 2022). As earlier stated, polycentric and clustered deconcentration are more beneficial in modern times, this is also stated by Kain et al. (2022). Polycentric is further expressed in green structures where green spaces corridors between urban areas (Kain et al., 2022). In network structures, Kain et al. (2022) explains that form is linked with connectivity in which for example densities or coverage of different urban network structures (streets, bike lanes, sidewalks, rail, etc.) are described.

Compact city vs. Garden city principles

States

People

For the compact city, various scholars have made clear that the density of the residential population would be high (Neuman 2005; Jabareen, 2006). This has also been found in empirical studies such as presented in Kain et al. (2022). Therefore, the intensity of the residential population is considered quite high. Higher density buildings or areas are often associated with reduced dwelling size in an area (Burton, 2000). Household sizes have been decreasing in developed countries, especially since the 20th century (Bradbury, Peterson, Liu, 2014). The decreasing household sizes have been influencing dwelling sizes in planning policy in countries such as Australia (Easthope & Tice, 2011). The compact city thus would include smaller household sizes because policies may favour smaller dwelling sizes. These households need to be distributed in a specific way, marking the importance of form within the state of ''People''. The increasing densification policies within cities need to be accompanied with instruments that influence the spatial distribution of firms and households (and their activities), such as decentralization of jobs (Gaigné, Riou & Thisse, 2012). For the specific form, we learn that trips such as travel for recreation or schooling have less impact differences among city structures but commuting does differ between city structures. The focus of the specific form must optimize residents with their jobs. An example would be creating secondary business centres (Gaigné, Riou & Thisse, 2012), the decentralization of jobs would reduce commuting distances and thus reduce GHG emissions. Communities within compact cities of different income groups are most likely to be mixed and thus less likely to be spatially segregated from valuable amenities such as schools and jobs (Burton, 2000). This indicates that diversity within compact cities focuses especially on income and thus mixing income groups should be favoured.

When looking at the people in the garden city according to the earlier discussed principles from (Korthals Altes, 2004; International Garden Cities Institute, n.d.) one can see that there should be a lot of space for gardens and urban green and that there is a low housing density in contrast with the compact city. In the original garden city, there would therefore be the possibility for 32,000 inhabitants on an area of 6,000 acres (Howard, 1898). This way there is a low density in the garden city, indirectly resulting in a strong community in the garden city neighbourhoods. These communities need to consist of ordinary people and therefore the garden city needs to promote social justice and give various groups of people the opportunities to live in this neighbourhood, by providing a mixture of homes and housing types that are affordable for the ordinary people (International Garden Cities Institute, n.d.). Therefore, a garden city often includes social renting houses into the neighbourhood. This makes for a mixed group of inhabitants in the neighbourhood that are encouraged to form communities in the neighbourhood. This is for example done by the goal of garden cities to be self-sufficient (Korthals Altes, 2004). By this goal the garden city provides enough local jobs and therefore tries to keep this on a local scale helping to get to know each other and creating communities.

Built structures

The paragraph above described how lower household sizes have influenced policies in lower dwelling sizes. Increased intensity of people would require housing for them too, it seems evident that buildings would also experience a greater density. The central idea of compact city is that buildings are indeed more densely built within an area (Burton, 2002). Compact city approaches aim favouring multifamily and/or semi-detached housing units (Holden & Norland, 2005). As a result of compact development, it was found in Rotterdam that high-rise buildings were seen more often. In addition, in Barcelona appartements were smaller which hints on reduced dwelling size (Kain et al. 2022). Concluding, a compact city would often include a high densely built area with high-rise buildings and smaller apartments. For diversity, mix-land use is one of the most prominent characteristics of a compact city which essentially describes the co-location of various uses such as recreational, employment, residential and retail (Ahfeldt & Pietrostefani, 2017). In compact cities, this is done both horizontally and vertically (Burton, 2002). As earlier stated, both polycentric and clustered deconcentration are viewed as more beneficial urban forms of compact cities. It should be noted that 2 criteria must be met: distance between urban areas must not be too great (Westerink et al., 2013) and it should be accompanied by transit development such as done in Seoul (Jun, 2020). By having both a diverse landscape and transit development, the distance to public transport should be close and thus accessible for lots of residents. Realizing that distances don't exceed the limits and providing a diverse area also improves the walkability and bike ability of the compact city.

