WALKABILITY OF LARGE DUTCH CITIES

A COMPARISON BETWEEN SCIENTIFIC WALKABILITY TRENDS AND PLANNING POLICY & PRACTICE OF THE CITIES AMSTERDAM AND UTRECHT

MSc Thesis Spatial Planning by Maurits Verhoeven

Oud Kerkhof, 2019

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Wageningen, October 2019

General information

Program:	MSc Landscape Architecture and Planning
Specialisation:	Spatial Planning
Course code:	LUP-80436 MSc Thesis Land Use Planning
Credits:	36 ECT
Submission date:	08-10-2019

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Cover pages
First cover photo: taken by the author of this master thesis report.
Second cover photo (p. ii): taken in 1976 by Reinink, A.W., Oudkerkhof, Utrechts Archief.

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Abstract

As a result of economic welfare, large Dutch inner cities are facing the mobility challenges of population growth and tourism, including traffic congestion and air pollution. As a response, municipalities have shifted their focus from automobile use to slow modes of transport, including walking. The term walkability is used to assess the pedestrian environment. The term walkability is defined and used in different ways by scientists and professionals, which affects the design of the pedestrian environment. Since little research has been conducted in the definition and use of walkability in the Netherlands, the objective of this study is to understand and declare the definition and use of the term walkability in planning policy and practice of large Dutch cities. Besides, the objective of this study is to analyse how walkability in planning policy is implemented in planning practice. These objectives were pursued by a quantitative analysis of scientific literature and a multiple case study analysis in the inner cities of Amsterdam and Utrecht, consisting of a policy document analysis, observations and semi-structured interviews. The various steps in this research were carried out through use of a conceptual model consisting of the domains: *interests*, *pedestrian characteristics*, *place characteristics*, *walking needs* and *planning & design*. This research shows that walkability in planning policies and practices of Amsterdam and Utrecht is viewed as making public space accessible, safe and comfortable by creating mainly more space for pedestrians, which reduces the pressure on public space, stimulates a modal shift, encourages self-reliance and improves the local economy. More research into the influence of local characteristics on the definition of walkability in other large Dutch cities is needed to further understand the definition and use of walkability in large Dutch cities.

Keywords: walkability | pedestrians | Dutch planning policy and practice | walking needs | inner cities

Acknowledgements

During my master thesis period, I made many walks on the university campus, the inner city and the beautiful surroundings of Wageningen. While I was walking, I felt happy, inspired, energetic and healthy. These walks gave me the power to keep working on my master thesis research and to explore the conditions that stimulate these rewarding walks. Although, I almost drowned in the factors and variables that influence walking behaviour, I cannot say anything other than I really like the topic of walkability. I would find it interesting to continue working on this topic in my future career.

My master thesis process has been a very educational experience for me with many ups and downs. Besides conducting scientific research and learning a lot about the topic of walkability, I also learned a lot about my own character and behaviour, such as dealing with the urge for perfectionism.

This master thesis would not have been possible without the help of some important people. I would like to thank to the people who supported me in finishing this master thesis.

First of all, I want to thank my supervisor Dr.ir. W.W.Y. Tan for her support, patience and feedback. I really appreciate the input of knowledge and inspiration, the time spent on discussing my process, and the recommendations for improving myself as a person. Besides, I would like to thank the second examiner Dr.ir. F. Orsi for reviewing my master thesis research.

I would also like to thank the interviewees for their time, knowledge and hospitality. I enjoyed the interesting conversations that gave me a lot of insights and findings for this research.

Finally, I would like to thank my family, friends, housemates and study mates for their great support. Especially, my parents and my sister for their trust and unconditional support, without them I would not have come this far in my study career. I can say that I had a great time in Wageningen and that I am looking forward to the next chapter of my life.

Maurits Verhoeven

Wageningen, 7th of October 2019

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Summary

Many large cities in the world are experiencing the consequences of economic welfare and population growth, including traffic congestion, air pollution, health problems and poor urban quality of life. As a response, local governments have shifted their focus from automobile use to slow modes of transport, including walking. Large Dutch cities also recently launched their pedestrian policies. The term walkability is used to assess the extent to which the built environment is suitable for walking. However, the term walkability is defined and used differently by many scientists and professionals. This research aimed to understand and declare the definition and use of the term walkability in large Dutch cities and analysed how walkability in planning policy is implemented in planning practice. The leading questions in this research were:

MQ: *How is walkability defined and used in planning policies and practices of large Dutch cities in comparison to international trends in scientific literature?*
Q1: *What are the current walkability trends in international scientific literature?*
Q2: *How is walkability defined and used in planning policies of large Dutch cities?*
Q3: *How is walkability applied in planning practice of large Dutch cities?*

A mix of qualitative and quantitative research was carried out for this research. Firstly, a quantitative analysis of sixty scientific papers of various disciplines was conducted to find the walkability trends in scientific literature. Secondly, a case study was conducted in the cities of Amsterdam and Utrecht. In both case studies, a policy document analysis was conducted to find an answer on how walkability is defined and used in planning policy of both municipalities. Subsequently, observations of four mini cases in Amsterdam and Utrecht were conducted to find out how walkability is applied in planning practice. Finally, semi-structured interviews were carried out to declare and understand the findings of planning policy and planning practice. The various steps in this research were carried out through use of a conceptual model consisting of the domains: *interests*, *pedestrian characteristics*, *place characteristics*, *walking needs* and *planning & design*.

This research showed that walkability in planning policies and practices of Amsterdam and Utrecht is viewed as making public space accessible, safe and comfortable by especially creating more space for pedestrians, which reduces the pressure on public space, stimulates a modal shift, encourages self-reliance and improves the local economy. Walkability in scientific literature is understood as an instrument to measure the accessibility, safety, comfort and attractiveness of environments, which contributes to a sustainable environment. This research concluded that most of the factors and variables discussed in scientific literature are present in planning policy and practice of Amsterdam and Utrecht, except some factors of traffic safety and safety from crime. In addition, it concluded the factors and variables that were found in planning policy largely correspond with was found in planning practice, although some obstacles are still blocking sidewalks. More research into the influence of local characteristics on the definition of walkability in other large Dutch cities is needed to further understand the definition and use of walkability in large Dutch cities. The cities of Amsterdam and Utrecht have different place characteristics in comparison to Rotterdam and The Hague, which affects the definition and use of walkability.

Samenvatting

Veel grote steden in de wereld ondervinden de gevolgen van economische groei en bevolkingsgroei, waaronder verkeerscongestie, luchtvervuiling, gezondheidsproblemen en een slechte stedelijke levenskwaliteit. Als een antwoord hierop hebben gemeentes hun focus verlegd van autogebruik naar langzame verkeer, waaronder lopen. De grote Nederlandse steden hebben de afgelopen jaren ook hun voetgangersbeleid gelanceerd. De term "walkability" wordt vaak gebruikt om te beoordelen in hoeverre de gebouwde omgeving geschikt is om te lopen. De term "walkability" wordt echter door veel wetenschappers en professionals anders gedefinieerd en gebruikt. Dit onderzoek is gericht op het begrijpen en verklaren van de definitie en het gebruik van "walkability" in grote Nederlandse steden, en analyseert hoe "walkability" in het beleid wordt door vertaald in de praktijk. De leidende vragen in dit onderzoek zijn:

MQ: Hoe wordt "walkability" gedefinieerd en gebruikt in het beleid en de praktijk van grote Nederlandse steden in vergelijking met internationale trends in wetenschappelijke literatuur?
Vr. 1: Wat zijn de huidige "walkability" trends in de internationale wetenschappelijke literatuur?
Vr. 2: Hoe wordt "walkability" gedefinieerd en gebruikt in het beleid van grote Nederlandse steden?
Vr. 3: Hoe wordt "walkability" toegepast in de praktijk van grote Nederlandse steden?

Een mix van kwalitatief en kwantitatief onderzoek is uitgevoerd bestaande uit vier methoden. De laatste drie methoden waren onderdeel van een casestudie in de steden Amsterdam en Utrecht. Als eerst is een kwantitatieve analyse van zestig wetenschappelijke artikelen van verschillende disciplines uitgevoerd om de "walkability" trends in de wetenschappelijke literatuur te vinden. Als tweede is een beleidsdocumentanalyse uitgevoerd om een antwoord te vinden op hoe de "walkability" wordt gedefinieerd in het beleid van beide gemeenten. Vervolgens is een observatie van vier mini-casussen in Amsterdam en Utrecht uitgevoerd om te ontdekken hoe "walkability" wordt toegepast in de praktijk. Ten slotte zijn er semigestructureerde interviews afgenomen om de bevindingen van het beleid en de praktijk van grote Nederlandse steden te verklaren en te begrijpen. De verschillende stappen in dit onderzoek zijn uitgevoerd door gebruik te maken van een conceptueel model bestaande uit de domeinen: belangen, voetgangerskenmerken, plaatselijke kenmerken, loopbehoeften en planning & ontwerp.

Dit onderzoek toonde aan dat "walkability" in het beleid en de praktijk van Amsterdam en Utrecht wordt gezien als een middel om de openbare ruimte toegankelijk, veilig en comfortabel te maken door vooral meer ruimte te creëren voor voetgangers, wat de druk op de openbare ruimte verminderd, autogebruik verminderd, zelfstandigheid van kwetsbare groepen stimuleert en de lokale economie verbeterd. "Walkability" in de wetenschappelijke literatuur wordt gezien als een instrument om de toegankelijkheid, veiligheid, comfort en aantrekkelijkheid van omgevingen te meten en draagt bij aan een duurzame omgeving. Dit onderzoek concludeerde dat de meeste factoren en variabelen die in de wetenschappelijke literatuur worden besproken aanwezig zijn in het beleid en de praktijk van Amsterdam en Utrecht, behalve enkele factoren die verkeersveiligheid en veiligheid tegen criminaliteit beïnvloeden. Daarnaast werd er geconcludeerd dat de factoren en variabelen die werden gevonden in het beleid grotendeels overeenkomen met de praktijk. Echter blokkeren sommige obstakels nog steeds trottoirs bleek uit de observatie. Meer onderzoek naar de invloed van plaatselijke kenmerken op de definitie van "walkability" in andere grote Nederlandse steden is nodig om de hoofdvraag van dit onderzoek verder te onderzoeken. De steden Amsterdam en Utrecht hebben verschillende plaatselijke kenmerken in vergelijking met Rotterdam en Den Haag. Plaatselijke kenmerken zoals dichtheid beïnvloeden de definitie en het gebruik van "walkability".

1. Introduction

Large cities are known as the places for jobs, education, innovation, goods, services and cultural facilities. The population living in cities is estimated at 60% of the world population in 2030 (UNDESA, 2012). Many large cities in the world are facing the mobility challenges of economic welfare and population growth. Economic welfare and population growth have led to an increase in the number of trips across the city (Wee, Annema and Banister, 2013). As a result of this, many cities experience traffic congestion, which arises when the amount of vehicles is larger than the handling capacity of a road (Wee, Annema and Banister, 2013). In the Netherlands there are even cycle paths starting to become overcrowded (NRC, 2015). Besides congestion on roads and bicycle paths, public transport in large cities also suffers from capacity problems (Pucher and Buehler, 2009). The large amount of motorized traffic in cities has led to air and noise pollution, which affects public health and quality of life (WHO Regional Office for Europe, 2005; WHO Regional Office for Europe and JRC European Commission, 2011).

Scientists have mentioned many benefits of walking for transport and leisure including benefits for planning and urban design, transportation, public health, economy and sociology. Having more people walking in the city results in less motorized traffic and therewith less road congestion, air pollution and noise pollution (Lee and Buchner, 2008). Reducing air and noise pollution may lower the chance on chronic diseases (Anderson et al., 1997) and may lower climate change (Ramanathan and Feng, 2009). Public health scientists identified a number of direct health benefits including a lower risk on chronic diseases, such as obesity and cardiovascular diseases (Powell, Paluch and Blair, 2011); an improvement of the physical condition (DiPietro, 2001) and a longer life expectancy (Lee et al., 2012). Besides public health benefits, scientists found many economic benefits of improved walking conditions. For instance, people who walk spend more in a shopping street than people who came by other modes of transport (Litman, 2018). Other studies found pedestrian environments have some social effects, such as social connection between neighbours (Leyden, 2003).

The characteristics of the built environment are important factors that play a role in people's decision whether or not to walk (Alfonzo, 2005; Ewing and Cervero, 2010). The term walkability is used to assess the extent to which the built environment is suitable for walking. Walkability is a complex term that is defined and used differently by scientists and professionals. For instance Pivo and Fisher (2011, p.1) define walkability as: *"the degree to which an area within walking distance of a property encourages walking for recreational or functional purposes",* while Litman (2018, p. 1) defines walkability as: *"the quality of walking conditions, including safety, comfort and convenience"*. The definitions, factors and variables dedicated by scientists and professionals to walkability are of major importance because they have a large influence on how mobility networks and walkable spaces are designed (Lo, 2009). According to Lo (2009), the question of "who is asking?" seems to be important in considering the question of "what is walkability?" because actors dedicated different definitions to walkability. Different interpretations of the term walkability can cause conflicts when actors try to create walkable places in practice (Forsyth, 2015). Walkability differs by walking purposes, such as just walking from origin to destination or walking for relaxation; and by place, such as a train station area or a shopping area (Forsyth, 2015). According to Forsyth (2015), walkability debates can be enriched by understanding these dimensions.

The definition and use of walkability in a city is largely determined in planning policy, which is translated into planning practice by municipal experts. In the past decades the awareness has grown about the importance of the walking environment by local governments. Many cities of Europe, North America and Oceania have launched a pedestrian policy plan (e.g. Mayor of London, 2010; City of Toronto, 2013; City of Sydney, 2017). The Netherlands seems to lag behind when it comes to pedestrian policies. Partly due to the focus on cycle policy which resulted in excellent cycle conditions, Dutch people often choose to cycle instead of walking (KiM, 2016). According to a study of KiM (2016), Dutch people do walk infrequently, and the percentage of pedestrian trips is lower than in other developed countries. However, large Dutch cities are starting to pay more and more attention to walkability, such as the city of Utrecht that launched the first pedestrian policy plan in the Netherlands (UTR-PD-PEDESTRIAN, 2015). Due to the lack of a national pedestrian policy, large Dutch cities seem to follow their own way in improving walkability. A general understanding is missing on how Dutch cities are addressing pedestrian policy. **This research addresses the following problem statement:** ***walkability is defined and used differently in planning policies and practices of large Dutch cities, which may result in missed chances to improve walkability and lower walking rates.***

The aim of this master thesis research is: ***1) understanding and declaring the definition and use of the term walkability in large Dutch cities;*** **and** ***2) analyzing how walkability in planning policy is implemented in planning practice.*** A mix of qualitative and quantitative research will be performed consisting of four methods, which are a literature review, a document analysis, observations and interviews. The last three methodologies are part of a case study in two large Dutch cities. Two comparisons will be made in the proposed research. Firstly, a comparison will be made between walkability in international scientific literature; and walkability in planning policy and planning practice of large Dutch cities. Secondly, a comparison will be made between planning policy and planning practice of large Dutch cities.

Summary

SUMMARY
• Many large cities in the world are facing the mobility challenges of population growth and economic welfare, such as traffic congestion, air and noise pollution, health problems and poor urban quality of life. • Scientists linked walking and pedestrian environments to many benefits for planning and urban design, transportation, public health, economy and sociology. • The term walkability is used to assess the extent to which the built environment is suitable for walking and is defined and used differently by scientists and professionals. • Large Dutch cities are shifting from a city focussed on automobile use to a city focussed on slow modes of traffic, including pedestrians but a general understanding is missing on how Dutch cities are addressing pedestrian policy. • This research addresses the following problem statement: *walkability is defined and used differently in planning policies and practices of large Dutch cities, which may result in missed chances to improve walkability and lower walking rates.* • The aim of this master thesis research is: *1) understanding and declaring the definition and use of the term walkability in large Dutch cities;* and *2) analyzing how walkability in planning policy is implemented in planning practice.*

2. Theoretical framework

2.1 Introduction

Since the use of the term walkability is influenced by its definition, the scientific literature will be reviewed to analyse the variety of definitions, concepts, instruments and theories. A closer look will be taken at the disciplines that consider walkability, from the perspective of different domains. After the literature review, a conceptual model of the theories discussed in the literature review will be presented. Finally, the main research question and sub-research questions will be given.

2.2 Domains

The definition and use of the term walkability are influenced by a number of domains. Based on what was found in literature, the following domains seem to influence the definition of walkability: *"interests", "pedestrians", "place", "walking needs" and "planning & design"*. The next paragraphs will explain how these domains influence the definition and use of term walkability. A question will be raised for each domain, which will be answered in the literature review.

Interests: why should walkability be investigated or improved?

As stated in the introduction, walking contains a large number of benefits for planning and urban design, transportation, public health, economy and sociology. Scientists and professionals have their own interests for investigating walkability. According to Lo (2009), the disciplines that have an interest in the activity of walking use different definitions of how to measure walkability. Figure 1 show the walkability definition framework of Forsyth (2015). Forsyth (2015) conducted research on the definition of walkability and categorised the various definitions of walkability through i) its *"means"* or conditions and criteria to encourage walking, ii) its *"outcomes"* or why walkability should be achieved and iii) its *"proxies"* or as a solution for a variety of urban problems. The *"outcomes"* and *"proxies"* can be considered as similar to the interests, because they are both about what should be achieved with walkability.