As for the Garden cities, they often have a lower density then the compact city, therefore the initial idea of the garden city also was to provide single-family homes for ordinary people on a large scale (Berghauser Pont & Haupt, 2019). However, in line with the garden city principles from the International Garden Cities Institute (n.d.), to prevent excessive sprawl and keep the land prices low they changed this idea into a mixture of housing types (Berghauser Pont & Haupt, 2019). The garden city exists of multiple parts, first of all there is the city part of the garden city which according to Howard (1898) consist of an area of 1000 acres, which should be populated by 30,000 citizens. This is the more densely populated part of the city. This is surrounded by an agricultural belt of 5000 acres with 2,000 inhabitants. This way the belt can prevent further sprawl. In the garden city structures it is important that everything is accessible and on a walkable distance within the garden city. As can be seen in the diagram below (Figure 3) the garden city center has all kind of facilities within walking distance and one can work close to home (Howard, 1898). The housing for the wealthiest inhabitants of the city is located near the garden city center with bigger appartements, and the more we get to the outer rings of the city the smaller the houses get, and the less expensive housing gets (Cramer-Greenbaum, 2011). A school is also placed in the neighbourhoods in a very centralised placement, so that all can have access. next to this walkability it is very important for the garden city to have a good public transport system that connects the polycentric garden city with the central city and with the other garden city agglomerations (Gatarić et al., 2019). Next to these mentioned structural aspects, the garden city is very much striving to be a pollution free and a healthy neighbourhood. Therefore, it is very important to have a good electricity network.

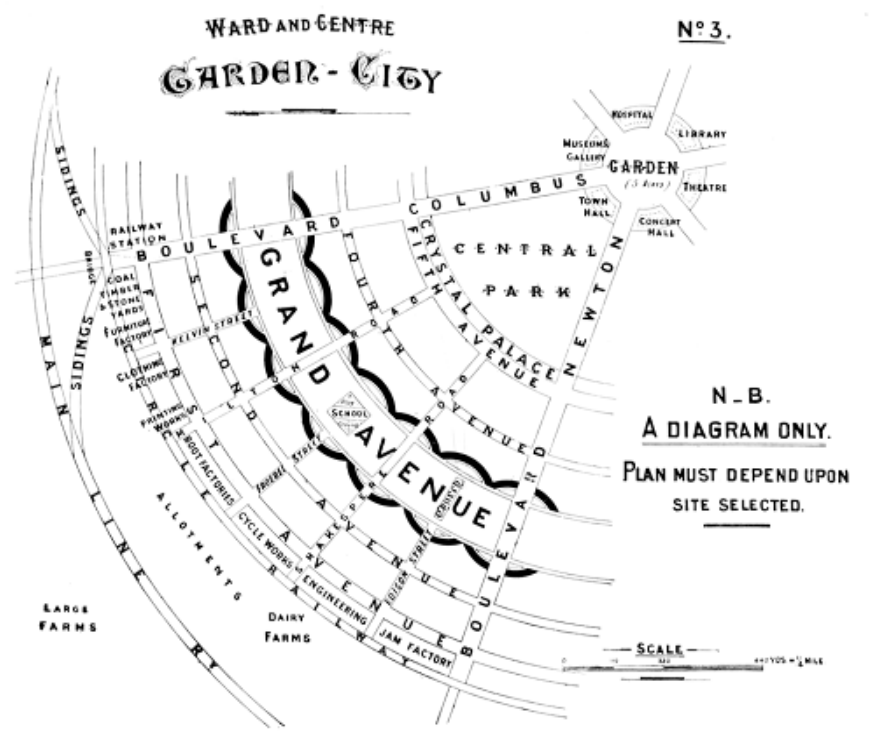

Figure 3: diagram of the Garden City (Howard, 1898)

Nature

Originally compact cities were meant to preserve rural land which was out of the edge of the urban city (Jabareen, 2006). In addition, historically compact cities tended to have more restrictions to greening within the city (Jim, 2004). Today, urban densification processes seem to pose a threat to urban green spaces (Haaland & van den Bosch, 2015). An example would be Amsterdam which its policies were insufficient to mitigate negative effects from densification processes on urban green space (Giezen, Balikci & Arundel, 2018). However, new ways of greening the city which include rooftops, walls or retrofitting structures such as avenues could increase greenspace and a multitude of benefits to citizens (Lennon, 2021). These green rooftops, walls or retrofitting existing structures provide ecosystem services. Providing ecosystem services within existing sites can be seen as intensifying the usage of an area which thus is a qualitative aspect of intensity (Kain et al. 2022). A multitude of activities can be mixed with the green spaces, the shape of the green spaces is also important. As for compact cities, an elongated park could offer more accessibility to citizens while facilitating movement of species, energy and nutrients along its long border (Tian, Jim, Wang, 2014). For nature in compact cities, there is less space within the city for big natural parks which limits the options. It's expected that greening will take place especially in smaller spaces such as retrofitting streets, rooftops and walls which is accompanied with intensifying usage of existing areas. Otherwise, human-made green parks should favour an elongated shape which gives great accessibility and environmental benefits. The small green spaces also lead to an increase of fragmentation between green spaces. This is further related to habitat loss for species and a minor reduction in access (Giezen, Balikci & Arundel, 2018). Which marks both the importance of biodiversity and availability of nature in compact cities.

Garden cities are as the name already suggests a way to combine both the clean and beautiful nature of the countryside with the social and economic benefits of the city. The garden city

according to Howard (1898) manages to do this by implementing a lot of urban green within the city. According to the principles by Korthals Altes (2004) and the International Garden Cities Institute (n.d.) it is important to have enough parks, gardens, green utilities, ornamental green and community gardens in the garden city. This can also be seen in the diagram in figure 3, which illustrates the central park within the garden city and shows the grand avenue that also will be green for a big part. What cannot be seen in this diagram is the amount of ornamental green etc which helps to battle the Urban Heat Island effect (Heaviside et al., 2017). This public urban green in the garden city should be accessible for all. Next to these different ways of urban green the garden city has a much wider agricultural belt around the garden city taking up an area of 5000 acres designated for farming and nature and with less housing (Howard, 1898). This agricultural belt can be seen as a land buffer around the city and furthermore also has the role of providing food for the city (Cramer-Greenbaum, 2011).

Table 1. summarises the characteristics of compact cities according to the different categories. The state of ´´*People*´´ in compact cities is marked by a high density because of high residential population (Neuman 2005; Jabareen, 2006) and households sizes decrease (Bradbury, Peterson, Liu, 2014). Also, income groups are more likely to be mixed (Burton, 2000) and jobs decentralized (Gaigné, Riou & Thisse, 2012). *''Built Structures''* for its intensity, a compact city is marked by densely built areas (Burton, 2002), building more multi-family homes (Holden & Norland, 2005) and smaller individual dwelling sizes (Kain et al., 2022). Furthermore, diversity is expressed by having mixed-land uses which combine different functions (Ahfeldt & Pietrostefani, 2017) and creating mixed-land uses horizontally and vertically (Burton, 2002). A polycentric form is favoured while not creating too great distances (Westerink et al., 2013) and accompanied with mass transit development (Jun, 2020). This would shorten distances towards public transport and also ensures walkability and bike-ability. At last, ‘'*Nature*'' its intensity is expressed of ecosystem services and amount of green spaces (Lennon, 2021). However, diversity is somewhat disadvantaged as densification processes pressurizes green space area which is related to smaller, fragmented green spaces (Haaland & van den Bosch, 2015; Giezen, Balikci & Arundel, 2018). This is further related to habitat loss and a minor reduction in access to green space (Giezen, Balikci & Arundel, 2018). Thus, there is lesser availability of green space. At last, besides small green spaces such as the retrofitting streets, green walls, green roofs (Lennon, 2021), public parks should have an elongated shape which increases connectivity (Tian, Jim, Wang, 2014).

States	**Intensity**	**Diversity**	**Access**	**Form**
People	- High density - Smaller Households	-Mix income groups	--	-population and activities distribution (decentralized jobs)
Built Structures	-More densely built -Multi-family homes - Smaller dwelling sizes	-Mixed-land uses (horizontally and vertically)	-Distance public transport -Walkability/bike-ability	-Polycentric or clustered deconcentration
Nature	- Green roofs, green walls (ecosystem services) -Amount green space	-Biodiversity: habitat fragmentation -Smaller green spaces	-Availability of green space; Opposing forces (greenspace/densification)	-Elongated park (connectivity) -Retrofitting avenues, green roofs, green walls

Table 1. Compact City Framework based on Kain et al. (2022)