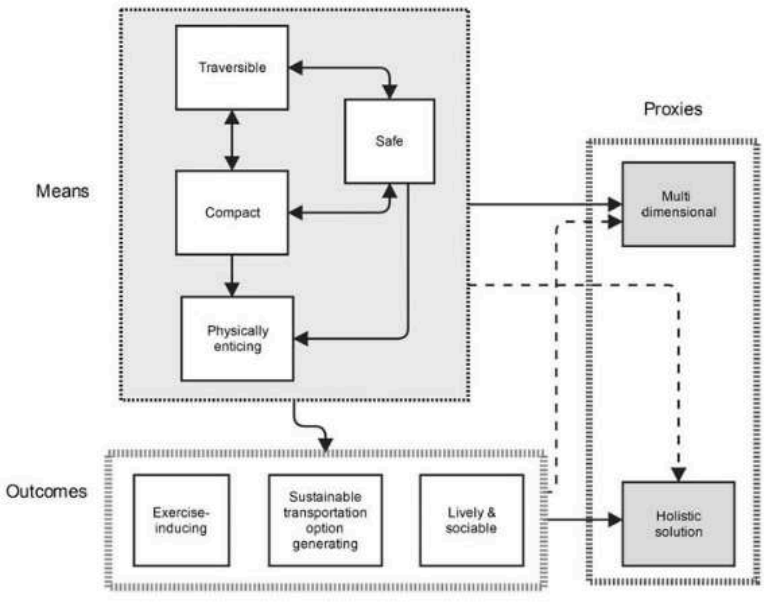

Figure 1: Framework Walkability (Forsyth, 2015).

Pedestrians: for whom is the pedestrian environment designed?

Besides interests, the definition and use of walkability is influenced by pedestrian characteristics. Lo (2009) states that the definition of a pedestrian strongly affects how pedestrians are integrated in the design of the environment. Many regulations define the term pedestrian more broadly to include people in wheelchairs and people who are only standing (Lo, 2009). Also Alfonzo (2005) conducted a literature study on personal characteristics related to walking and found many individual and group characteristics that influence people's decision to walk.

Place: where does the walk take place?

In addition to pedestrian characteristics, the definition and use of walkability is also influenced by place characteristics. Forsyth (2015) concludes people have different purposes and underlying motivations to go for a walk, which demands for different place characteristics. As a result, scientists and professionals from different places with different characteristics may define walkability differently (Forsyth, 2015). Also Alfonzo (2005) found regional-level characteristics that influence people's decision to walk.

Walking needs: which walking needs do influence walkability?

Walkability definitions and instruments often contain non-tangible factors that are used to describe the needs of walking. Alfonzo (2005) conducted research to walking needs and argued that people who consider to walk are motivated by a hierarchy of walking needs, which is based on the nature of basic needs from Maslow (1954). Whilst Alfonzo (2005) called these non-tangible factors "walking needs", Ewing and Handy (2009) conducted research on non-tangible factors and called them *"perceptual qualities"*.

Planning & design: which planning & design measures do influence walkability?

Walkability is directly influenced by planning & design measures, which can be described as tangible factors that are visible in public space. Many scientists conducted research to the planning & design measures of walkability (e.g. Pikora *et al.*, 2003; Alfonzo, 2005; Moura, Cambra and Gonçalves, 2017).

2.3 Disciplines

Some scientists mentioned multiple disciplines that have an interest in walkability or walking. Alfonzo (2005) conducted a literature study on factors that affect physical activity and found factors in the disciplines of public health, community medicine, transportation and urban planning. According to Lo (2009), the disciplines of traffic engineering, transportation planning, urban design, public health and sociology conducted research into walkability. Talen and Koschinsky (2013) argue that scientists who research walkability are transportation planners, sustainability advocates, sociologists, urban designers, health scientists and biologists. According to Moura, Cambra and Gonçalves (2017), the disciplines of public health, social sciences, transport engineering, urban planning and architecture have developed many instruments to measure walkability. Based on these scientists, the disciplines of *"planning and urban design"*; *"transportation"*; *"public health"*; *"economy"* and *"sociology"* have been selected for the literature review. In the next section, the planning and urban design discipline will be discussed by use of the domains. In each discipline, the walkability definitions will be discussed before the domains.

2.4 Planning and urban design

In planning and urban design literature the following definitions of "walkability" were found:

"Walkability is the extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort, and offering visual interest in journeys throughout the network"
(Southworth, 2005, p. 247 and 248).

"A concise definition of "walkable neighborhood" is that it is a safe, well-serviced neighbourhood, imbued with qualities that make walking a positive experience". "A positive walking experience means that streets, sidewalks and paths (pedestrian routes) are comfortable and interesting"
(Talen and Koschinsky, 2013, p. 43).

Some similarities and differences can be distracted when both definitions are compared. Both definitions include the factors of *"safety"*, *"comfort"* and *"visual interest"*. Besides this, both definitions refer to land use diversity by mentioning the characteristics of *"varied destinations"* and *"well serviced neighbourhood"*. The definition of Southworth (2005) includes accessibility by mentioning the factors of *"time"* and *"effort"*, whilst the definition of Talen and Koschinsky (2013) is more focussed on the attractiveness of walking by explaining the meaning of *"a positive walking experience"*. It can be deduced from these definitions that planning and urban design scientists seem to be interested in a broad range of walking needs.

Interests

Planning and urban design scientists conducted research on walkability for a variety of reasons. According to Southworth (2005), walkability is the basis of the sustainable city and contributes to less automobile use, less air and noise pollution, physical health, social cohesion and recreation. Moura, Cambra and Gonçalves (2017) also argue walking can be considered as the basis of the sustainable city and that walking has environmental, economic and social benefits. Similar to Southworth (2005), Ewing and Cervero (2010) were interested in the environmental benefits of less automobile use resulting in improved mobility, liveability, social justice and public health. Forsyth (2015) also mentioned a couple of problems that can be linked to the interests of improved public health, environment and social cohesion, including less obesity, traffic congestion, environmental problems and social isolation. Habibian and Hosseinzadeh (2018) focus on the environmental and social interests by mentioning that increased walking rates would benefit a society and contribute to less energy consumption and less air and noise pollution. According to Alfonzo (2005), planners and architects believe increased walking rates influence quality of life and sense of community. Based on the interests of the previous mentioned scientists, planning and urban design scientists seem to be interested in the ***sustainable interests*** including ***less automobile use*** and thereby ***less traffic congestion*** and ***less air and noise pollution***; ***public health interests***; ***quality of life***; and ***social equity***.

Pedestrians

Multiple planning and urban design scientists stress the importance of considering pedestrian characteristics when improving walkability. As mentioned in the domain section, Alfonzo (2005) conducted a literature study on personal and group characteristics influencing walking and found *"psychological factors"* (e.g. attitudes and awareness); *"demographic factors"* (e.g. age and gender); *"biological factors"* (e.g. weight); *"sociological factors"* (e.g. levels of social support); and *"cultural factors"* (e.g. informal culture of neighbourhoods). Southworth (2005) mentioned demographic and

biological factors, such as age and health that influence walking rates. Similar to Southworth (2005), Moura, Cambra and Gonçalves (2017) included demographic and biological factors when measuring walkability, such as young/old, male/female and fit/unfit. Lo (2009) and Moura, Cambra and Gonçalves (2017) emphasise the importance of making pedestrian infrastructure accessible for all users by including also disabled people (e.g. with a wheelchair) in the definition of a pedestrian. Based on these scientists, the pedestrian characteristics ***age***, ***gender*** and ***disability*** can be considered as important in the planning and urban design discipline.

Besides personal factors, some planning and urban design scientists state that the walking purpose of people is important when improving walkability. Lo (2009) stresses the importance to consider that pedestrians walk for different walking purposes. The latter is confirmed by Forsyth (2015) who concluded walkability differs for each walking purpose, which requires different walkable environments. Besides this, Forsyth (2015) argued some walking purposes (including walking that is incidental to other activities) are not included in walkability definitions and risk being left out of debate. According to Forsyth (2015), the level of walkability is dependent on the walking purposes including walking for transportation, exercise and recreation; and knowledge about walkability can be improved by understanding these dimensions. Moura, Cambra and Gonçalves (2017) made a distinction between walking for utilitarian and leisure purposes and concluded that the purpose of a trip has a significant impact on the walkability evaluation. Habibian and Hosseinzadeh (2018) made also a distinction in their research between job, educational and shopping trips and found differences in walking rates. Based on these scientists, the ***walking purpose*** can be considered as important in the planning and urban design discipline and can be divided in walking for transportation and recreation.

Place

According to a couple of planning and urban design scientists, walkability is considered differently in each place or environment. Besides individual and group level characteristics, Alfonzo (2005) conducted research into the regional-level characteristics and found that factors of topography (e.g. slope), geography (e.g. coastal neighbourhoods vs. inland areas) and climate (e.g. warm vs. cold climates) are frequently mentioned as important determinants to walk. Similar to Alfonzo (2005), the scientists Southworth (2005), Mehta (2008) and Forsyth (2015) mentioned climate or weather as one place characteristics that affect walking behaviour. Alfonzo (2005) mentioned some measures for weather protection, such as canopies and arcades. Hooi and Pojani (2019) found lack of shading and cooling elements, such as trees, shrubs and awnings negatively influenced comfort in the warm climate of Brisbane. Southworth (2005) mentioned street trees providing protection against the sun. Besides climate, Southworth (2005) mentioned a few topographic and geographic features that influence the connection between places, such as rivers, railroads and the post-industrial suburban landscapes. Based on these studies, the place characteristics of ***topography***, ***geography*** and ***climate*** seem to be important in the planning and urban design discipline.

Walking needs

Many different instruments and frameworks have emerged from the planning and urban design discipline to evaluate the walking conditions of the physical environment. Southworth (2005) presented six criteria for the design of a successful pedestrian environment: *"connectivity"*, *"linkage with other modes"*, *"fine grained land use patterns"*, *"safety"*, *"quality of path"* and *"path context"*. Alfonzo (2005) developed a multilevel theoretical model called "the hierarchy of walking needs" that explains how individual, group, regional and environmental factors influence walking activity,

consisting of the factors: *"feasibility"*, *"accessibility"*, *"safety"*, *"comfort"* and *"pleasurability"* (see Figure 2). Although both scientists mentioned safety, Alfonzo (2005) considers safety as security against crime, whilst Southworth (2005) means both security against crime and traffic safety. The concepts of comfort and pleasurability of Alfonzo (2005) can be considered as similar to the concepts of quality of path and path context of Southworth (2005). Besides this, the concept of accessibility of Alfonzo has similar grounds to the concepts of connectivity and linkage with other modes of Southworth (2005).

Moura, Cambra and Gonçalves (2017) developed the seven C's layout consisting of the five C's layout: *"connectivity"*; *"convenience"*; *"comfort"*; *"conviviality"*; *"conspicuousness"* (Gardner et al., 1996) and two added C factors: *"coexistence"* and *"commitment"*. The seven C's layout follows the instruments of Alfonzo (2005) and Southworth (2005) by using the factors of comfort, connectivity and conviviality. Zuniga-Teran et al. (2016) conducted a literature study on walkability factors in various disciplines and developed a walkability framework consisting of *"connectivity"*; *"land use"*; *"density"*; *"traffic safety"*; *"surveillance"*; *"parking"; "experience"*; *"green space"*; and *"community"*. Similar to the previous scientists, Zuniga-Teran et al. (2016) mentioned surveillance, which can be linked to safety from crime and experience, which can be linked to pleasurability. Based on the above, it can be noted that the walking needs ***accessibility***, ***connectivity***, ***safety from crime, traffic safety***, ***comfort*** and ***pleasurability*** or similar terms were frequently used in the planning and urban design discipline.

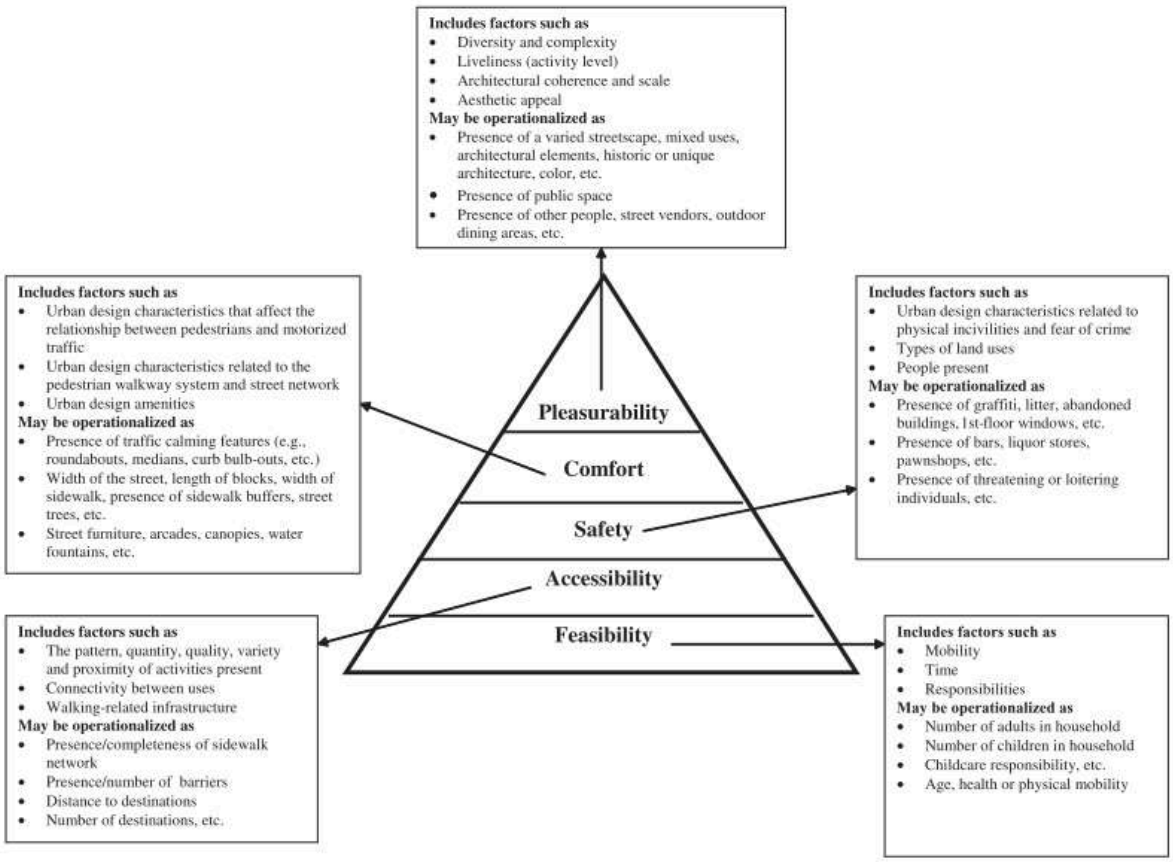

Figure 2: The hierarchy of walking needs (Alfonzo, 2005).

Planning & design

Multiple planning and urban design scientists are interested in factors influencing walking distances. Ewing and Cervero (2010) conducted a literature research into the effects of planning and design features on motorised traffic and used the five D variables as measures of the built environment, consisting of the original three D variables: *"density"*, *"diversity"*, and *"design"* (Cervero and Kockelman, 1997) and two added D variables: *"destination accessibility"* and *"distance to transit"*. They found walking is most strongly influenced by *"land use diversity"*, *"intersection density"* and the *"number of destinations within walking distance"*. Figure 2 (previous page) shows Alfonzo (2005) mentioned *"the pattern, quantity, quality and proximity of activities present"* as the factors that influence walking distance. Similar to Alfonzo (2005), Southworth (2005) states that "*a fine grained and varied land use pattern"* contributes to short walking distances and can be considered as an important factor. In summary, planning and urban design scientists seem to have an interest in factors influencing ***walking distance***, including ***land use density*** and ***land use diversity***.

Planning and urban design scientists seem to be interested in crime preventing factors and variables. Alfonzo (2005) found in her literature review, safety from crime is influenced by "*urban design characteristics related to crime"* (e.g. presence of litter, first floor windows and abandoned buildings), "*type of land use"* (e.g. presence of bars and liquor stores) and "*presence of people"* (e.g. threatening groups). Mehta (2008) found similar factors and variables in literature, including "*physical condition"* and "*maintenance"* of the environment, the "*configuration of street spaces"*, "*the type of land uses"*, the "*alternation"* of environments, and "*the presence or absence of people"*. According to Southworth (2005), "*eyes on the street"* and "*street lighting"* can be considered as important elements for safety from crime. Forsyth (2015) considers "*streetlights"*, "*no entrapment spots"* and "*free signs of disarray"* as important for crime prevention. Based on the previous scientists, ***urban form*** and ***land use type*** seem to be important in the planning and urban design discipline. These factors can be linked to non-tangible walking needs, such as ***maintenance***, ***visibility*** and ***presence or absence of certain people***.

Besides safety from crime, planning and urban design scientists discussed the factors and variables that influence traffic safety. Alfonzo (2005) found perceived traffic safety is influenced by *"traffic calming features"* (e.g. speed bumps, roundabouts, lane width or sidewalk width), *"traffic volume"* and *"the presence of buffers"*. Also planning and design scientist Southworth (2005) mentioned a variety of techniques to reduce speeds of motorized traffic including *"chokers"*, *"chicanes"*, *"speed bumps"*, *"raised crosswalks"*, *"narrowed streets"*, *"rough paving"*, *"traffic diverters"*, *"roundabouts"* and *"landscaping"*. Besides this, Southworth (2005) focused on pedestrian crossings by mentioning *"crossing times for people of varied mobility"*, *"placement and length of cross walks"*, *"traffic speeds"* and *"traffic control signing and signals"*. According to Mehta (2008), scientists who conducted research into traffic safety suggested the importance of *"traffic calming features"* (e.g. trees or planting to reduce traffic), *"separation of pedestrians from fast moving traffic" and "safety of street crossings".* In summary, ***low traffic speed***, ***low traffic volume***, ***distance to fast traffic*** and ***ease of crossing*** can be considered as important walking needs in planning and urban design literature.