Table 2 summarises characteristics of garden cities according to the different categories from Kain et al. (2022). The state of ´´*People*´´ in garden cities is marked by a low housing density because of the importance of urban green in the neighbourhoods (Korthals Altes, 2004; international garden cities institute, n.d.). this low housing density is combined with mixed income groups and social housing (Howard, 1898). These people form communities together by the local jobs and by making use of the urban green spaces in the neighbourhood. *''Built Structures''* for its intensity, a garden city is marked by open areas for urban green, in particular an agricultural belt around the city (Howard, 1898). Furthermorethe garden city should have mixed housing types and should be well connected with public transport. Diversity of the built structure is also expressed by mixed landuse for recreational and living purposes and should have different functional zones within the city (Howard, 1898). Everything should be accessible for the inhabitants by a good electricity network, walkability of the city and good public transport between the polycentric garden cities and the main city (Gatarić et al., 2019). ''*Nature''* its intensity is expressed by large agricultural land use and large amounts of urban green (Heaviside et al., 2017). Which both result in a high level of biodiversity. As for the access of nature in the garden city it is important to make nature and urban green accessible for all inhabitants resulting in parks, trees, community gardens, ornamental green and an agricultural belt that provides food for the garden city (Cramer-Greenbaum, 2011).

States	**Intensity**	**Diversity**	**Access**	**Form**
People	-Low housing density	-Ordinary people - Mixed income groups -Social housing	-	- Local jobs - Mixed housing types - Communities in the neighbourhood -32,000 people in a garden city
Built Structures	-Mixed housing types (Single/Multi-Family homes) - City with 30,000 people in 1000 acres -Agricultural land with 2,000 in 5000 acres -Public transport	-Mixed housing types(Social housing, luxury etc.) -Mixed land use (recreational, and living) -Different functional zones in the city	-Walkability of the garden city -Good public transport -Electricity network	-Polycentric cities (multiple garden cities around one - main city)
Nature	-Large agricultural land use -Large amounts of urban green	-High level of biodiversity	-Public access	-Parks, trees, community gardens, ornamental green, agricultural belt.

Table 2. Garden City Framework based on Kain et al., (2022)

Results

Compact Garden cities

People

For its intensity, garden cities are essentially the opposite of compact cities. Whereas compact cities favour high density, garden cities favour low density. However, the modern garden city movement also wishes to reduce urban sprawl (by for example promoting mixed housing types) (Berghauser Pont & Haupt, 2019). Therefore, it's most likely that the modern garden city has a more densely populated area in comparison of historical approaches as the ones put forward by Howard. Furthermore, declining household sizes are a global trend which implications such as the need for more housing area in the future (Bradbury, Peterson, Liu, 2014). However, high-rise appartements such as presented in Amsterdam described by Kain et al. (2022) aren't compatible with garden city principles as is described in the next paragraph. Therefore, we argue that the compact garden city should have a balanced density of people and accompany smaller households. In terms of diversity, both garden cities and compact cities favour mixed income groups, therefore the compact garden city should focus on mixing income groups.

In terms of form, the garden city has a stronger emphasis on community and especially a smaller number of residents. The distribution of people seems to be of importance in compact cities, especially focussing on decentralizing job which reduces commuting GHG emissions. This can also help to create local jobs, which is a quality of a garden city. Concluding, the compact garden city should include jobs throughout the area while needing to form a more cohesive community.

Built structures

As earlier stated, the original garden city movement switched from only applying single family home units to a mixed housing approach (Berghauser Pont & Haupt, 2019). Also, compact cities tend to build multifamily and/or semi-detached housing units (Holden & Norland, 2005). Considering the previously stated household size decline and compact cities also focus on smaller dwellings. A mixture of housing should be favoured in the compact garden city. In this light, the smaller dwellings will create more space for a mixture of housing in which its possible to also include single-family houses despite the less efficiency in terms of space. For diversity, both compact city and garden city aim towards mix-land uses in some way. It must be said that compact city puts more emphasis on this quality and extends it to creating mix land uses both horizontally and vertically (Burton, 2002). Garden cities according to the original sketch by Howard (1898) include different functional zones which limits the degree of mix land uses. However, as mentioned in the diagrams, the plan must depend on the site that it is located on. Therefore, this could potentially be a good addition to implement. Comparing the different city structures, Chang-Moo & Ahn (2003) found that a garden city also included mix land use schemes. It is therefore advised that a compact garden city will make use of mix land use schemes. Accessibility both garden city and compact city states are similar, they both favour good accessibility for public transport and walkability/bike ability within the area. This is because they are also similar in form, as they both favour a polycentric form. As earlier stated, originally compact cities were designed as a monocentric paradigm, this is partly because it's thought that polycentric structures produce wasteful emissions due to commuting (Gaigné, Riou &

Thisse, 2012). However, these claims about the relationship between polycentric structures and commuting emissions remain inconclusive. Accompanied with a transit-oriented development, modern cities such as Seoul can be described as a polycentric compact city (Jun 2020). The garden city principle was always polycentric too and the importance of public transport which connected multiple garden cities and provided a good connection with the central city (Gatarić et al., 2019). Despite decentralizing jobs and thus create a more distributed employment area, it's likely that there still will be dominant business centres which indicate the need for commuting of residents (Gaigné, Riou & Thisse, 2012). Therefore, the compact garden city will focus on a polycentric form which emphasizes on creating a steady public transport network while still providing enough amenities within the area to reduce some need for travel of residents.

One of the results of the compact city concept as an important paradigm in city development has been the construction of high-rises for housing residents. Research shows that living in high-rises can have a negative impact on social cohesion. A broad literature review has been conducted by Gifford (2007) which found negative effects besides a reduction, although these are influenced by other variables such as social-economic status. The effects of living in a high-rise building mentioned range from lower overall satisfaction, more experienced strain and more behavioural problems with children to higher suicide rates. An interesting consequence regarding social cohesion is that research is unanimous in concluding that people living in high-rise buildings are less inclined to help each other (Gifford, 2007). This is also confirmed by Dwijendra et al. (2021) who argue that sense of community and social contact with neighbours was significantly lower in residents of high-rise buildings. For these reasons a compact garden city cannot contain high-rise dwellings as this would conflict with the original garden city principles.

Nature

For compact cities, green spaces are essential in sustainable development because they provide ecosystem services which are associated with all kinds of benefits ranging from economic, health, ecological and quality of life (Jansson, 2014). This is also stressed by garden city literature who favours large amounts of urban green spaces, as they illustrate with the presence of a large central park in the middle of the garden city center (Howard, 1898). Furthermore, the garden cities also stress the importance of a large agricultural belt that can be used for both recreational purposes and food production (Cramer-Greenbaum, 2011). However, compact cities often undervalue certain qualities of green spaces, as for example small green spaces don't provide the same quality of life and ecological benefits than large green spaces (Jansson, 2014). Therefore, the compact garden city must ensure enough larger sized green spaces (such as parks or green belts). In addition, small green spaces are still of importance as they have benefits such as housing insects (raising biodiversity), act as a sound barrier or lowering local temperature (Jansson, 2014). More specifically, the use of rooftops (which are often unused space) for urban agriculture increases the efficient use of space within cities and is a well-known strategy among city planners to meet sustainability goals (Nadal, Pons, Cuerva, Rieradevall, Josa, 2018). The risk of this and why this type of urban agriculture for garden cities does not really work is however that roofs of buildings are often more private areas that are not publicly accessible, communal roof gardens for building blocks could however work as a part of a compact garden city. The intensity of nature within the compact garden city must put emphasis on intensifying presence of green spaces by providing a great number of green spaces. Space will be efficiently used and therefore small green spaces should be available everywhere (streets, walls, rooftops) while also still providing large green spaces such as parks. The diversity of a compact garden city regarding nature will be marked by the mixture of large and small green spaces in order to optimise all qualities of green spaces (Jansson, 2014). Both the garden city and compact

city have ideals to ensure great accessibility of green spaces. However, the garden city puts more emphasis on this matter. As earlier mentioned, compact city development pressures have led to a decreasing amount of green space and a fragmentation of green spaces in Amsterdam (Giezen, Balikci & Arundel, 2018). This counterbalance between development pressures and urban green spaces should be sufficiently addressed by the compact garden city. Therefore, public accessibility in terms of the garden city quality should be followed. In terms of form, garden city principles favour a mixture of different types which include parks, trees, green belts. Compact city qualities as earlier stated often include more small green spaces which also can lead to fragmentation. However, for public parks compact cities an elongated public park should be favoured as the long boundaries allow for great connectivity which enhances accessibility of people and movement of species, nutrients and energy (Tian, Jim, Wang, 2014). For the compact garden city, it's proposed to have nature in various sizes. For public parks, the elongated shape should be prioritised as it provides great accessibility and ecological benefits. Furthermore, it's more efficient in land-use than complex natural shapes and suits better with development pressures.