As mentioned in the previous section of walking needs, planning and urban design scientists are also interested in the factors and variables that provide comfort to pedestrians. According to Southworth (2005), path quality or comfort is influenced by *"path width"*, *"paving"*, *"signing"* and *"landscaping"*. Similar to Southworth (2005), Alfonzo (2005) considers *"sidewalk width"* and

"sidewalk maintenance" as important. Mehta (2008) identified *"sidewalk width"*, *"shade and shelter"*, *"obstacle free path"* and *"traffic-calming strategies"* as planning & design measures that contribute to comfort. The walking need comfort is interpreted differently by planning and urban design scientists. Some planning and urban design scientists consider only path characteristics relevant for comfort, whilst others consider protection against weather (e.g. Mehta, 2008) and traffic safety (e.g. Alfonzo, 2005) also as comfort. In summary, ***path width***, ***absence of obstacles***, ***surface*** and ***street furniture*** can be considered as important in the planning and urban design discipline.

Planning and urban designers seem to also have an interest in the attractiveness of the environment for pedestrians. For instance, Alfonzo (2005) considers "*pleasurability"* as an important walking need that is influenced by *"diversity"*, *"complexity"* and *"liveliness"* of spaces, which is linked to architecture, street design, street art and presence of greenery. According to Mehta, (2008), planners and urban designers are interested in the *"sensorial qualities"* that make places attractive to walk. Besides this, Mehta (2008) argued *"buildings characteristics"* (e.g. shop windows with goods, canopies, canopies) and *"street and sidewalk characteristics"* (e.g. vehicles, trees, colours) influence the sensorial experience. According to Lo (2009), urban design scientists do approach walkability at a more fine-grained level and from the perspective of the user instead of efficient transport or connection between pedestrian facilities. In summary, the factors of ***diversity***, ***complexity*** and ***liveliness*** can be considered as important walking needs in the planning and urban design disciplines. The planning & design measures linked to these walking needs are ***street design***, ***greenery***, ***architecture*** and ***presence of activities.***

2.5 Transportation

In the transportation literature the following definitions of "walkability" were found:

> *"Walkability can be defined as the extent to which the built environment is walking friendly"* (Abley, 2005, p. 3).

> *"Walkability can be defined as the quality of walking conditions, including safety, comfort and convenience"* (Litman, 2018, p. 1).

> *"Walkability can be defined as the extent to which an environment, usually the built environment, enables walking (Kelly et al., 2011) and is pedestrian friendly (Gebel et al., 2009; Moura et al., 2017)"* (Hall and Ram, 2018, p. 2).

A frequently cited and short walkability definition is the definition above of Abley in 2005 (e.g. Reyer *et al.*, 2014; Zakaria and Ujang, 2015; Bandini, Gorrini and Nishinari, 2016). The word "friendly" can be interpreted in different ways and the definition lacks further description of the term. The second definition of Litman is a concise definition that includes some elements of walking such as safety and comfort. While Abley (2005, p. 3) mentions the "built" environment in his definition, Litman (2018, p. 1) and Hall and Ram (2018, p. 2) do not mention the place or only mention the environment.

Interests

Transportation scientists have become interested in walkability for a variety of reasons. In the past, transportation research was mainly focussed on motorized traffic but later transportation scientists became more interested in pedestrian travel (Saelens, Sallis and Frank, 2003). A reason why transportation scientists investigate walkability is that pedestrian travel might go together with less motorized traffic and thereby less traffic congestion, air pollution and other environmental

consequences (Cao, Handy and Mokhtarian, 2006). Transportation scientists conducted research on how the physical environment influences walking as a means of transport; and how this affects traffic congestion and air pollution (Frank *et al.*, 2009). Besides an interest in sustainability, transportation scientists also paid attention to walkability to improve traffic safety (Litman, 2018). Pucher and Dijsktra (2003) found that traffic-calming features reduce accidents by 20 - 70% depending on the area. Besides traffic safety, Litman (2018) emphasises the space efficiency of walking. Litman (2018) conducted research on the economic value of walkability and found benefits, such as consumer savings of transportation costs; savings of public health care costs; and savings of environmental impact costs. In summary, transportation scientists seem to be interested in walkability due to the interests of ***less automobile use, less air and noise pollution***, ***sustainability*** and ***traffic safety***.

Pedestrians

Transportation scientists developed some instruments that contain pedestrian characteristics. Abley (2005) included different age groups and gender in his walkability prediction model. Besides "*age"* (adult/child/elderly), Henson (2000) considers the pedestrian characteristics of "*cultural attitude to walking"* and "*disability"* (e.g. prams, strollers, shopping trolleys) as important in estimating pedestrian level of services (LOS). Cao, Handy and Mokhtarian (2006) included a list of demographic variables that may influence travel behaviour, including "*gender*, "*age"*, "*employment status"*, "*the presence of a pet"*, "*auto ownership"*, "*household income"*, "*house- hold size"*, and "*the number of children in the household"*. In contrast to the previous scientists, Weinberger and Sweet (2012) included different trip purposes, consisting of walking for work, school, shopping, meal, social, not home based or other purposes. According to Lo (2009), transportation scientists are mainly interested in walking for ***transportation purposes***, such as ***commuters***. Based on these scientists, transportation seems to be mainly approached from the perspective of demographic factors, including ***age***, ***gender*** and ***walking purpose.***

Place

Some transportation scientists do approach walkability from the perspective of current place characteristics. Henson (2000) makes a distinction in urban, suburban, non-urban and rural landscapes when estimating pedestrian level of services (LOS). Jaskiewicz (2000) emphasises that certain design parameters of the proposed walkability measures can be implemented universally, while others are dependent on the specific physical characteristics of a particular location. Besides topographic and geographic characteristics, some transportation scientists included climate characteristics. According to Henson (2000), weather protection and climate control should be provided by *"arcades"*, "*transit shelters"* and "*pedestrian amenities"*. Jaskiewicz (2000) also proposes measures for climate comfort, such as the "*presence of shade trees"*, "*overhangs"* and *"awnings"* providing shade and shelter. In contrast to the other scientists, Abley (2005) conducted research into windy weather conditions and found this can result in a decrease of walkability. Transportation scientists seem to be mainly interested in ***climate*** characteristics, such as planning & design features providing ***coolness***, ***shade*** and ***shelter***.

Walking needs

Transportation scientists used several instruments and frameworks to investigate factors related to pedestrian safety and motorized traffic. Fruin (1971) developed the *"Level of Services"* (LOS) for pedestrians consisting of six levels, which describe the conditions of factors such as *"speed"*, *"travel time"*, *"space to maneuverer"*, *"traffic interruptions"*, *"comfort"*, *"convenience"* and *"safety"*.

According to Henson (2000), environmental factors that influence perceived walking and perceived LOS include: *"comfort" ("weather protection"*); *"convenience"* (including *"walking distance"*, *"path directness"* and *"directional signing"*); *"safety"* (including *"separation of pedestrian from vehicular traffic"*, *"vehicle-free areas"* and *"vertically using overpasses and underpasses"*); *"security"*; and *"economy"*. Similar to Henson, transportation researcher Jaskiewicz (2000) added a number of qualitative factors to the LOS model for pedestrians including *"enclosure"*; *"complexity of path network"*; *"building articulation"*; *"complexity of spaces"*; *"overhangs and rooflines"*; *"buffer"*; *"shade trees"*; *"transparency"* and *"physical components"* (including interventions to reduce vehicular speed). Abley (2005) found *"crossing type"*, *"vehicle speed"*, *"visibility to traffic"* and *"footpath condition"* are the most important factors that influence walkability on pedestrian crossings. Kelly et al. (2011) argue pedestrians may feel unsafe because of "*closeness of other traffic"*, "*speed of other traffic"* and "*traffic noise"*. According to Cao, Handy and Mokhtarian, (2006), a higher traffic volume in shopping streets reduces the amount of pedestrians. Based on the above, transportation scientists seem to be interested in the factors that influence traffic safety, including ***low traffic speed***, ***low traffic volume***, ***distance to other traffic*** and ***visibility***.

Planning & design

Transportation scientists mentioned some factors and variables that can influence pedestrian safety. According to Jaskiewicz (2000) vehicular speeds can be reduced by *"enclosure of buildings"*, *"narrow lane width"*, *"the number of carlanes"*, *"broken sight lines"*, *"sharp turns"*, *"on street parking"* and *"emphasizing pedestrian crossings"*. Abley (2005) found "*footpath condition"* and "*the presence of comfort features"* as the most important factors influencing pedestrian safety. Besides this, the pleasantness of a footpath is strongly influence by "*the presence of greenery"*, *"footpath condition"*, *"weather (wind)"* and "*presence of comfort features"*. Ferrer and Ruiz (2018) conducted a study into short walking trips in two Spanish cities and found planning & design features creating a crime setting, such as "*absence of people"*, "*poor street lighting"* or "*a conflictive area"* that discourages people from walking. In summary, transportation scientists are interested in various planning & design features, including ***traffic calming features,*** such as narrow lane width, number of lanes and speed bumps, ***ease of crossing*** and ***safety from crime***.

2.6 Public health

In public health literature the following definitions of "walkability" were found:

"Walkability is *the extent to which characteristics of the built environment and land use may or may not be conducive to residents in the area walking for either leisure, exercise or recreation, to access services, or to travel to work"* (Leslie, Butterworth and Edwards, 2006, p. 4).

"*These features that promote various forms of physical activity (such as walking) can be referred to as 'neighborhood walkability' and often include access to walking destinations such as retail stores and parks, and community design features such as street connectivity and sidewalk access"* (Duncan et al., 2011, p. 4161).

Interestingly, most public health scientists seem to emphasize walking purposes, such as leisure, exercise and recreation. Physical activity is a frequently used word by many public health scientists and shows public health scientists focus not only on walking but also on other forms of physical activity, such as running. Both Leslie, Butterworth and Edwards (2006) and Duncan and colleagues (2011) emphasize the importance of *"accessibility*" to different kinds of land uses. Besides this, both focus on a specific group by the word's *"residents"* and *"neighborhood"*.

Interests

Public health scientists have been interested in walking and walkability for a long time and they conducted research on the influences of personal and environmental factors on physical activity. Since walking rates have dropped and motorized traffic negatively affects cities, public health scientists have become more interested in walking (Alfonzo, 2005). Public health scientists have an interest in the pedestrian environment, because it leads to physical activity and therefore improves public health and lower health care costs (Cao, Handy, & Mokhtarian, 2006). According to Lo (2009), public health scientists view walkability as a basis for addressing obesity, cardiovascular disease and other prevalent conditions. Walking provides an extensive number of health benefits including improved cardio-vascular fitness, reduced stress, stronger bones, weight control, mental alertness and creativity (Southworth, 2005). According to Frank, Engelke and Schmid, (2003), lack of physical activity has been linked to many health problems, such as obesity, cardiovascular diseases, osteoporosis and mental health problems. Public health scientists such as Lee and Buchner (2008), Kahn and colleagues (2010), Lee and colleagues (2012), and Powell, Paluch and Blair (2011) see a daily walk as the solution to chronic diseases and rising health care costs. In summary, public health scientists are interested in walking and the environmental factors that stimulate walking due to the large number of ***public health benefits,*** including ***prevention of diseases***, ***improved physical condition***, which may result into ***less health care costs***.

Pedestrians

Similar to planning and urban design scientists, public health scientists focus on the personal factors that affect walking behaviour. According to Alfonzo (2005), public health scientists were first focussed on personal factors related to walking and later also became interested in the physical environment factors related to walking. Hajna et al. (2015) conducted research on the influence of street connectivity, land use mix and population density on utilitarian walking behaviour of Canadian adults. Besides personal factors, a couple of public health scientists emphasize the importance of the walking purpose (e.g. Saelens, Sallis & Frank, 2003; Pikora et al., 2003; Leslie, Butterworth and Edwards, 2006). Different walking purposes, such as excercise, pleasure or transport, demand for different physical interventions (Leslie, Butterworth, & Edwards, 2006). According to Alfonzo (2005) and Lo (2009), public health scientists are focussed on walking for ***exercise*** and other ***recreational*** purposes rather than walking for transportation. Based on the above, the factors of ***age***, ***gender*** and ***walking purposes*** can be considered as important in the discipline of public health.

Place

Public health scientists considered some place characteristics in their researches. Leslie and colleagues (2005) declare the difference in a higher rating for aesthetics of low walkable neighbourhood than high walkable neighbourhood by the bushier and hillier topography with scenic views of the low walkable neighbourhood. According to Sallis (2009), place characteristics (for example: climate, vegetation and topography) could change the level of physical activity. Other public health scientists included climate characteristics in their study. Zuniga-Teran Leslie and colleagues (2017) selected their case study of Tuscon based on the dry and warm climate, which makes walking accessible for a large part of the year. Kahn *et al.*, 2010 argue other environmental characteristics, such as weather and air quality also influence physical activity levels. In summary, place characteristics of ***topography*** and ***climate*** are slightly considered as important by public health scientists.

Walking needs

Public health scientists developed a number of instruments and frameworks to evaluate walkability. Pikora and colleagues (2003) developed a theoretical framework of physical environmental factors that may influence walking for recreation in local neighbourhoods, which are *"functional features"* (including walking surface, streets, traffic and permeability); *"safety features"* (including personal and traffic); *"aesthetic features"* (including streetscape and views); and *"destination features"* (including facilities). Similar to Pikora and colleagues (2003), Hoedl, Titze and Oja (2010) focussed on the environmental factors in a neighbourhood and developed *"the Bikeability and Walkability Evaluation Table"* (BiWET) that includes the factors: *"traffic safety"* (including speed limitations and traffic lanes); *"attractiveness of the surroundings"* (including billboards, green space, trees and sport fields and non-green open space); *"land use"* (including residential or business area, lower or higher than three stories and special buildings); and *"walking and cycling infrastructure"* (including cycle lanes and sidewalks). Both included the factors of traffic safety and pay attention to the pleasure of walking and cycling by including the aesthetic features and the attractiveness of the surroundings. Similar to Hoedl, Titze and Oja (2010), Pikora and colleagues (2003) included land use type by including destination features. In addition, both paid attention to the path quality by including walking surface.

Another instrument that also includes land use and safety is the Neighbourhood Environment Walkability Scale (NEWS) of Saelens and colleagues (2003). It contains a questionnaire that can measure residents' perception of the factors: *"residential density"*, *"land use mix–diversity"*, *"land use mix–access"*, *"street connectivity"*, *"walking/cycling facilities"*, *"aesthetics"*, *"pedestrian/traffic safety"* and *"crime safety"*. Similar to the framework of Pikora, the instrument of Saelens et al. includes traffic and crime safety; aesthetics and land use. As a response to the instrument of Saelens and colleagues (2003), Cerin and colleagues (2006) examined the validity of NEWS and developed a new version called NEWS-A that includes the factors *"residential density"*; *"land-use mix"*; *"access to services"*; *"street connectivity"*; *"infrastructure"* and *"safety for walking"*; *"aesthetics"*; *"traffic load"*; *"crime safety"*; *"parking difficulties"*; *"hilly streets"*; *"physical barriers to walking"*; and *"not many cul-de-sacs"*. The instruments of both scientists discussed land use factors in their instruments, which can be linked to short walking distance and accessibility. Similar to Saelens and colleagues (2003), Pikora and colleagues (2003) included connectivity by including the permeability of the neighbourhood. Based on the previous instruments and frameworks, multiple walking needs seem to be important in the public health discipline including ***accessibility***, ***connectivity***, ***safety from crime***, ***traffic safety***, ***pleasurability*** and ***aesthetics***.

Planning & design

Two other scientists developed a different instrument from the previous scientists, focussed on the spatial characteristics of the environment. Leslie, Butterworth and Edwards (2006) developed an instrument called *"Walkability Index"* that is based on GIS data and includes the factors of *"dwelling density"*, *"street connectivity"*, *"land use mix"*, and *"net retail area"*. In contrast to Leslie, Butterworth and Edwards (2006), Frank et al. (2009) developed a more detailed walkability index abbreviated with WAI using parcel-level information that includes *"connectivity index or intersection density"*; *"entropy index"*; *"floor area ratio"*; and *"household density index"*. Whilst Leslie, Butterworth and Edwards use only dwelling density, Frank et al. (2009) uses household density and intersection density. Similar to the instruments mentioned in the previous paragraphs, land use factors and connectivity are present in both instruments. In summary, the planning & design features of ***land use density*** and ***land use diversity*** can be considered as important in the public health discipline.

2.7 Economy

In the economic literature the following definition of "walkability" was found:

> *"Walkability is the degree to which an area within walking distance of a property encourages walking for recreational or functional purposes"* (Pivo and Fisher, 2011, p. 1).

The definition of Pivo and Fisher (2011) is the only definition that was found in the economic discipline. The word *"property"* indicates that definition comes from an economic perspective. In addition, this definition distinguishes walking for recreational and functional purpose, which could be linked to the economic benefits of more expenditure to recreation and other facilities.

In comparison to the disciplines of planning and urban design, transportation and public health, less research has been conducted into walkability by economists. The economist mainly conducted research to the benefits of improved walkability. Most research about walking and walkability in the field of economy focuses on these benefits. Pivo and Fisher (2011) conducted research on the effects of improved walkability on property values and found that offices, shops and apartments increased in value. Another study of Cortright (2009) conducted research into the relation between house values and walkability as measured by the online Walk Score tool and found a strong connection between these factors. Besides increased real estate values, economists seem to be interested in consumer expenditure in relation to walkability. Tolley (2011) analysed the effect of improved walking conditions in shopping streets on retailers and found increased local economic activity; increased property values and rents; and increased attraction on new retailers. In summary, the interests of ***real estate values*** and ***consumer expenditure*** can be considered as important interests in the economic discipline.

2.8 Sociology

Similar to the discipline of economy, the discipline of sociology seems to lag behind in research into walking and walkability. The sociologists mainly conducted research into the benefits of improved walkability. According to Rogers et al. (2011), the social benefits of walkability have not been studied as much as the health and environmental benefits of walkability. However, some sociologists conducted research into the social benefits of walkability. Leyden (2003) conducted a study on the social effects of living in a walkable neighbourhood and found that in these neighbourhoods, people have more social contact, a higher chance to know each other, trust each other, participate in communal events and are socially involved. Individuals who have a lot of social contact and are socially involved might be physically and mentally healthier and tend to live longer (Leyden, 2003). According to Rogers *et al.* (2011), social effects are also strongly connected with local economy and quality of life. Based on the above, the interests of ***social contact***, ***social involvement***, ***social equity*** and ***public health*** can be considered as important drivers for the sociology discipline to investigate walkability.

Summary

OVERVIEW WALKABILITY IN SCIENTIFIC DISCIPLINES				
PLANNING AND URBAN DESIGN	**TRANSPORTATION**	**PUBLIC HEALTH**	**ECONOMY**	**SOCIOLOGY**
INTERESTS				
- Sustainability - Less automobile use - Air and noise pollution - Public health - Quality of life - Social equity	- Sustainability - Less automobile use - Air and noise pollution - Traffic safety	- Prevention for diseases - Physical conditions - Less health care costs - Social equity	- Real estate values - Consumer expenditure - Savings of costs	- Social contact - Social involvement - Social equity - Public health
PEDESTRIANS				
- Age - Gender - Disability - Walking purpose	- Age - Gender - Walking purpose (transportation)	- Age - Gender - Walking purpose (exercise and recreation)	-	-
PLACE				
- Topography - Geography - Climate	- Climate	- Topography - Climate	-	-
WALKING NEEDS				
- Accessibility - Connectivity - Safety from crime - Traffic safety - Comfort - Pleasurability - Short walking distance - Maintenance - Visibility - Low traffic speed - Low traffic volume - Distance to fast traffic - Ease of crossing - Diversity - Complexity - Liveliness	- Low traffic speed - Low traffic volume - Distance to other traffic - Visibility - Ease of crossing - Safety from crime	- Accessibility - Connectivity - Safety from crime - Traffic safety - Pleasurability - Aesthetics	-	-
PLANNING & DESIGN				
- Land use density - Land use diversity - Land use type - Urban form - Path width - Surface - Absence of obstacles - Street furniture - Street design - Greenery - Architecture - Presence of activities	- Narrow lane width - Number of car lanes - Speed bumps	- Land use density - Land use diversity	-	-

2.9 Conceptual model

The relation between the domains, and categories that are bold in this paragraph are visible in the conceptual model (figure 3). The literature review shows that walkability is a broadly defined term that includes an extensive list of factors and variables. The theoretical framework shows these factors and variables are influenced by the analysed domains. Besides this, it shows the domains of ***walking needs*** and ***planning & design*** are affected by the domains of ***interests***, ***pedestrian characteristics*** and ***place characteristics***. For instance, the interest of transportation scientists to improve traffic safety for pedestrians resulted in specific attention to lower traffic speed of vehicles and thereby traffic-calming design measures, such as speed bumps. The domain of ***interests*** shows that the interests of the disciplines contain ***environmental interests*** (e.g. less automobile use), ***public health interests*** (e.g. prevention for diseases), ***economic interests*** (e.g. real estate values) and ***social interests*** (e.g. social equity). The domain of ***pedestrians*** shows that scientists conducted research into the influence of various pedestrian characteristics on walking including ***age***, ***disability*** and ***purpose*** that were frequently mentioned. The domain of place shows that scientists conducted research into characteristics of the local ***climate*** and ***topography***. The walking needs or related concepts of accessibility, safety, comfort and pleasurability were frequently mentioned. Alonzo (2005) used the same concepts in her hierarchy of walking needs. Many scientists divide the walking need of safety in ***safety from crime*** and ***traffic safety***. The domain of ***planning & design*** can be linked to the walking needs and contains an exhaustive list of measures.

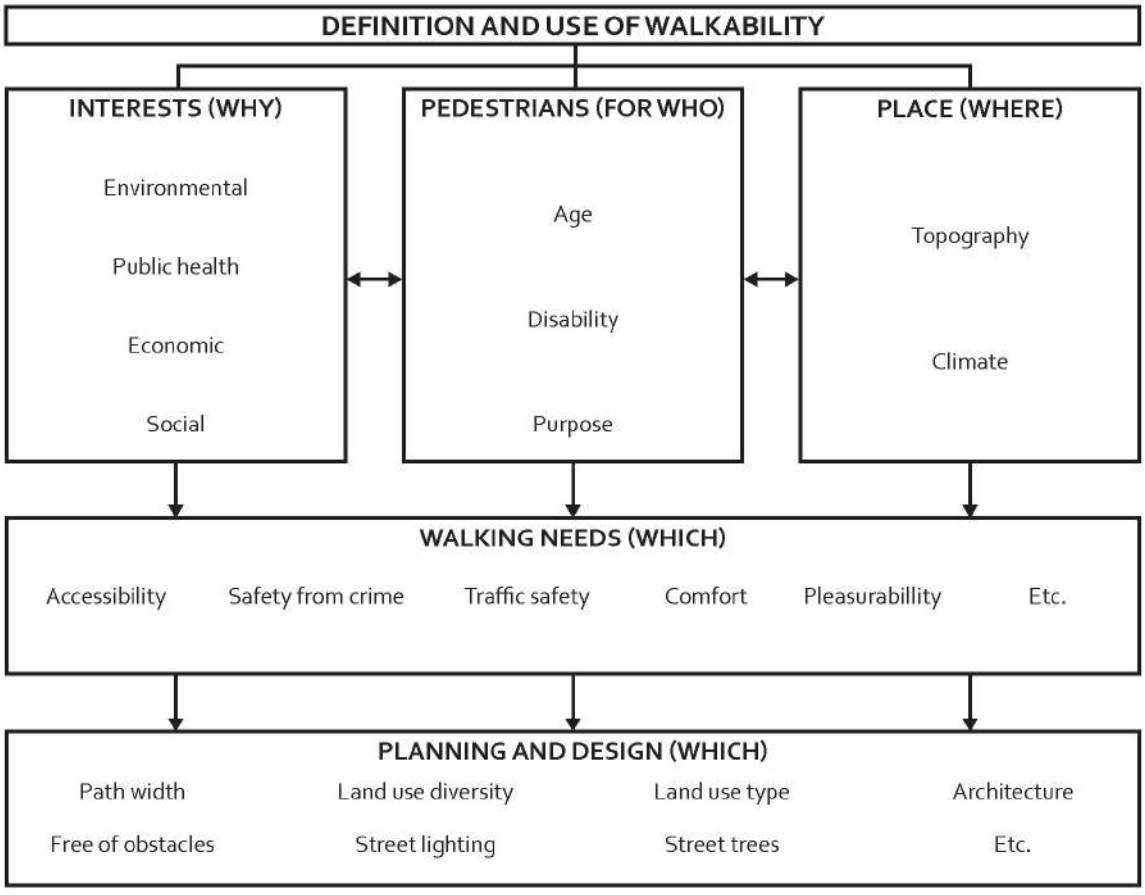

Figure 3: Conceptual model.

2.10 Research questions

The previous paragraphs have shown how walkability is defined and used in scientific literature. As stated in the introduction, walkability is also defined and used differently in planning policy and practices of large Dutch cities. Given the different ways of using the term "walkability" in planning policies and practices of Dutch large cities, this research will answer the following main research question:

How is walkability defined and used in planning policies and practices of large Dutch cities in comparison to international trends in scientific literature?

Defined and used

Walkability is a broad and multidisciplinary concept that is defined and used differently by scientists and professionals. Many different factors and variables are used to define the term walkability. These factors and variables can be found in definitions, instruments and models.

Planning policies

The spatial translation of walkability is determined by policymakers, spatial planners and urban designers of municipalities in planning policy. The planning policy is fixed in policy documents of the municipality, such as pedestrian plans, transportation plans and public space plans.

Practices

The Oxford University Press (2018) defines practices as: *"the actual application or use of an idea, belief, or method, as opposed to theories relating to it"*. In order to have a fully understanding how walkability is defined and use in Dutch large cities, it is important to know how planning policy (what they say) is translated into planning practice (what they do).

Large Dutch cities

As stated in the introduction, large (Dutch) cities are experiencing various problems, such as traffic congestion on roads and bicycle lanes, capacity problems in public space and air and noise pollution. Recently, large cities have started to implement walkability in their planning policies. The meaning of a large Dutch city will be further elaborated in the methodology chapter.

International trends in scientific literature

The walkability trends in scientific literature have been presented in the theoretical framework chapter. The question is to what extend the international trends in scientific literature are present in planning policies and practices of large Dutch cities.

The main research question can be divided in the following sub-research questions:

Q1: What are the current walkability trends in international scientific literature?

Q2: How is walkability defined and used in planning policies of large Dutch cities?

Q3: How is walkability applied in planning practice of large Dutch cities?

Summary

SUMMARY
• The definition and use of walkability will be investigated by the domains of interests, pedestrians, place, walking needs and planning & design. • Walkability is defined and used differently by the disciplines of planning and urban design, transportation, public health, economy and sociology. • This research will answer the following research questions: MQ: *How is walkability defined and used in planning policies and practices of large Dutch cities in comparison to international trends in scientific literature?* Q1: *What are the current walkability trends in international scientific literature?* Q2: *How is walkability defined and used in planning policies of large Dutch cities?* Q3: *How is walkability applied in planning practice of large Dutch cities?*

3. Research methodology

3.1 Introduction

The conceptual model of the previous chapter will be used to find an answer for the sub-research questions. The research is a mixed method of quantitative and qualitative research. The methods that are used are quantitative analysis, document analysis, interviews and observation. Firstly, the overall methodological design will be explained. Secondly, the two Dutch cases and the mini cases will be outlined. Thirdly, an overview of the different phases of the proposed research will be given. Subsequently, the credibility, ethical consideration and the position of the researcher will be described.

3.2 Methodological design

Figure 4 provides an overview of the phases in the methodology. **Phase 1** answers sub-research question 1: *"what are the current walkability trends in international scientific literature?"* Beside the literature review in the theoretical framework, a quantitative analysis was conducted to find walkability trends in scientific literature. The outcome was a list of factors and variables that are frequently mentioned by scientists in scientific papers.

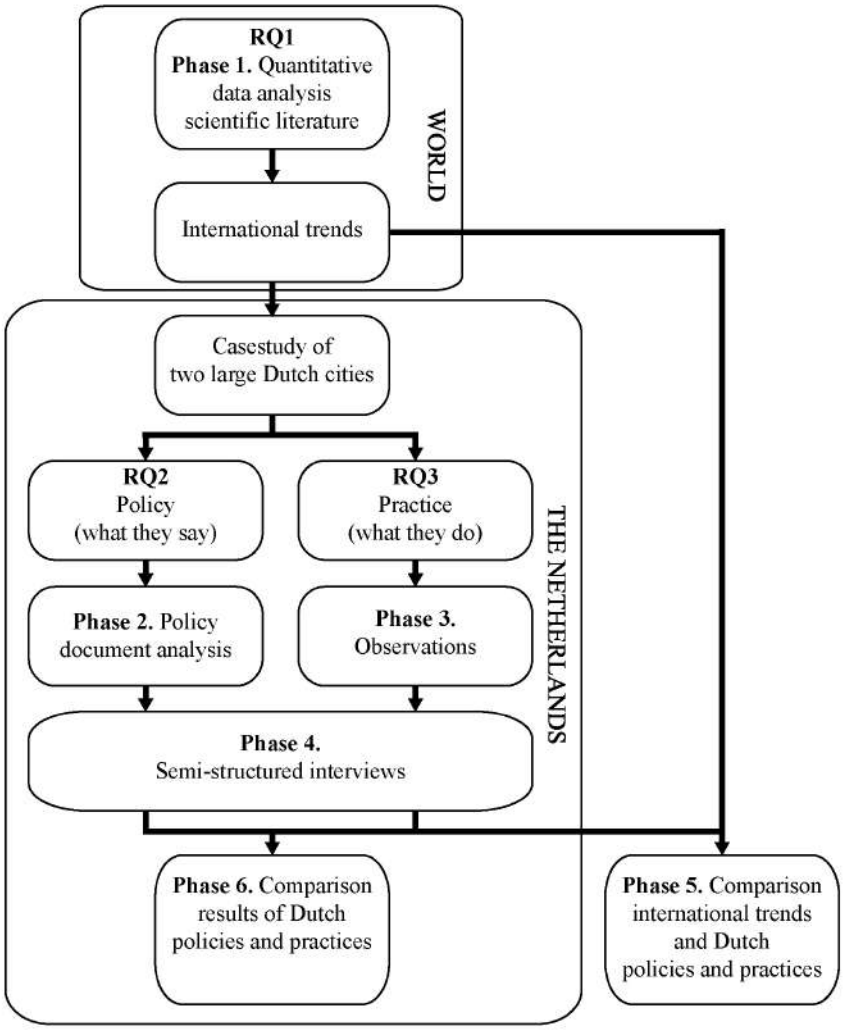

Figure 4: Methodological design in phases.

Subsequently, a case study will be conducted in two large Dutch cities. In both cases, a distinction will be made between planning policy: *"what they say"*; and planning practice: *"what they do"*. The second sub-research question: *"how is walkability defined and used in planning policies of large Dutch cities?"* will be answered in **phase 2**. This question will be answered by using a document analysis of various policy plans. The third sub-research question: *"how is walkability applied in planning practice of large Dutch cities?"* will be answered in **phase 3**. In this phase, an observation will be conducted in various streets or mini cases of both cities. The results of phase 2 and 3 will be further explored in **phase 4** by conducting semi-structured interviews with municipal officials, experts and city guides. In **phase 5**, a comparison will be made between walkability in scientific literature and walkability in large Dutch cities. Additionally, planning policy and practice of large Dutch cities will be compared in **phase 6**.

3.3 Case study selection

Case study selection cities

Two paradigmatic cases were selected based on a list of selection criteria. Table 1 provides an overview of the selection criteria. The cases were chosen based on an information oriented selection, which means that they are selected based on the expected information to develop an outcome for a certain domain (Flyvbjerg, 2006). Due to time constraints, two cases were selected for this research. Statistics Netherlands (CBS, 2019) defines a large city as a city with more than 250.000 inhabitants. Only the cities of Amsterdam, Rotterdam, The Hague and Utrecht also known as the G4 have a population size of more than 250.000 inhabitants (CBS, 2018). These cities in particular are experiencing problems with traffic congestion, overcrowded public transport (KiM, 2017) and air pollution (RIVM, 2018). The presence of city problems is also considered a selection criterion. Besides population size and city problems, the selection of the cases is based on the availability of policy documents that include pedestrians, the year of publication which should be later than 2005 and the attention for pedestrians and walkability in these plans. Additionally, the availability of a pedestrian plan was taken into consideration, because this shows the attention for pedestrians. Moreover, the urban form of the inner city has been considered in the selection of the cases, because there might be a difference in pedestrian policies between a historical city with mainly narrow streets and a modern city with wide streets. Since most Dutch cities have a historical structure with mainly narrow streets, the case studies were preferably historical. The last criterion contains whether a city is a member of the Walk21 charter, which is a worldwide collaboration of cities that pay more attention to pedestrians and walkability.

Table 1: Selection criteria case studies.

Legend: green colour = good; orange colour = sufficient; red colour = insufficient.

Criteria City	Population >250.000	City problems	Availability policy plans	Relevance of data	Attention in policy plans	Pedestrian plan	Urban form inner city	Walk 21
Amsterdam	859.732						Historical	
Rotterdam	641.326						Old / modern	
The Hague	534.158						Historical	
Utrecht	349.234						Historical	
Eindhoven	229.637						Historical	
Tilburg	215.946						Historical	
Almere	205.058						Modern	
Groningen	203.954						Historical	

The cases selected for this research are the cities of Amsterdam and Utrecht. Both cities are located in the Randstad Area and experience the challenges of population growth and mobility (Ritsema van Eck *et al.*, 2013). The city of Utrecht holds a pedestrian policy document, which shows their attention for pedestrians (UTR-PD-PEDESTRIAN, 2015). The city of Amsterdam reveals attention for pedestrians by having a separated pedestrian network in their policy (AMS-PD-MOBILITY, 2013). The cities of Amsterdam and Utrecht are comparable due to their fine-grained land use patterns and the presence of canals. Similar to the city of Amsterdam and Utrecht, the city of The Hague meets most criteria. However, the urban form of the cities of Amsterdam and Utrecht can be considered as more comparable than the urban form of The Hague with one of these cities. The city of Rotterdam has not been selected as a case study due to the old publication years of the policy documents, relatively little attention for pedestrians in the policy documents and the post-war urban structure of the city. The selected cases will be shortly introduced in the next two paragraphs.

With a population size of 859.732 inhabitants (CBS, 2018), the capital city of Amsterdam is the largest city of the Netherlands. Amsterdam consists of a historical ring structure of buildings and canals and is positioned along the IJ-river. The city centre has become popular by tourists and attempts to restrict the consequences of mass tourism (NRC, 2018). As a response to this problem the municipality has been focussing more and more on walkability (Municipality of Amsterdam, 2018a). In the past decades, it has taken a variety of measures, such as car free zones and the removal of obstacles from sidewalks (Municipality of Amsterdam, 2018ab). Since tourism concentrates mainly in the inner city and the public space in the inner city is scarce, the inner city will be the case study area. Figure 5 shows the case study area of the inner city, which is based on the boarders of the map in the inner city policy document (AMS-PD-INNERCITY, 2018).

Figure 5: Case study area Amsterdam (Map information Google, 2019).

Figure 6: Case study area Utrecht (Map information Google, 2019).

The city of Utrecht is located in the province of Utrecht and is the fourth largest city of the Netherlands with a population of 349.234 inhabitants (CBS, 2018). The city of Utrecht is together with Amsterdam one of the fastest growing cities in the Netherlands (PBL and CBS, 2016). The inner city has a historical structure with old buildings and canals. The city of Utrecht was the first city in the Netherlands with a pedestrian policy plan (Municipality of Utrecht, 2015). Figure 6 shows the case study area of the inner city. The border of the case study area is based on the map of the inner city policy document (UTR-PD-INNERCITY, 2015). The Jaarbeurs district on the west side the historical inner city, which is officially part of the inner city is not included in the case study area, because this is a new development area with another urban atmosphere.