Table 3 is used to summarise the characteristics of compact garden cities. For *''People''*, intensity is marked by a balanced density and smaller households. Balanced density is significantly higher than original garden city movement ideals (Berghauser Pont & Haupt, 2019) but smaller than the need for high rise as presented in Kain et al. (2022). Development in the future should be aimed towards smaller households (Bradbury, Peterson, Liu, 2014). The city should function polycentric with decentralizing jobs while establishing a community feeling according to the garden city principles. *''Built structures''* its intensity is marked by the need for a mixture of housing types (Holden & Norland, 2005) and smaller dwelling sizes. Furthermore, for diversity, the compact garden city should make use of mixed land uses as they are found within both garden- and compact cities (Chang-Moo & Ahn, 2003). Access is connected with polycentric form because just as in compact cities, ensuring short distances and transit development are important for accessibility in services and walkability/bike-ability in the area. At last, *''Nature''* its intensity is marked by ecosystem services (Jansson, 2014), ensuring larger green spaces (Howard, 1898) and agriculture (Cramer-Greenbaum, 2011). There should be a higher density of green spaces than reported in compact cities. For diversity, there should be more room for a mixture of green spaces to optimize all benefits (Jansson, 2014). Usage of green roofs are often private areas, the garden city must ensure public access whenever is possible. At last, for form a mixture of green spaces in the green structure is needed, as well as community gardens and the elongated shape is advised for public parks.

States	**Intensity**	**Diversity**	**Access**	**Form**
People	-Balanced density -Smaller households	-Mixed income groups	--	-Decentralized jobs - Community feeling within neighbourhood
Built Structures	- Mixture of housing types -Smaller dwelling size	-Mixed land uses (horizontally/vertically)	-Public transport proximity -Walkability/bike-ability	-Polycentric or clustered deconcentration
Nature	- Ecosystem services (green roofs, walls, streets) -Urban agriculture -High density of green spaces	- Mix of large and small green spaces	- Ensure public access	-Elongated shape of public parks -Community gardens -Mixture trees, parks, green roofs/walls, patches

Table 3: Compact Garden City Framework based on Kain et al. (2022)

Case study

To see whether the compact garden city can be applied to real-world cases, the concept will be applied to the Zaanstraat Emplacement, an area in the North-West of Amsterdam. This area is part of a bigger plan of the municipality of Amsterdam to develop the Havenstad area. With plans to build approximately 70.000 apartments and create 58.000 workplaces, it is a large part of the effort to make Amsterdam ready for the expected growth (Gemeente Amsterdam, n.d.-b). Situated between the Spaarndammerbuurt and the Westerpark the area is situated relatively close to the city centre (Figure 4).

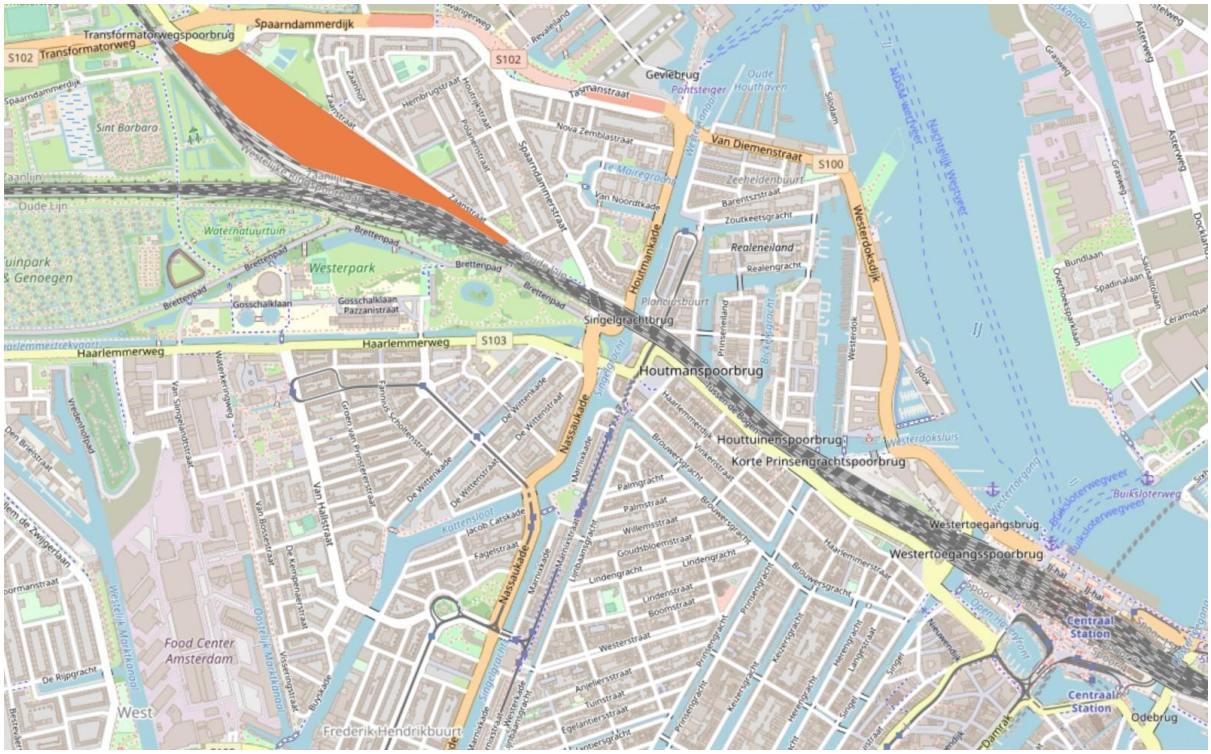

Figure 4: The Zaanstraat Emplacement in orange (Source: Openstreetmap)