Case study selection streets

Four streets in both cities were selected based on a number of selection criteria to find an answer on research question 3: *"how is walkability applied in planning practice of large Dutch cities?"* The streets were selected based on a diverse case study selection method of Seawright and Gerring (2008). Investigating a variety of streets with a variety of place characteristics results in a representative image of walkability in planning practice. Besides this, the observation of different streets may result in discovering different typologies of walkability.

The first selection criterion was that the streets should be located within the borders of the historical inner cities, since these are the case study areas of this research. The second selection criterion was that the streets had to be redesigned in the past ten years, since the implementation of the current pedestrian policy started around ten year ago in both cities (AMS-PD-EMPEROR, 2009; UTR-PD-PEDESTRIAN, 2015). In this way, this research analysed how the current planning policy was translated into planning practice. The search for redesigned streets on the Internet resulted in a list of six streets for both cities. The search terms "herinrichting straat Amsterdam/Utrecht" (translated: redesign street Amsterdam/Utrecht) and "herinrichting voetgangers Amsterdam/Utrecht" (translated:

pedestrian project Amsterdam/Utrecht) were used to find redesigned streets. Besides, redesigned streets were found by asking for successful pedestrian projects during the interviews with interviewees of both municipalities. AMS-IN-Terpstra (2019) mentioned the streets of the Rode Loper (e.g. Damrak) as successful pedestrian projects. UTR-IN-Tsakmakis&Ditewig (2019) mentioned the Mariaplaats, Zadelstraat and Kortejanstraat as successful pedestrian projects. The search for redesigned streets resulted in a list of six streets for both inner cities. Table 2 and 3 provide an overview of the streets and the selection criteria. The other selection criteria will be further explained in the next paragraph.

Table 2: Selection criteria mini case studies of Amsterdam.

Sources: 1: (Het Parool, 2018b); 2: (Het Parool, 2013); 3: (Het Parool, 2017b); 4: (Municipality of Amsterdam, 2018a); 5: (Heijmans, 2014); 6: (Het Parool, 2018a); 7: (Google, 2017). **Legend:** green colour = reason why the case is eligible for selection.

AMSTERDAM						
Criteria / **Streets**	**Year of redesign**	**Street width (7)**	**Functions in the network**	**Land use types (All have living)**	**Pedestrian zone**	**Public transport**
Vijzelgracht	2017 (1)	32 meter	Traffic + staying	Hospitality, stores	X	X
Haarlemmerstraat	2013 (2)	10 meter	Traffic + shopping	Hospitality, stores		
Oude Turfmarkt	2017 (3)	13 meter	Staying	Offices, hospitality	X	X
Herenstraat	2018 (4)	10 meter	Shopping	Hospitality, stores		
Damrak	2014 (5)	30 meter	Traffic + shopping	Hospitality, stores		X
Amstel	2018 (6)	21 meter	Traffic + shopping	Hospitality, stores		

Table 3: Selection criteria mini case studies of Utrecht.

Sources: 1: (Algemeen Dagblad, 2017); 2: (DUIC, 2016); 3: (DUIC, 2016); 4: (DUIC, 2017); 5: (De kracht van Utrecht, 2013); 6: (Municipality of Utrecht, 2017); 7: (Google, 2017). **Legend:** green colour = reason why the case is eligible for selection.

UTRECHT						
Criteria / **Streets**	**Year of redesign**	**Street width (7)**	**Function in the network**	**Land use types (All have living)**	**Pedestrian zone**	**Public transport**
St. Jacobsstraat	2016 (1)	25 meter	Traffic	Offices, stores		X
Twijnstraat	2016 (2)	10 meter	Traffic + shopping	Stores, hospitality		
Zadelstraat	2016 (3)	7 meter	Shopping	Stores	X	
Oudkerkhof	2017 (4)	11 meter	Staying + shopping	Hospitality, stores		
Kortejanstraat	2014 (5)	12 meter	Staying	Hospitality, stores		
Mariaplaats	2015 (6)	23 meter	Traffic + staying	Hospitality, stores	X	

The other selection criteria were determined based on the findings of the domains of place characteristics and planning & design in the policy document analysis. The main focus for place was on topographical characteristics of the streets since the climate circumstances can be considered as almost similar in the streets. Both municipalities stated that the public space from façade to façade is scarce in the inner city (UTR-PD-MOBILITY, 2016; AMS-PD-TRAFFIC, 2018). For this reason the street width was used as a criterion and was measured through use of Google Earth (2017). Besides street width, both municipalities stated that the design of a street depends on the function in the network, such as the function of a place to stay or a place for traffic (AMS-PD-TRAFFIC, 2018; UTR-PD-INNERCITY, 2015). Therefore, the function in the network was chosen as a criterion and streets were analysed whether it was a place for traffic, shopping or staying based on observations in Google Street View (2019). Another topographical place characteristic chosen as a criterion is land use type, since the designs of both pedestrian networks are based on facilities that attract crowds (AMS-PD-TRAFFIC, 2018; UTR-PD-FOOTPATH, 2014). The land use types were analysed based on

observations in Google Street View (2019). In addition, the planning & design measure presence of a pedestrian zone was chosen as a criterion. Both municipalities aim to make some streets in the inner city free of automobile use (AMS-PD-PUBLIC, 2017; UTR-PD-INNERCITY, 2015). The presence of a pedestrian zone might influence the design of the pedestrian environment. Finally, the planning & design measure presence of large public transport stops was chosen as a selection criterion, since both municipalities focus on the combination between public transport and walking (AMS-PD-TRAFFIC, 2018; UTR-PD-PEDESTRIAN, 2015). Both planning & design measures were analysed through use of Google Streetview (2019).

Based on the case study selection criteria, the mini cases of Vijzelgracht, Haarlemmerstraat, Oude Turfmarkt and Herenstraat emerged as the most suitable mini cases. The Vijzelgracht was selected based on the large street section width, the function of a flow road for motorized traffic, the presence of a car-free pedestrian zone and the presence of a tram and metro station. The Haarlemmerstraat was selected due to the small street section, the function of a flow road for motorized traffic and the function of a shopping street. The Oude Turfmarkt was selected as a case due to the function as a place to stay, the presence of offices and hospitality, the presence of a car-free pedestrian zone and the presence of a metro station. Lastly, the Herenstraat was selected due to small street section width and the function of a shopping street.

Based on the case study selection criteria, the mini cases of St. Jacobsstraat, Twijnstraat, Zadelstraat and Oudkerkhof were selected. The St. Jacobsstraat was selected due to the large street section width, the function of a main traffic road, the presence of offices and stores and the presence of many bus stops. The Twijnstraat was chosen due to the narrow street section width, its function as a street for traffic and shopping and the presence of many stores and hospitality. The Zadelstraat was selected due to the narrow street section width, its function as a shopping street, the presence of mainly stores and the absence of cars in the street. The Oudkerkhof was selected due to its function as a place for shopping and staying, and the presence of hospitality and stores.

3.4 Methodology in phases

Phase 1: Quantitative analysis of scientific literature

Besides the literature review in the theoretical framework, a quantitative analysis was conducted to find the walkability trends in scientific literature. Walkability trends are factors and variables of walkability definitions and instruments that are frequently used. A search on Internet searching machines, such as Google scholar; WUR library; Elsevier Journal finder; and Research Gate was conducted to find papers and scientific reports about walkability. Beside the term walkability, the search was also done on terms, such as “walkable”, “walkable neighbourhoods”, “pedestrian friendly”, “walking friendly”, “pedestrian-oriented planning” and “pedestrian-oriented places”. Scientific literature starting from the year 1995 was selected to create a relevant overview of walkability. This resulted in sixty scientific literature pieces from the disciplines: planning and urban design; transportation; public health; economy and sociology. Subsequently, the literature was scanned on factors and variables of walkability definitions and instruments by use of the qualitative data analysis system (QDAS) of “Atlas.ti”. The factors and variables in the scientific literature pieces have been coded manually. Appendix I provides an overview of the walkability definitions and instruments. This scan was done by use of the five domains: interests, pedestrians, place, walking needs and planning & design.

Phase 2: Policy document analysis

The aim of phase 2 is to find out how walkability is defined and used in policy documents of large Dutch cities. The policy documents were selected based on a number of selection criteria. First, the policy documents had to contain walkability factors and variables mentioned in the theoretical framework. Secondly, the documents had to be published within the last ten years in order to have a reliable analysis. Thirdly, the policy documents consist of both sectorial policy documents as well as area documents.

A variety of policy documents of different policy areas was selected to ensure no essential information was missed. The theoretical framework showed that walkability could be linked to many environmental factors and variables. The environmental factors and variables can be linked to the policy areas of mobility, spatial planning, greenery, public space, maintenance, safety and public health. First, *pedestrian policy documents* were selected when they were available. Secondly, *mobility plans* were selected, which explains the coherence between pedestrian networks and other transportation networks. Subsequently, the overall *city plan* and the *inner city plans* were selected to investigate walkability trends, such as land use diversity and land use density. Since the largest part of walking takes place in public space, the *public space plans* of both municipalities were also selected. Moreover, the walking need of traffic safety was analysed in the *traffic safety plans*. Additionally, the *motion plans* were selected since walking is a form of movement. As is shown in the literature, walking rates are also influenced by the presence of green in streets. Therefore, also *greenery plans* were selected. Lastly, *maintenance plans* were selected since walking rates are influenced by the presence of litter, graffiti and vandalism.

The search for policy documents went according to the following procedure. First, the policy sections of municipal websites were scanned on recent and relevant policy documents that include walkability factors and variables. This search resulted in a number of policy documents, including pedestrian policy documents, mobility documents, structure visions of the city, inner city plans, greenery visions and maintenance plans. Secondly, the search bars of the websites were used to find policy document by searching on the key words: “voetganger(s)” (translated: pedestrian(s)), “lopen” (translated: walking), “mobiliteit” (translated: mobility), “groen” (translated: greenery), “veiligheid” (translated: safety), “handhaving” (translated: maintenance) and “bewegen” (translated: movement). This resulted for instance in the policy document: “De Beweegvriendelijke stad” (translated: The city in motion). In order to not miss essential policy documents, interviewees of the municipality were asked to mention the most important policy documents that include pedestrians. This resulted in the policy documents: “Beleidskader Verkeersnetten” (translated: policy traffic networks) and “Notitie Stand van Zaken Voetganger” (translated: Note Situation Pedestrians). It turned out that municipalities have organised and named their policy documents in different ways. Due to the different way of structuring documents, particular information was not available or was documented in multiple documents.

Table 19 and Table 20 in the bibliography provide an overview of the policy documents that were analysed. The document analysis was conducted by using the code scheme in appendix II. The coding was conducted with the qualitative data analysis system (QDAS) of “Atlas.ti”. The outcome was a list of factors and variables of how walkability is defined and used in policy documents of Dutch large cities.

Phase 3: Observations

The aim of phase 3 was to give an answer on the third sub-research question: *"how is walkability applied in planning practice of large Dutch cities?"* This question was answered through a non-participatory observation in four streets or mini cases of both inner cities. A non-participatory observation can be described as an observation in which the observer only watches and listens and does not interfere in its normal activities (Kumar, 2014).

The streets were observed during working days on a Monday and Tuesday from ten o' clock in the morning until five o' clock in the afternoon, in the month July. At these times there were enough pedestrians on the street to analyse the street under average circumstances. Besides, the streets were observed under dry weather conditions to have enough pedestrians on the street. The presence of pedestrians and other traffic on the street showed how the street was functioning for pedestrians. Each street was observed for one hour by walking through the street. As an observer, it was important to act normal and make photos unobtrusive in order that pedestrians do not show other behaviour. Characteristics of the street that can be linked to walkability were photographed. Characteristics of the street that were photographed are the street section, the sidewalks, the obstacles, the presence of shops, lines of sights and the way pedestrians use the street. A panorama photo was taken for each street to analyse how the street section is arranged. While taking the photos in the street, the code of conduct to not have pedestrian recognizable in the picture was taken into account as much as possible. Besides photographing the streets, notes were taken of the walkability factors and variables in the street. The walkability factors and variables present in the street were written down for the domains of pedestrians, place, walking needs, and planning & design. The domain of interests was not analysed through observation. Policy documents, newspaper articles and other sources were used to find the interests of the pedestrian project.

The outcome of the observation was a large number of pictures and a list of walkability factors and variables of each street. The pictures were arranged and ten pictures for each street were selected for further analysis. These pictures were analysed on walkability factors and variables through use of the coding scheme in appendix II. The pictures were compared with pictures from the past. Together with the list of walkabilty factors and variables that were written down during the observation, a walkability profile was made of each street through use of the domains interests, pedestrians, place, walking needs and planning & design.

Phase 4: Semi-structured interviews

The outcomes of the policy document analysis and the observation have been verified and elucidated using eight semi-structured interviews. The interviews have been taken with experts of both municipalities, experts of advice companies and city guides. Half of the participants came from Amsterdam and the other half from Utrecht. The interviewees were selected on the academic level and the affinity with walking and developments in the city. The interviewees were recruited by using contact details in policy documents or by searching the Internet. Table 21 in the bibliography provides an overview of the interviewees. The interviewee was invited for the interview by e-mail. The e-mail informed the interviewee about the objective of the research and the reasons why it would be interesting for them to participate in the interview.

The semi-structured interviews were done according to the interview protocols, which can be found in appendices III, IV and V. A semi-structured interview can be described as an interview with some

probing and open space to share the interviewees perception and ideas (Silverman, 2014). The interviews were recorded by a mobile phone recorder and transcribed afterwards. After transcribing the interview, the interview transcripts were sent to the interviewee for a final check. Subsequently, the interview transcript was coded manually in the qualitative data analysis system (QDAS) of "Atlas.ti". The interviews took place at the organization of the interviewee mostly in a room without other persons. The interviewer brought a printed version of the document analysis and the interview protocol. Each interview question was initiated with a short introduction, based on the findings of the policy document analysis and the observation. The interview was held in Dutch to make the interviewee more comfortable and avoid problems with English terminology.

3.5 Credibility

A couple of strategies were used to secure the credibility of this research. In order to conduct a credible research, it was important to pay attention to the repeatability, reliability and internal validity of the research (Kumar, 2014). Repeatability means the study should have the same results when the study is repeated with the same research design (Kumar, 2014). Reliability is about the research instrument, which should lead to the same results when the study is repeated under the same conditions (Kumar, 2014). Internal validity can be described as the suitability of each step in the research process (Kumar, 2014). In the next paragraphs, the strategies to ensure internal validity for the first four phases of this research will be described.

Multiple strategies were taken into account while conducting the literature review (phase 1). Firstly, a considerable amount of scientific literature pieces have been reviewed in order to give an adequate answer on how walkability is defined and used in scientific literature. Secondly, only scientific papers of journals have been reviewed. Thirdly, the scientific papers were only used if they had a clear connection with walkability. Fourthly, the number of times that a factor or variable was considered as important in the scientific documents was counted with the help of the program "Atlas-ti". Whether a factor or variable is considered as important has been determined by the number of times a factor or variable is mentioned in scientific literature.

Multiple strategies for internal validity were taken into account for the policy document analysis (phase 2). More than 12 policy documents per case were reviewed in order to have a considerable number of sources. The interviews of phase 4 served as an extra check to verify the results of the policy document analysis and observations. Due to the Dutch language of the policy documents, the factors and variables of the coding scheme needed to be translated. The translations of Dutch to English words were thoroughly checked in order to ensure a valid translation.

Lastly, the internal validity of the interviews was ensured. A total of eight interviews with experts were conducted to gain information from a considerable number of sources. All interviews were conducted with the same procedures. The interviewer made sure not to point the interviewee in a particular direction. Lastly, everything was done to ensure that the setting of the interview was as similar as possible.

3.6 Ethical considerations

During the research, multiple ethical considerations were taken into account. Ethics can be described as adhering to the code of conduct (Kumar, 2014). This was mostly applicable to phase 2 of the research, when two municipalities were involved. The policy documents for phase 2 were freely available on the website of the municipalities. When reporting about these documents, the name of the

municipality and the date of publication were always mentioned. Besides this, it was made sure to interpret the data with care to avoid incorrect statements about the municipality. In phase 3, ethics were ensured in the following way. The interviewee was invited by sending a clear and polite e-mail. The interviews were held in Dutch to make sure the interviewee felt comfortable. Besides this, the interviewee was asked for permission to record the conversation at the beginning of the interview. Afterwards, the interviews were transcribed and sent to the interviewee for a final check.

3.7 Position of researcher

The research mainly consists of qualitative research. According to Silverman (2014), qualitative research is influenced by the position of the researcher. The position of the researcher includes personal knowledge and opinions about walkability based on someone's background. These factors might influence the outcome of this research. For this reason, it is important to consider my own position as a researcher.

Due to a bachelor study 'Urban Design' at the NHTV University of Applied Science in Breda and my current master study 'Spatial Planning' at the University of Wageningen, I have combined both the professions of urban design and spatial planning. This resulted in my approach of space from a high strategic level to a detailed urban design level. During my internship at consultancy and engineering firm Movares, I became interested in the world of mobility and in particular walkability. My internship at Movares made me realize how important mobility is and how large the impact of mobility is on space and vice versa.

I believe the benefits of walking are still underestimated and unknown by many professionals and residents. In my opinion walking and walkability should be more encouraged by the government and municipalities. This made me enthusiastic to conduct research on walkability and investigate how we can encourage people to walk. As an "urban designer" and "spatial planner", I am mainly interested in the walking needs of different target groups. I believe walkability should be mainly approached from the perspective of these groups, such as children, working adults, elderly and disabled.

In terms of ontology, I believe observable phenomena can contribute to knowledge about the topic of walkability. My research philosophy during this topic came from a pragmatism perspective. I think walkability can be measured by people's perception and with environmental statistics, which requires a mix of both quantitative and qualitative research. From my point of view, outcomes will be most valuable when people have the opportunity to say what they think.

Summary

SUMMARY
• The research consists of six phases: Phase 1. Quantitative analysis of the scientific literature (Q1). Phase 2. Policy document analysis (Case studies) (Q2). Phase 3. Observations of four redesigned streets in both inner cities (Mini cases) (Q3). Phase 4. Semi-structured interviews with municipal employees, experts and city guides (declare results Q2 and Q3). Phase 5. Comparing the scientific literature and planning policies & practices of large Dutch cities (MQ). Phase 6. Comparing planning policies and practices of large Dutch cities (MQ). • The inner cities of Amsterdam and Utrecht were selected as cases based on a list of selection criteria to find how walkability is defined and used in planning policies and practices of large Dutch cities. • Four streets in both inner cities were selected as mini cases based on a list of selection criteria to find how walkability is applied in planning practice of large Dutch cities.

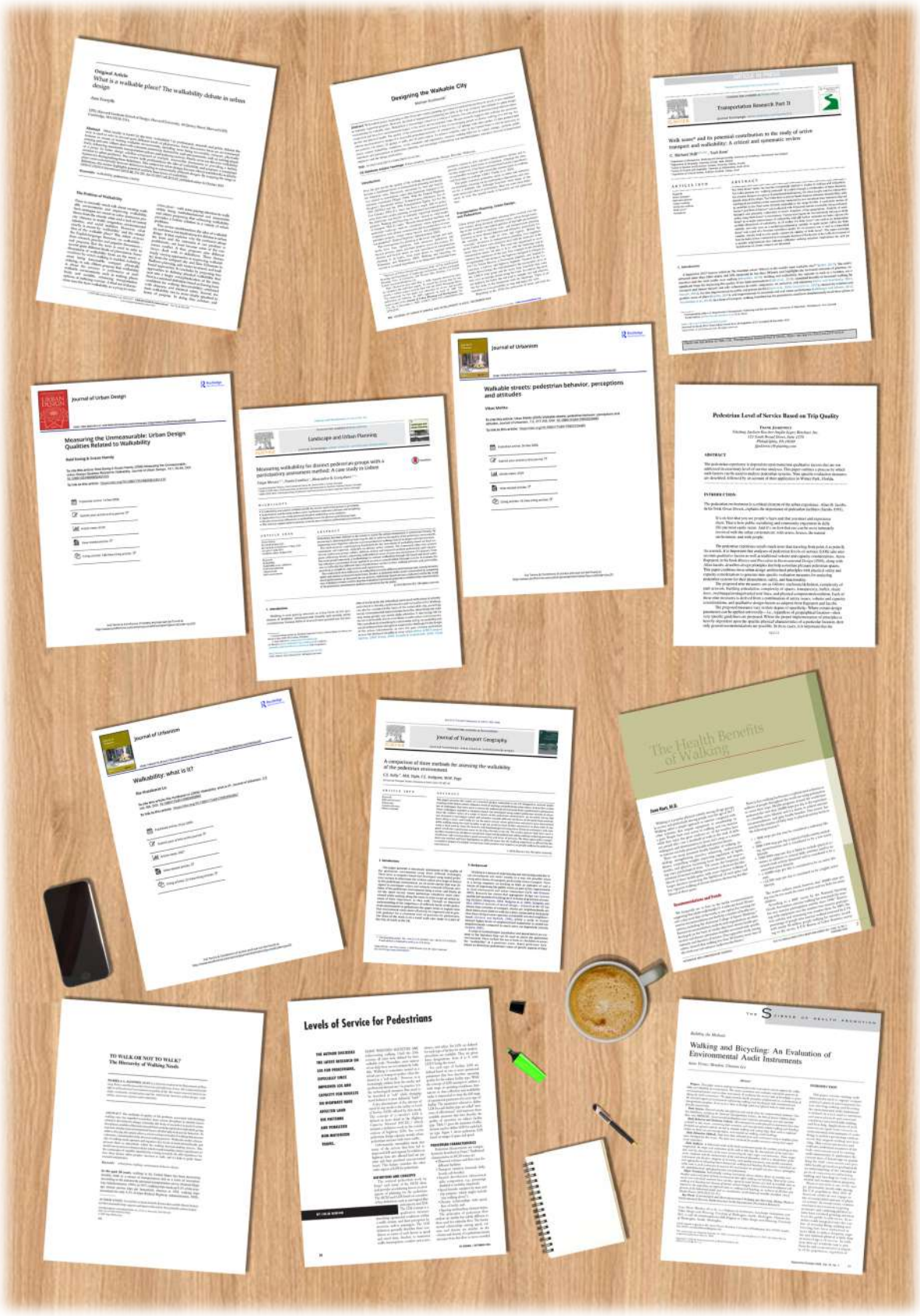

Figure 7: Impression scientific literature.

4. Results

4.1 Introduction

This chapter presents the results of the sub-research questions. Firstly, the results of the first sub-research question will be outlined through a list of walkability trends in scientific literature. Secondly, the results of the second sub-research question will be described by showing the findings of walkability in planning policy of the case studies Amsterdam and Utrecht. Finally, the results of the third sub-research question will be outlined by showing the results of walkability in planning practice of the case studies.

4.2 Walkability in scientific literature

The results of the first sub-research question: *"what are the current walkability trends in international scientific literature?"* will be outlined in this paragraph. The theoretical framework has introduced many walkability factors and variables. In this section, the occurrence of these factors and variables in each discipline will be presented. A factor or variable is considered as a trend when it is mentioned in five papers or more in the disciplines of planning and urban design, and public health; three or more in the discipline of transportation; and two or more in the disciplines of economy and sociology. The factor or variables are considered as a general. trend when it is ten or more in the last column.

Interests

Table 4 (next page) shows the results of the domain of interest in scientific literature. Multiple findings can be derived from the domain of interests when analysing. Many papers, including planning and urban design papers, consider walkability as a means to ***reduce automobile use*** in cities (e.g. Cervero and Kockelman, 1997; Southworth, 2005; Lo, 2009). Part of these papers link less automobile use also to ***less air and noise pollution*** (e.g. Moudon and Lee, 2003; Cao, Handy and Mokhtarian, 2006; Sallis, 2009) and ***less energy consumption*** (e.g. Cervero and Kockelman, 1997; Southworth, 2005; Mehta, 2008).

The interests most frequently mentioned by scientists, including many public health scientists and planning and urban design scientists is ***physical and mental health*** (e.g. Lee and Buchner, 2008; Frank *et al.*, 2009; Hall and Ram, 2018). An interest that can be linked to public health is ***quality of life*** and is mentioned by some planning and urban design, and public health scientists (e.g. Pucher and Dijkstra, 2003; Alfonzo, 2005; Shamsuddin, Hassan and Bilyamin, 2012). Reducing the number of accidents and providing ***traffic safety*** can be linked to public health and is often mentioned by transportation papers (e.g. Henson, 2000; Jaskiewicz, 2000; Kelly *et al.*, 2011).

Besides the public health benefits, the economic benefits of walkability are frequently mentioned. Walkability in seen as a way to ***save societal costs*** by many planning and urban design, transportation and economic scientists (e.g. Cortright, 2009; Pivo and Fisher, 2011; Litman, 2018). Besides this, many scientists, including economic scientists link walkability to the ***increase of real estate values*** (e.g. Pivo and Fisher, 2011; Rauterkus and Miller, 2011; Litman, 2018). Although not many research have been conducted about the social benefits of walkability, scientists of planning and urban design, economy and sociology often link walkability to improved ***social capital*** (e.g. Leyden, 2003; Rogers *et al.*, 2011; Forsyth, 2015). A few planning and urban design scientists link improved walkability also to ***social equity*** (e.g. Tolley, 2011; Moura, Cambra and Gonçalves, 2017; Litman, 2018) and improved ***safety from crime*** (e.g. Alfonzo, 2005; Mehta, 2008; Zakaria and Ujang, 2015).

Table 4: List of interests mentioned in various disciplines.

P: Planning and Urban design; T: Transportation; H: Public Health; E: Economy; S: Sociology; #: Total. Trends are **bold**.

INTERESTS IN SCIENTIFIC LITERATURE							
TRENDS	**SCIENTISTS**	**P 20**	**T 10**	**H 20**	**E 5**	**S 5**	**# 60**
Less automobile use	(Cervero and Kockelman, 1997; Moudon and Lee, 2003; Pucher and Dijsktra, 2003; Southworth, 2005; Cao, Handy and Mokhtarian, 2006; Lee and Buchner, 2008; Lo, 2009; Sallis, 2009; Cortright, 2009; Frank *et al.*, 2009; Ewing and Cervero, 2010; Pivo and Fisher, 2011; Rauterkus and Miller, 2011; Tolley, 2011; Reyer *et al.*, 2014; Zakaria and Ujang, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Zuniga-Teran *et al.*, 2016; Litman, 2018; Ferrer and Ruiz, 2018; Habibian and Hosseinzadeh, 2018; Hall and Ram, 2018)	**10**	**3**	**5**	**5**	0	**23**
Less air and noise pollution	(Cervero and Kockelman, 1997; Pucher and Dijsktra, 2003; Moudon and Lee, 2003; Southworth, 2005; Cao, Handy and Mokhtarian, 2006; Lee and Buchner, 2008; Sallis, 2009; Frank *et al.*, 2009; Ewing and Cervero, 2010; Rauterkus and Miller, 2011; Tolley, 2011; Pivo and Fisher, 2011; Reyer *et al.*, 2014; Habibian and Hosseinzadeh, 2018; Hall and Ram, 2018; Litman, 2018)	**6**	2	**5**	**2**	0	**15**
Less energy consumption	(Cervero and Kockelman, 1997; Pucher and Dijsktra, 2003; Southworth, 2005; Mehta, 2008; Ewing and Cervero, 2010; Tolley, 2011; Pivo and Fisher, 2011; Lee and Talen, 2014; Forsyth, 2015; Ferrer and Ruiz, 2018; Litman, 2018)	**6**	2	1	**2**	0	**11**
Physical and mental health	(Moudon and Lee, 2003; Pikora *et al.*, 2003; Pucher and Dijsktra, 2003; Saelens, Sallis and Frank, 2003; Leslie *et al.*, 2005, 2007; Frank, Andresen and Schmid, 2004; Alfonzo, 2005; Southworth, 2005; Brennan Ramirez *et al.*, 2006; Leslie, Butterworth and Edwards, 2006; Cao, Handy and Mokhtarian, 2006; Doyle *et al.*, 2006; Lee and Buchner, 2008; Mehta, 2008; Hart, 2009; Cortright, 2009; Frank *et al.*, 2009; Hoedl, Titze and Oja, 2010; Powell, Paluch and Blair, 2011; Rauterkus and Miller, 2011; Rogers *et al.*, 2011; Tolley, 2011; Duncan *et al.*, 2011; Shamsuddin, Hassan and Bilyamin, 2012; Weinberger and Sweet, 2012; Talen and Koschinsky, 2013, 2014; Lee and Talen, 2014; Reyer *et al.*, 2014; Weber, 2014; Hajna *et al.*, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Zuniga-Teran *et al.*, 2016; Moura, Cambra and Gonçalves, 2017; Hall and Ram, 2018; Litman, 2018)	**11**	**4**	**17**	**4**	**2**	**38**
Quality of life	(Pucher and Dijsktra, 2003; Alfonzo, 2005; Ewing and Handy, 2009; Frank *et al.*, 2009; Sallis, 2009; Rauterkus and Miller, 2011; Tolley, 2011; Shamsuddin, Hassan and Bilyamin, 2012; Weinberger and Sweet, 2012; Blečić *et al.*, 2015)	3	1	3	**2**	1	**10**
Traffic safety	(Henson, 2000; Jaskiewicz, 2000; Leyden, 2003; Pikora *et al.*, 2003; Pucher and Dijkstra, 2003; Saelens *et al.*, 2003; Abley, 2005; Alfonzo, 2005; Southworth, 2005; Mehta, 2008; Kelly *et al.*, 2011; Weber, 2014)	3	**5**	3	0	1	**12**
Cost savings	(Henson, 2000; Pucher and Dijkstra, 2003; Cao, Handy and Mokhtarian, 2006; Doyle *et al.*, 2006; Lee and Buchner, 2008; Cortright, 2009; Tolley, 2011; Pivo and Fisher, 2011; Shamsuddin, Hassan and Bilyamin, 2012; Talen and Koschinsky, 2013, 2014; Weber, 2014; Zakaria and Ujang, 2015; Gilderbloom, Riggs and Meares, 2015; Litman, 2018)	4	**4**	2	**4**	1	**15**
Real estate values	(Henson, 2000; Cortright, 2009; Tolley, 2011; Pivo and Fisher, 2011; Rauterkus and Miller, 2011; Talen and Koschinsky, 2013; Lee and Talen, 2014; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Zuniga-Teran *et al.*, 2016; Hall and Ram, 2018; Litman, 2018)	4	2	1	**5**	0	**12**
Social capital	(King *et al.*, 2002; Leyden, 2003; Southworth, 2005; Tolley, 2011; Pivo and Fisher, 2011; Rauterkus and Miller, 2011; Rogers *et al.*, 2011; Talen and Koschinsky, 2013; Lee and Talen, 2014; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Litman, 2018)	4	1	1	**4**	**2**	**12**
Social equity	(Frank *et al.*, 2009; Lo, 2009; Tolley, 2011; Talen and Koschinsky, 2013, 2014; Forsyth, 2015 Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Moura, Cambra and Gonçalves, 2017; Litman, 2018)	**5**	1	1	2	0	9
Safety from crime	(Alfonzo, 2005; Brennan Ramirez *et al.*, 2006; Doyle *et al.*, 2006; Mehta, 2008; Pivo and Fisher, 2011; Lee and Talen, 2014; Gilderbloom, Riggs and Meares, 2015; Zakaria and Ujang, 2015; Litman, 2018)	**5**	1	1	2	0	8

Pedestrians

Table 5 shows the results of the domain of pedestrians in scientific literature. A few pedestrian characteristics have been frequently mentioned in multiple papers. A large number of scientists, including many planning and urban design, transportation and public health scientists included ***age*** (e.g. vulnerable groups, such as children and elderly) as one of the personal factors influencing walking behaviour (e.g. Moudon and Lee, 2003; Leslie *et al.*, 2005; Moura, Cambra and Gonçalves, 2017). Besides age, ***gender*** is often considered a factor influencing walking rates and is often included in walkability instruments (e.g. Alfonzo, 2005; Mehta, 2008; Blečić *et al.*, 2015). Another vulnerable group are ***disabled***, such as people in a wheelchair or other walking aids, which are frequently mentioned by planners and urban designers (e.g. Henson, 2000; Pikora *et al.*, 2003; Lo, 2009). A large number of scientists, including many planning and urban design, transportation and public health scientists argue what is most walkable is different for each ***walking purpose*** (e.g. Forsyth, 2015; Moura, Cambra and Gonçalves, 2017; Ferrer and Ruiz, 2018). Various walking purposes have been investigated, including walking for transportation, recreation and exercise.

Table 5: List of pedestrian characteristics mentioned in various disciplines.

P: Planning and Urban design; T: Transportation; H: Public Health; E: Economy; S: Sociology; #: Total. Trends are **bold**.

PEDESTRIAN CHARACTERISTICS IN SCIENTIFIC LITERATURE							
TRENDS	**SCIENTISTS**	**P 20**	**T 10**	**H 20**	**E 5**	**S 5**	**# 60**
Age	(Moudon and Lee, 2003; Pucher and Dijkstra, 2003; Saelens, Sallis and Frank, 2003; Saelens *et al.*, 2003; Frank, Andresen and Schmid, 2004; Leslie *et al.*, 2005; Abley, 2005; Southworth, 2005; Alfonzo, 2005; Cao, Handy and Mokhtarian, 2006; Cerin *et al.*, 2006; Doyle *et al.*, 2006; Lee and Buchner, 2008; Mehta, 2008; Lo, 2009; Frank *et al.*, 2009; Rogers *et al.*, 2011; Reyer *et al.*, 2014; Blečić *et al.*, 2015; Forsyth, 2015; Moura, Cambra and Gonçalves, 2017; Zuniga-Teran *et al.*, 2017; Habibian and Hosseinzadeh, 2018; Hall and Ram, 2018; Ferrer and Ruiz, 2018)	**10**	**4**	**9**	0	**2**	**25**
Gender	(Leyden, 2003; Moudon and Lee, 2003; Saelens, Sallis and Frank, 2003; Saelens *et al.*, 2003; Frank, Andresen and Schmid, 2004; Abley, 2005; Alfonzo, 2005; Cao, Handy and Mokhtarian, 2006; Cerin *et al.*, 2006; Doyle *et al.*, 2006; Mehta, 2008; Lo, 2009; Duncan *et al.*, 2011; Talen and Koschinsky, 2013, 2014; Blečić *et al.*, 2015; Forsyth, 2015; Moura, Cambra and Gonçalves, 2017; Zuniga-Teran *et al.*, 2017; Habibian and Hosseinzadeh, 2018; Hall and Ram, 2018; Ferrer and Ruiz, 2018; Hooi and Pojani, 2019)	**12**	**4**	**5**	0	**2**	**23**
Disability	(Henson, 2000; Saelens, Sallis and Frank, 2003; Pikora *et al.*, 2003; Lo, 2009; Talen and Koschinsky, 2013; Reyer *et al.*, 2014; Talen and Koschinsky, 2014; Blečić *et al.*, 2015; Forsyth, 2015; Zakaria and Ujang, 2015; Moura, Cambra and Gonçalves, 2017; Litman, 2018)	**7**	2	3	0	0	**12**
Purpose	(Cervero and Kockelman, 1997; Henson, 2000; Saelens *et al.*, 2003; Moudon and Lee, 2003; Alfonzo, 2005; Leslie *et al.*, 2007; Southworth, 2005; Brennan Ramirez *et al.*, 2006; Cao, Handy and Mokhtarian, 2006; Leslie, Butterworth and Edwards, 2006; Lee and Buchner, 2008; Mehta, 2008; Lo, 2009; Sallis, 2009; Frank *et al.*, 2009; Ewing and Cervero, 2010; Pivo and Fisher, 2011; Weinberger and Sweet, 2012; Lee and Talen, 2014; Reyer *et al.*, 2014; Blečić *et al.*, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Moura, Cambra and Gonçalves, 2017; Zuniga-Teran *et al.*, 2017; Habibian and Hosseinzadeh, 2018; Hall and Ram, 2018; Ferrer and Ruiz, 2018)	**12**	**5**	**9**	**2**	0	**28**

Place

Table 6 shows the results of the domain of place in scientific literature. Two factors influencing walkability have been frequently mentioned in the domain of place. Many scientists, including many planning and urban design, and transportation scientists included walking needs and planning & design for ***climate*** or weather in their paper (e.g. Henson, 2000; Alfonzo, 2005; Southworth, 2005). Besides climate, ***topographical characteristics*** (e.g. slope and view) have been frequently mentioned by various scientists, including scientists of planning and urban design, transportation and economy (e.g. Alfonzo, 2005; Ewing and Handy, 2009; Hall and Ram, 2018).