The Zaanstraat Emplacement is currently in use as a marshalling yard, with train repairs still happening in the big warehouse. According to the current plans of the municipality, construction is scheduled to start in 2025 (Gemeente Amsterdam, n.d.-c). The area is supposed to be developed as both a living and working area, with 1820 apartments and 1213 workplaces. These plans however are still very uncertain and no concrete construction plans have been published yet.

Residents from the bordering Spaarndammerbuurt voiced their concerns and wishes regarding the construction at the Zaanstraat Emplacement. Many of these stakeholders understood why new housing has to be constructed, but also voiced their concerns regarding the project. Their main concern was around the currently calm atmosphere of the neighbourhood. They view the Spaarndammerbuurt as a precious, calm area close to the busy city centre of Amsterdam. Another concern was the possibility of the construction of high-rises as this could have multiple negative effects ranging from an obstructed view and less sunlight to a significant increase in traffic. A factor that is also of importance, is that large parts of the Spaarndammerbuurt are constructed according to the principles of the Amsterdamse School, which can be recognized by its warm colours and rich decorations. A central element of the neighbourhood is that it was built with affordable houses, for regular citizens (Het Schip, n.d.). In the interviews, it became apparent that the residents of the

Spaarndammerbuurt would like to see this affordable and social character mirrored in the new development.

Applying the compact garden city framework as shown in the last chapter would result in an area with medium building density. In this case the number of floors would be four or five, as this would create room for a substantial number of apartments, while at the same time not resulting in problems associated with high-rises. An additional advantage for this density would be that it creates the possibility of green courtyards as spaces where the residents can meet each other. Inspiration for this could be taken from the neighbouring Spaarndammerbuurt.

Ideally the transportation in this area would mainly be by bike, with access points and parking spaces for cars at the edges of town. This fits well with Ebenezer Howards idea of an electric city. As roads take up lots of space, changing them to bike lanes or walking paths would allow the density to be higher, while not negatively impacting the amount of green space (Nieuwenhuijsen & Khreis, 2016). Surrounding residents mentioned that they were worried about more traffic in their neighbourhood due to the new housing. Placing parking spaces close to main roads could reduce this negative side effect. Inspiration for this could be taken from another neighbourhood which will be constructed in Utrecht (Gemeente Utrecht, n.d.).

Looking at the compact garden city framework presented in the results of our report, the new neighbourhood should have a mixture of social housing and privately owned housing. We could conclude from the interviews that the residents value a population consisting of many different social groups. The respondents explained that this mix of social groups keeps the neighbourhood alive and sociable.

Social cohesion is an important aspect of Howards' Garden city. Creating social cohesion and community feeling is one of our main goals in our vision. Therefore, the plan does not include high rise buildings. But because we choose for low to medium rise building blocks, we had to give up some space for greenery. In our vision we chose to make the homes smaller in order to realize more homes in the same amount of space. Regarding urban green space, we want to involve the following aspects of the compact garden city framework.

Firstly, the compact garden city seeks for a balance between built environment and urban green space. Our vision for the Zaanstraat emplacement does not contain high-rise buildings, making less space available for greenery. Because of this, our vision focusses on efficient land-use, to maximize the amount of greenery. Greenery has to be part of every street scene. This could be in the form of trees, small green squares and public parks. Based on our compact garden city framework, all of the green areas should be public and accessible for all residents.

Secondly, just like in the new neighbourhood in the Houthavens, we plan to make the new neighbourhood low-traffic, creating a calm atmosphere on the streets. This leaves room for green spaces and trees on every corner of the street. Figure 5 and 6 are photos taken in the Houthavens. It gives an impression of how a calm street scene can be created by adding greenery and not allowing car-traffic in.

Figures 5 and 6. Houthavens, calm and green walls. (Source: own pictures)

Also, during the interviews, the residents expressed their concerns about the lack of grass areas that are commonly used during the summer. Our vision aims to solve this by involving green parks with a lot of grass areas as shown in Figure 7.

Figure 7. Impression of the planned public parks (Source: Visit Gent)

Fourthly, a strong need for community gardening was often mentioned during the interviews with residents from the Spaarndammerbuurt. According to the literature as well, green spaces encourage people to go outside. Parks and community gardens increase the number of social activities, which has positive effects on the social cohesion. We plan to make community gardens on the roofs of the buildings, but next to that, we want to put a lot of effort in creating a community garden that is accessible for all residents. This aligns with the compact garden city framework. In the figures 8 and 9 an example of urban agriculture initiated by the community is presented. We see this as a clear example of how the community gives meaning to space and fostering social relations by creating urban agriculture.



Figures 8 and 9. Community Garden initiated by local residents. (Source: Moestuinboek, 10 jaar Brediustuin)

Fifthly, our vision of the area includes vertical greenery on the walls of the apartment blocks. Again, we take the Houthavens as example for our vision. Here, bins that contain green plants are fixed to the walls of the building, surviving on rainwater which is caught on the roofs of the buildings as seen in figures 5 and 6. Beside the green walls, the roofs are also going to be used for urban agriculture (Figure 10). Although the roofs are not accessible for all residents, the plan is to create small community gardens that provide the building with fresh food.


Figure 10. An impression of urban agriculture on the roof. (Source: Garden Pals)

Lastly, we want to leave space for local initiatives with minimum intervention of the municipality. It is a place for the community and therefore they should get the chance to create a space by themselves. Figure 11 is meant to illustrate what how local initiatives contribute to the social cohesion in the neighbourhood. These photos were obtained by one of the residents we interviewed.

Figure 11. Community gardens fostering social cohesion. (Source: Moestuinboek, 10 jaar Brediustuin)

Discussion

Finding a balance between densification, high rise building, and urban green is not easy. Using one of the leading paradigms of contemporary city development, the compact city, the differences with the original garden city concept could be mapped. The differences between the two concepts were mainly regarding density and green spaces. Other elements are surprisingly similar. Both concepts stress walkability, mixed land use and a mix of housing for different income groups.

In attempting to find a balance between some of the garden city principles and modern-day development we found that the idea of a compact garden city is possible, but a few central elements of both concepts have to be dropped. A medium density is proposed with the maximum number of floors ranging from four to five. This would exclude the construction of high-rises, as research has shown that this can negatively impact social cohesion, which is one of the central elements of Ebenezer Howards Garden City. A compact garden city would include small patches of green to create biodiversity as well as larger areas of greenery for recreational purposes. The case study of the Zaanstraat emplacement, next to the Spaarndammerbuurt provides an example of what implementing the compact garden city framework could look like in praxis. With proposals like community gardens, car-free areas and a combination of residential and commercial spaces this could be used as an example for new developments in the rest of the city of Amsterdam.

Future directions for research could aim towards a more quantitative side of answering the research question. Due to time constraints, quantitative elements of the compact garden city framework couldn’t be added as well as all the impacts described in the original framework of Kain (2022). One thing that should be kept in mind is that certain impacts are caused by other things than urban forms or its qualities as it's also questioned whether urban form itself does significantly cause these associated effects. However, calculations on density and the amount of greenery could really add to the strength and usability of the framework. It would also be interesting to research what the results of such calculations would be for future developments in Amsterdam.

Reflection

As we only had four weeks to finish this project the required level of cooperation was high. For this reason, we met multiple times every week, both online and on campus. Because of the short time period the process was sometimes chaotic. As we weren't able to conduct the interviews early on in the project, the interviews had to be done while we were already drafting up the results and working on the case study. This meant that the interviews had to be integrated at a later time. Another difficulty was the communication with museum Het Schip. In the second week of the project, we met with the client for a second time. He asked us to focus more on the marshalling yard itself and to come up with concrete plans, despite the fact that our research question pointed in another direction. After discussing this in class we decided to focus more on coming up with an answer on the research question. This shift in research focus happening multiple times sometimes made it difficult to come up with a clear plan and concrete ideas.

We're pretty satisfied with the group process, although the work load was heavier at the end of the project. As for the division of work, Nick and Stijn focussed more on the literature part of this research, Fedde on the methodology and part of the case study and Bart on the introduction, part of the case study and the conclusion. Nick specifically focussed on literature about the compact city and the framework of Kain et al. (2022). Furthermore, Nick made the results based upon the literature together with Stijn. And he also took part in an interview alongside Fedde. We decided to distribute the grade equally among our group.

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