Table 6: List of place characteristics mentioned in various disciplines.

P: Planning and Urban design; T: Transportation; H: Public Health; E: Economy; S: Sociology; #: Total. Trends are **bold**.

PLACE CHARACTERISTICS IN SCIENTIFIC LITERATURE							
TRENDS	**SCIENTISTS**	**P 20**	**T 10**	**H 20**	**E 5**	**S 5**	**# 60**
Climate	(Henson, 2000; Saelens, Sallis and Frank, 2003; Abley, 2005; Alfonzo, 2005; Southworth, 2005; Mehta, 2008; Sallis, 2009; Hart, 2009; Lo, 2009; Pivo and Fisher, 2011; Rauterkus and Miller, 2011; Rogers *et al.*, 2011; Forsyth, 2015; Ferrer and Ruiz, 2018; Hall and Ram, 2018; Hooi and Pojani, 2019)	**6**	**4**	3	**2**	1	**16**
Topography	(Cervero and Kockelman, 1997; Henson, 2000; Saelens, Sallis and Frank, 2003; Leslie *et al.*, 2005, 2007; Alfonzo, 2005; Southworth, 2005; Sallis, 2009; Ewing and Handy, 2009; Pivo and Fisher, 2011; Rauterkus and Miller, 2011; Blečić *et al.*, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Ferrer and Ruiz, 2018; Hall and Ram, 2018)	**6**	**3**	4	**3**	0	**16**

Walking needs

Table 7 (next page) shows the results of the domain of walking needs in scientific literature. The ***accessibility*** (e.g. Moudon and Lee, 2003; Alfonzo, 2005; Moura, Cambra and Gonçalves, 2017) of walking environments and ***connectivity*** (e.g. Henson, 2000; Jaskiewicz, 2000) by foot between places are both considered as important in all disciplines. Similar to accessibility and connectivity, ***proximity*** can be linked to short walking distance and is frequently mentioned by scientists of planning and urban design, public health, economy and sociology (e.g. Pikora *et al.*, 2003; Saelens *et al.*, 2003).

Safety from crime is considered as important by many scientists of planning and urban design, transportation and economy (Southworth, 2005; Pivo and Fisher, 2011; Ferrer and Ruiz, 2018). Safety from crime is often linked to the walking needs of ***visibility*** (e.g. Alfonzo, 2005; Zuniga-Teran *et al.*, 2016; Moura, Cambra and Gonçalves, 2017) and ***maintenance*** (e.g. Pikora *et al.*, 2003; Alfonzo, 2005; Mehta, 2008). ***Traffic safety*** is frequently mentioned by the disciplines of planning and urban design, transportation and public health (e.g. Jaskiewicz, 2000; Pikora *et al.*, 2003; Mehta, 2008). Traffic safety is mainly linked to the walking needs of ***low traffic speed*** (e.g. Jaskiewicz, 2000; Abley, 2005; Southworth, 2005) and ***low traffic volume*** (e.g. Jaskiewicz, 2000; Mehta, 2008; Kelly *et al.*, 2011), and to a lower extent to ***distance between pedestrians and fast traffic*** (e.g. Jaskiewicz, 2000; Moudon and Lee, 2003; Lo, 2009) and ***visibility*** (e.g. Pucher and Dijkstra, 2003; Abley, 2005).

Many scientists, including scientists of planning and urban design, transportation and sociology consider ***comfort*** as an important walking need to increase walking rates (e.g. Alfonzo, 2005; Southworth, 2005). Comfort can be linked to climate comfort, which is linked to ***coolness*** (e.g. Mehta, 2008; Lo, 2009), ***shade*** and ***shelter*** (e.g. Henson, 2000; Pikora *et al.*, 2003).

Multiple scientific papers, including papers of planning and urban design and public health also paid attention to ***pleasurability*** or related words, such as attractiveness (e.g. Moudon and Lee, 2003; Alfonzo, 2005; Cerin *et al.*, 2006). Pleasurability is often supported by other walking needs, including ***experience*** (e.g. Mehta, 2008; Ewing and Handy, 2009; Ferrer and Ruiz, 2018), ***complexity*** (e.g. Ewing *et al.*, 2006; Moura, Cambra and Gonçalves, 2017; Hooi and Pojani, 2019), ***liveliness*** (e.g. Mehta, 2008; Forsyth, 2015; Ferrer and Ruiz, 2018) and ***aesthetics*** (e.g. Pikora *et al.*, 2003; Brennan Ramirez *et al.*, 2006; Sallis, 2009). The first three walking needs have been frequently mentioned in planning and urban design papers, while the last one has been mentioned frequently in all disciplines.

Table 7: List of walking needs mentioned in various disciplines.

P: Planning and Urban design; T: Transportation; H: Public Health; E: Economy; S: Sociology; #: Total. Trends are **bold**.

WALKING NEEDS IN SCIENTIFIC LITERATURE							
TRENDS	**SCIENTISTS**	**P 20**	**T 10**	**H 20**	**E 5**	**S 5**	**# 60**
Accessibility	(Cervero and Kockelman, 1997; King *et al.*, 2002; Saelens *et al.*, 2003; Moudon and Lee, 2003; Saelens, Sallis and Frank, 2003; Leslie *et al.*, 2005, 2005; Alfonzo, 2005; Southworth, 2005; Leslie, Butterworth and Edwards, 2006; Brennan Ramirez *et al.*, 2006; Cerin *et al.*, 2006; Cao, Handy and Mokhtarian, 2006; Cerin *et al.*, 2007; Lee and Buchner, 2008; Mehta, 2008; Hart, 2009; Lo, 2009; Cortright, 2009; Ewing and Cervero, 2010; Pivo and Fisher, 2011; Rogers *et al.*, 2011; Tolley, 2011; Duncan *et al.*, 2011; Rauterkus and Miller, 2011; Shamsuddin, Hassan and Bilyamin, 2012; Weinberger and Sweet, 2012; Talen and Koschinsky, 2013, 2014; Blečić *et al.*, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Hajna *et al.*, 2015; Zakaria and Ujang, 2015; Moura, Cambra and Gonçalves, 2017; Habibian and Hosseinzadeh, 2018; Hall and Ram, 2018; Litman, 2018)	**14**	**4**	**11**	**5**	**4**	**38**
Connectivity	(Henson, 2000; Jaskiewicz, 2000; King *et al.*, 2002; Moudon and Lee, 2003; Saelens, Sallis and Frank, 2003; Saelens *et al.*, 2003; Frank, Andresen and Schmid, 2004; Leslie *et al.*, 2005; Alfonzo, 2005; Southworth, 2005; Cerin *et al.*, 2006; Leslie, Butterworth and Edwards, 2006; Doyle *et al.*, 2006; Ewing *et al.*, 2006; Cerin *et al.*, 2007; Mehta, 2008; Lo, 2009; Frank *et al.*, 2009; Ewing and Cervero, 2010; Kelly *et al.*, 2011; Pivo and Fisher, 2011; Tolley, 2011; Duncan *et al.*, 2011; Shamsuddin, Hassan and Bilyamin, 2012; Weinberger and Sweet, 2012; Talen and Koschinsky, 2013, 2014; Lee and Talen, 2014; Reyer *et al.*, 2014; Gilderbloom, Riggs and Meares, 2015; Hajna *et al.*, 2015; Zakaria and Ujang, 2015; Forsyth, 2015; Zuniga-Teran *et al.*, 2016, 2017; Moura, Cambra and Gonçalves, 2017; Habibian and Hosseinzadeh, 2018; Hall and Ram, 2018; Ferrer and Ruiz, 2018)	**16**	**6**	**11**	**3**	**3**	**39**
Proximity	(King *et al.*, 2002; Moudon and Lee, 2003; Saelens *et al.*, 2003; Saelens, Sallis and Frank, 2003; Pikora *et al.*, 2003; Leslie *et al.*, 2005; Alfonzo, 2005; Leslie *et al.*, 2007; Cerin *et al.*, 2006, 2007; Mehta, 2008; Cortright, 2009; Frank *et al.*, 2009; Pivo and Fisher, 2011; Rogers *et al.*, 2011; Rauterkus and Miller, 2011; Talen and Koschinsky, 2013, 2014; Reyer *et al.*, 2014; Lee and Talen, 2014; Zakaria and Ujang, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Zuniga-Teran *et al.*, 2017; Hall and Ram, 2018)	**8**	1	**9**	**4**	**3**	**25**
Safety from crime	(Henson, 2000; King *et al.*, 2002; Moudon and Lee, 2003; Pikora *et al.*, 2003; Leslie *et al.*, 2005; Alfonzo, 2005; Southworth, 2005; Cerin *et al.*, 2007; Mehta, 2008; Lo, 2009; Kelly *et al.*, 2011; Pivo and Fisher, 2011; Lee and Talen, 2014; Talen and Koschinsky, 2014; Blečić *et al.*, 2015; Zakaria and Ujang, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Zuniga-Teran *et al.*, 2016; 2017; Moura, Cambra and Gonçalves, 2017; Ferrer and Ruiz, 2018)	**12**	**3**	4	**2**	1	**22**
Traffic safety	(Jaskiewicz, 2000; Henson, 2000; King *et al.*, 2002; Moudon and Lee, 2003; Pucher and Dijkstra, 2003; Pikora *et al.*, 2003; Leslie *et al.*, 2005; Alfonzo, 2005; Southworth, 2005; Cao, Handy and Mokhtarian, 2006; Cerin *et al.*, 2007; Mehta, 2008; Lo, 2009; Hoedl, Titze and Oja, 2010; Kelly *et al.*, 2011; Pivo and Fisher, 2011; Lee and Talen, 2014; Talen and Koschinsky, 2014;	**12**	**5**	**6**	1	1	**25**

	Blečić *et al.*, 2015; Zakaria and Ujang, 2015; Forsyth, 2015; Zuniga-Teran *et al.*, 2016; 2017; Moura, Cambra and Gonçalves, 2017; Ferrer and Ruiz, 2018)						
Visibility	(Moudon and Lee, 2003; Pucher and Dijkstra, 2003; Abley, 2005; Alfonzo, 2005; Southworth, 2005; Ewing *et al.*, 2006; Ewing and Handy, 2009; Zakaria and Ujang, 2015; Zuniga-Teran *et al.*, 2016; Moura, Cambra and Gonçalves, 2017)	**8**	1	1	0	0	**10**
Maintenance	(Moudon and Lee, 2003; Pikora *et al.*, 2003; Alfonzo, 2005; Southworth, 2005; Mehta, 2008; Sallis, 2009; Lo, 2009; Tolley, 2011; Kelly *et al.*, 2011; Lee and Talen, 2014; Blečić *et al.*, 2015; Zakaria and Ujang, 2015; Forsyth, 2015; Zuniga-Teran *et al.*, 2016, 2017; Moura, Cambra and Gonçalves, 2017)	**11**	1	3	1	0	**16**
Distance to other traffic	(Jaskiewicz, 2000; Moudon and Lee, 2003; Alfonzo, 2005; Lo, 2009; Lee and Talen, 2014; Forsyth, 2015; Zuniga-Teran *et al.*, 2016)	**6**	1	0	0	0	7
Low traffic speed	(Henson, 2000; Jaskiewicz, 2000; King *et al.*, 2002; Leyden, 2003; Pikora *et al.*, 2003; Pucher and Dijkstra, 2003; Saelens *et al.*, 2003; Moudon and Lee, 2003; Leslie *et al.*, 2005; Abley, 2005; Southworth, 2005; Alfonzo, 2005; Cao, Handy and Mokhtarian, 2006; Mehta, 2008; Lo, 2009; Ewing and Handy, 2009; Hoedl, Titze and Oja, 2010; Kelly *et al.*, 2011; Duncan *et al.*, 2011; Tolley, 2011; Weinberger and Sweet, 2012; Lee and Talen, 2014; Weber, 2014; Blečić *et al.*, 2015; Zakaria and Ujang, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Zuniga-Teran *et al.*, 2016, 2017; Ferrer and Ruiz, 2018; Hall and Ram, 2018; Hooi and Pojani, 2019)	**12**	**9**	**8**	**2**	1	**32**
Low traffic volume	(Jaskiewicz, 2000; Pikora *et al.*, 2003; Alfonzo, 2005; Southworth, 2005; Mehta, 2008; Lo, 2009; Kelly *et al.*, 2011; Litman, 2018)	4	**3**	1	0	0	8
Comfort	(Henson, 2000; Jaskiewicz, 2000; Moudon and Lee, 2003; Abley, 2005; Alfonzo, 2005; Southworth, 2005; Cao, Handy and Mokhtarian, 2006; Ewing *et al.*, 2006; Mehta, 2008; Ewing and Handy, 2009; Lo, 2009; Rogers *et al.*, 2011; Shamsuddin, Hassan and Bilyamin, 2012; Talen and Koschinsky, 2013; Zakaria and Ujang, 2015; Forsyth, 2015; Zuniga-Teran *et al.*, 2016, 2017; Moura, Cambra and Gonçalves, 2017; Litman, 2018)	**12**	**5**	1	0	**2**	**20**
Shade and shelter	(Cervero and Kockelman, 1997; Henson, 2000; Jaskiewicz, 2000; Moudon and Lee, 2003; Pikora *et al.*, 2003; Brennan Ramirez *et al.*, 2006; Cao, Handy and Mokhtarian, 2006; Cerin *et al.*, 2006; Leslie, Butterworth and Edwards, 2006; Mehta, 2008; Lo, 2009; Ewing and Handy, 2009; Tolley, 2011; Zakaria and Ujang, 2015; Zuniga-Teran *et al.*, 2016, 2017; Ferrer and Ruiz, 2018; Hooi and Pojani, 2019)	**8**	**4**	4	1	1	**18**
Coolness	(Jaskiewicz, 2000; Saelens, Sallis and Frank, 2003; Abley, 2005; Mehta, 2008; Lo, 2009; Talen and Koschinsky, 2014; Zuniga-Teran *et al.*, 2016; Hooi and Pojani, 2019)	**5**	2	1	0	0	8
Pleasurability	(Cervero and Kockelman, 1997; Pikora *et al.*, 2003; Moudon and Lee, 2003; Frank, Andresen and Schmid, 2004; Leslie *et al.*, 2005, 2007; Alfonzo, 2005; Southworth, 2005; Cerin *et al.*, 2006; Mehta, 2008; Hoedl, Titze and Oja, 2010; Tolley, 2011; Blečić *et al.*, 2015; Zakaria and Ujang, 2015; Forsyth, 2015; Moura, Cambra and Gonçalves, 2017; Zuniga-Teran *et al.*, 2017; Litman, 2018; Ferrer and Ruiz, 2018)	**9**	2	**6**	1	1	**19**
Experience	(Alfonzo, 2005; Southworth, 2005; Mehta, 2008; Ewing and Handy, 2009; Talen and Koschinsky, 2013; Forsyth, 2015; Zakaria and Ujang, 2015; Zuniga-Teran *et al.*, 2016, 2017; Ferrer and Ruiz, 2018)	**8**	1	1	0	0	**10**
Aesthetics	(Jaskiewicz, 2000; King *et al.*, 2002; Saelens *et al.*, 2003; Saelens, Sallis and Frank, 2003; Pikora *et al.*, 2003; Leslie *et al.*, 2005, 2007; Southworth, 2005; Alfonzo, 2005; Brennan Ramirez *et al.*, 2006; Cerin *et al.*, 2006, 2007; Lo, 2009; Sallis, 2009; Kelly *et al.*, 2011; Pivo and Fisher, 2011; Tolley, 2011; Duncan *et al.*, 2011; Forsyth, 2015; Hajna *et al.*, 2015; Zuniga-Teran *et al.*, 2016, 2017; Ferrer and Ruiz, 2018; Hall and Ram, 2018)	**5**	**4**	**11**	**2**	**2**	**24**
Complexity	(Jaskiewicz, 2000; Alfonzo, 2005; Southworth, 2005; Ewing *et al.*, 2006, 2009; Mehta, 2008; Lo, 2009; Moura, Cambra and Gonçalves, 2017; Hooi and Pojani, 2019)	**8**	1	0	0	0	9
Liveliness	(Alfonzo, 2005; Mehta, 2008; Cortright, 2009; Tolley, 2011; Talen and Koschinsky, 2013; Lee and Talen, 2014; Forsyth, 2015; Zuniga-Teran *et al.*, 2017; Ferrer and Ruiz, 2018)	**5**	1	1	**2**	0	9

Planning & design

Table 8 shows the results of the domain of planning & design in scientific literature. A few planning & design measures are often linked to the accessibility of walking routes, including the ***presence of a path*** (e.g. Alfonzo, 2005; Southworth, 2005; Mehta, 2008) and ***absence of obstacles*** (e.g. Pikora *et al.*, 2003; Lo, 2009; Ferrer and Ruiz, 2018). The level of accessibility is also influenced by walking distance, which can be linked to the planning & design features of ***absence of barriers*** (e.g. Saelens, Sallis and Frank, 2003; Leslie *et al.*, 2007; Duncan *et al.*, 2011), ***land use diversity*** (e.g. Cervero and Kockelman, 1997; Frank *et al.*, 2009; Habibian and Hosseinzadeh, 2018) and ***land use density*** (e.g. Cervero and Kockelman, 1997; Saelens *et al.*, 2003; Cerin *et al.*, 2006).

The walking need safety from crime is often linked to ***land use type*** (e.g. Moudon and Lee, 2003; Alfonzo, 2005; Frank *et al.*, 2009), ***street lighting*** (e.g. Henson, 2000; Southworth, 2005; Kelly *et al.*, 2011), ***urban form*** (e.g. Alfonzo, 2005; Shamsuddin, Hassan and Bilyamin, 2012; Zakaria and Ujang, 2015) and ***windows visible from the street*** (e.g. Jaskiewicz, 2000; Alfonzo, 2005; Zuniga-Teran *et al.*, 2016). Traffic safety is often supported by measures limiting traffic speeds and traffic volume, including the ***number of lanes*** (e.g. Jaskiewicz, 2000; Southworth, 2005; Gilderbloom, Riggs and Meares, 2015). Besides this, some planning and urban design scientists link the ***presence of a buffer zone*** to traffic safety (e.g. Jaskiewicz, 2000; Alfonzo, 2005; Forsyth, 2015).

According to some planning and urban design scientists, the level of pedestrian comfort is provided by ***path width*** (e.g. Moudon and Lee, 2003; Mehta, 2008; Kelly *et al.*, 2011), ***surface*** (e.g. Pikora *et al.*, 2003; Ewing and Handy, 2009; Hooi and Pojani, 2019) and ***street furniture*** (e.g. Alfonzo, 2005; Mehta, 2008; Lee and Talen, 2014). The presences of ***street trees*** (e.g. Southworth, 2005; Brennan Ramirez *et al.*, 2006; Hoedl, Titze and Oja, 2010) is also mentioned as a factor providing comfort and pleasurability.

Multiple planners and urban designers link pleasurability also to ***architecture*** (e.g. Pikora *et al.*, 2003; Alfonzo, 2005; Moura, Cambra and Gonçalves, 2017), ***urban design*** (e.g. Pikora *et al.*, 2003; Leslie *et al.*, 2007; Ewing and Handy, 2009) and ***outdoor activities*** (e.g. Alfonzo, 2005; Cortright, 2009).

Table 8: List of planning & design measures mentioned in various disciplines.

P: Planning and Urban design; T: Transportation; H: Public Health; E: Economy; S: Sociology; #: Total. Trends are **bold**.

PLANNING & DESIGN IN SCIENTIFIC LITERATURE							
TRENDS	**SCIENTISTS**	**P 20**	**T 10**	**H 20**	**E 5**	**S 5**	**# 60**
Presence of path	(King *et al.*, 2002; Moudon and Lee, 2003; Alfonzo, 2005; Southworth, 2005; Leslie, Butterworth and Edwards, 2006; Mehta, 2008; Frank *et al.*, 2009; Lo, 2009)	**5**	0	3	0	0	8
absence of obstacle	(Henson, 2000; Pikora *et al.*, 2003; Pucher and Dijkstra, 2003; Abley, 2005; Alfonzo, 2005; Leslie *et al.*, 2007; Cerin *et al.*, 2006, 2007; Leslie, Butterworth and Edwards, 2006; Mehta, 2008; Lo, 2009; Zakaria and Ujang, 2015; Moura, Cambra and Gonçalves, 2017; Ferrer and Ruiz, 2018)	**5**	**3**	4	0	**2**	**14**
Absence of physical barriers	(Moudon and Lee, 2003; Pikora *et al.*, 2003; Saelens, Sallis and Frank, 2003; Leslie *et al.*, 2005, 2007; Alfonzo, 2005; Southworth, 2005; Brennan Ramirez *et al.*, 2006; Leslie, Butterworth and Edwards, 2006; Cerin *et al.*, 2007; Mehta, 2008; Pivo and Fisher, 2011; Duncan *et al.*, 2011; Kelly *et al.*, 2011; Shamsuddin, Hassan and Bilyamin, 2012; Lee and Talen, 2014; Blečić *et al.*, 2015; Zuniga-Teran *et al.*, 2016, 2017; Moura, Cambra and Gonçalves, 2017; Litman, 2018)	**8**	**8**	2	1	**2**	**21**

Land use diversity	(Cervero and Kockelman, 1997; Saelens *et al.*, 2003; Saelens, Sallis and Frank, 2003; Frank, Andresen and Schmid, 2004; Alfonzo, 2005; Leslie *et al.*, 2007; Southworth, 2005; Cao, Handy and Mokhtarian, 2006; Leslie, Butterworth and Edwards, 2006; Cerin *et al.*, 2006, 2007; Frank *et al.*, 2009; Ewing and Cervero, 2010; Pivo and Fisher, 2011; Talen and Koschinsky, 2013; Gilderbloom, Riggs and Meares, 2015; Hajna *et al.*, 2015; Forsyth, 2015; Zuniga-Teran *et al.*, 2016; Moura, Cambra and Gonçalves, 2017; Habibian and Hosseinzadeh, 2018; Ferrer and Ruiz, 2018)	**9**	2	**7**	**2**	**2**	**22**
Land use density	(Cervero and Kockelman, 1997; Henson, 2000; King *et al.*, 2002; Leyden, 2003; Saelens, Sallis and Frank, 2003; Moudon and Lee, 2003; Frank, Andresen and Schmid, 2004; Leslie *et al.*, 2005, 2007; Alfonzo, 2005; Southworth, 2005; Cerin *et al.*, 2006; Ewing *et al.*, 2006; Leslie, Butterworth and Edwards, 2006; Cerin *et al.*, 2007; Mehta, 2008; Frank *et al.*, 2009; Lo, 2009; Sallis, 2009; Cortright, 2009; Ewing and Handy, 2009; Hoedl, Titze and Oja, 2010; Ewing and Cervero, 2010; Pivo and Fisher, 2011; Tolley, 2011; Duncan *et al.*, 2011; Rauterkus and Miller, 2011; Weinberger and Sweet, 2012; Talen and Koschinsky, 2013, 2014; Lee and Talen, 2014; Reyer *et al.*, 2014; Blečić *et al.*, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Hajna *et al.*, 2015; Zuniga-Teran *et al.*, 2016, 2017; Ferrer and Ruiz, 2018; Habibian and Hosseinzadeh, 2018; Hall and Ram, 2018; Litman, 2018)	**16**	**5**	**12**	**5**	**3**	**42**
Land use type	(Moudon and Lee, 2003; Saelens, Sallis and Frank, 2003; Frank, Andresen and Schmid, 2004; Alfonzo, 2005; Mehta, 2008; Frank *et al.*, 2009; Lee and Talen, 2014; Habibian and Hosseinzadeh, 2018)	**5**	0	3	0	0	8
Street lighting	(Cervero and Kockelman, 1997; Jaskiewicz, 2000; Henson, 2000; Moudon and Lee, 2003; Pikora *et al.*, 2003; Pucher and Dijkstra, 2003; Alfonzo, 2005; Southworth, 2005; Leslie *et al.*, 2007; Mehta, 2008; Lo, 2009; Ewing and Handy, 2009; Frank *et al.*, 2009; Kelly *et al.*, 2011; Zakaria and Ujang, 2015; Forsyth, 2015; Zuniga-Teran *et al.*, 2016, 2017; Ferrer and Ruiz, 2018)	**10**	**4**	**5**	0	0	**19**
Urban form	(Moudon and Lee, 2003; Frank, Andresen and Schmid, 2004; Alfonzo, 2005; Leslie *et al.*, 2007; Southworth, 2005; Frank *et al.*, 2009; Shamsuddin, Hassan and Bilyamin, 2012; Talen and Koschinsky, 2013; Forsyth, 2015; Zakaria and Ujang, 2015)	**6**	0	3	0	1	**10**
Windows on the street	(Jaskiewicz, 2000; Alfonzo, 2005; Ewing *et al.*, 2006; Ewing and Handy, 2009; Talen and Koschinsky, 2014; Zuniga-Teran *et al.*, 2016; Hooi and Pojani, 2019)	**6**	1	0	0	0	7
Buffer zone	(Jaskiewicz, 2000; Moudon and Lee, 2003; Alfonzo, 2005; Lo, 2009; Lee and Talen, 2014; Forsyth, 2015; Zuniga-Teran *et al.*, 2016)	**6**	1	0	0	0	7
Number of lanes	(Jaskiewicz, 2000; Moudon and Lee, 2003; Southworth, 2005; Ewing *et al.*, 2006; Hoedl, Titze and Oja, 2010; Lee and Talen, 2014; Blečić *et al.*, 2015; Gilderbloom, Riggs and Meares, 2015; Zuniga-Teran *et al.*, 2016; Ferrer and Ruiz, 2018)	**6**	2	1	1	0	**10**
Path width	(Moudon and Lee, 2003; Pikora *et al.*, 2003; Abley, 2005; Alfonzo, 2005; Southworth, 2005; Mehta, 2008; Lo, 2009; Kelly *et al.*, 2011; Pivo and Fisher, 2011; Zakaria and Ujang, 2015)	**6**	2	1	1	0	**10**
Surface	(Moudon and Lee, 2003; Pikora *et al.*, 2003; Southworth, 2005; Ewing and Handy, 2009; Kelly *et al.*, 2011; Lee and Talen, 2014; Talen and Koschinsky, 2014; Forsyth, 2015; Zakaria and Ujang, 2015)	**7**	1	1	0	0	9
Street furniture	(Moudon and Lee, 2003; Southworth, 2005; Alfonzo, 2005; Ewing *et al.*, 2006; Mehta, 2008; Ewing and Handy, 2009; Tolley, 2011; Kelly *et al.*, 2011; Lee and Talen, 2014; Forsyth, 2015; Zuniga-Teran *et al.*, 2016; Hooi and Pojani, 2019)	**10**	1	0	1	0	**12**
Street trees	(Cervero and Kockelman, 1997; Jaskiewicz, 2000; King *et al.*, 2002; Moudon and Lee, 2003; Pikora *et al.*, 2003; Leslie *et al.*, 2005; Southworth, 2005; Alfonzo, 2005; Brennan Ramirez *et al.*, 2006; Cao, Handy and Mokhtarian, 2006; Ewing *et al.*, 2006; Mehta, 2008; Lo, 2009; Hoedl, Titze and Oja, 2010; Tolley, 2011; Talen and Koschinsky, 2013, 2014; Lee and Talen, 2014; Forsyth, 2015; Zuniga-Teran *et al.*, 2016, 2017; Ferrer and Ruiz, 2018; Hooi and Pojani, 2019)	**13**	**3**	**6**	1	0	**23**
Architecture	(Jaskiewicz, 2000; Moudon and Lee, 2003; Pikora *et al.*, 2003; Alfonzo, 2005; Brennan Ramirez *et al.*, 2006; Ewing *et al.*, 2006; Ewing and Handy, 2009; Lee and Talen, 2014; Blečić *et al.*, 2015; Forsyth, 2015)	**7**	1	2	0	0	**10**
Urban design	(Pikora *et al.*, 2003; Saelens, Sallis and Frank, 2003; Alfonzo, 2005; Southworth, 2005; Leslie *et al.*, 2007; Brennan Ramirez *et al.*, 2006; Ewing *et al.*, 2006; Ewing and Handy, 2009; Lo, 2009; Tolley, 2011; Talen and	**12**	0	4	**2**	0	**18**

	Koschinsky, 2013; Lee and Talen, 2014; Zakaria and Ujang, 2015; Forsyth, 2015; Gilderbloom, Riggs and Meares, 2015; Zuniga-Teran *et al.*, 2016; Moura, Cambra and Gonçalves, 2017; Hooi and Pojani, 2019)						
Outdoor activities	(Alfonzo, 2005; Mehta, 2008; Lee and Buchner, 2008; Cortright, 2009; Tolley, 2011; Shamsuddin, Hassan and Bilyamin, 2012; Blečić *et al.*, 2015; Zakaria and Ujang, 2015; Forsyth, 2015; Moura, Cambra and Gonçalves, 2017; Ferrer and Ruiz, 2018; Litman, 2018)	**6**	2	1	**2**	1	**12**

The quantitative analysis of scientific literature resulted in a long list of walkability trends in various disciplines. Appendix VI provides a list of descriptions for each walkability trend.

Summary

The quantitative analysis of the scientific literature showed that many factors and variables are a trend in various disciplines. The overview below shows the trends in each discipline.

OVERVIEW WALKABILITY IN SCIENTIFIC DISCIPLINES					
PLANNING AND URBAN DESIGN		**TRANSPORT**	**PUBLIC HEALTH**	**ECONOMY**	**SOCIOLOGY**
INTERESTS					
- Less automobile use - Air and noise pollution - Energy consumption - Public health - Social equity - Safety from crime		- Less automobile use - Public health - Traffic safety - Cost savings	- Less automobile use - Air and noise pollution - Public health	- Less automobile use - Air and noise pollution - Energy consumption - Public health - Quality of life - Cost savings - Real estate values - Social capital	- Public health - Social capital
PEDESTRIANS					
- Age - Gender	- Disability - Purpose	- Age - Gender - Purpose	- Age - Gender - Purpose	- Purpose	- Age - Gender
PLACE					
- Climate - Topography		- Climate - Topography		- Climate - Topography	
WALKING NEEDS					
- Accessibility - Connectivity - Proximity - Safety from crime - Traffic safety - Visibility - Maintenance - Distance to traffic - Low traffic speed	- Comfort - Shade + shelter - Coolness - Pleasurability - Experience - Aesthetics - Complexity - Liveliness	- Accessibility - Connectivity - Safety from crime - Traffic safety - Low traffic speed - Low traffic volume - Comfort - Shade and shelter - Aesthetics	- Accessibility - Connectivity - Proximity - Safety from crime - Traffic safety - Low traffic speed - Pleasurability - Aesthetics	- Accessibility - Connectivity - Proximity - Low traffic speed - Aesthetics - Liveliness	- Accessibility - Connectivity - Proximity - Comfort - Aesthetics
PLANNING & DESIGN					
- Presence of path - Free of obstacles - Free of barriers - Land use diversity - Land use density - Land use type - Streetlighting - Urban form - Windows	- Buffer zone - Number of lanes - Path width - Surface - Street furniture - Street trees - Architecture - Urban design - Activities	- Free of obstacles - Free of barriers - Land use density - Streetlighting - Street trees	- Land use diversity - Land use density - Streetlighting - Street trees	- Land use diversity - Land use density - Urban design - Outdoor activities	- Free of obstacles - Free of barriers - Land use diversity - Land use density

Figure 8: Impression policy documents of Amsterdam.

4.3 Walkability in planning policy

The results in this paragraph are presented to answer the second sub-research question: *"how is walkability defined and used in planning policies of large Dutch cities?"* The two case studies of Amsterdam and Utrecht will be used. Firstly, the results of walkability in planning policy for Amsterdam will be outlined. Subsequently, the same will be done for Utrecht. Both results will be described based on the five domains: interest, pedestrians, place, walking needs, and planning & design. The domains of walking needs and planning & design will be discussed together due to the overlap of both domains. Finally, the results for both cities in planning policy will be compared.

4.3.1 Amsterdam

The term walkability is rarely used in Amsterdam's planning policy. It is only used for an instrument developed by the municipality of Amsterdam, which is named "The Walkability score". Instead of walkability, the policy document AMS-PD-PEDESTRIAN (2017) uses the Dutch words *"prettig voetgangersklimaat"* (translated: pleasant pedestrian climate). AMS-PD-MOBILITY (2013) uses the Dutch words: *"kwaliteit van de voetgangersruimte"* (translated: quality of pedestrian space).

Interests

The municipality of Amsterdam started to pay more attention to pedestrians since the council initiative of political party Groen Links in 2009 called: *"de voetganger Keizer en de fietser Koning''* (translated: the pedestrian emperor and the cyclists king) (AMS-IN-Terpstra, 2019). Multiple issues have come into play regarding pedestrian conditions in the inner city of Amsterdam. As a result of economic growth, population growth and an increase of visitors, traffic movements in the city have increased (AMS-PD-MOBILITY, 2013). The number of pedestrians has expanded by 19% in the past 10 years (AMS-PD-TRAFFIC, 2018). The growth in mobile movements resulted in a pressure on the relatively scarce amount of public space in the inner city of Amsterdam (AMS-PD-CITY, 2011; AMS-PD-MOBILITY, 2013). As a result of this, the municipality of Amsterdam started giving priority to space efficient modes of transport, such as walking (AMS-PD-MOBILITY, 2013). ***The increase of pedestrians***, ***the pressure on public space*** and the ***space efficiency*** of walking can be seen as the main reasons for initiating pedestrian policy in Amsterdam.

Besides the previous interests, the municipality of Amsterdam sees the economic potential of improved walking conditions. Pedestrians are of great economic value in shopping streets and due to the increase of tourism and recreation, pedestrian space is becoming more and more important (AMS-PD-MOBILITY, 2013). Furthermore, an improvement in public space and thereby walking conditions is regarded as a mean to improve the international economic position and to attract new companies and employment (AMS-PD-MOBILITY, 2013). The local economy including the ***economic value of pedestrians in shopping streets*** and the improvement of the ***international economic position*** can be considered as important interests in the municipality of Amsterdam.

In addition, the municipality of Amsterdam views walkability as a means that contributes to a variety of other problems of different policy areas. According to AMS-PD-PEDESTRIAN (2017), pedestrian friendly environments enable ***social interaction***; contribute to ***social-economic development***; create ***social surveillance*** and ***liveliness***; contribute to ***public health***; contribute to ***independence of elderly***; and ensures ***less CO_2 emission***. In addition to these benefits, providing space to pedestrians is also seen as a mean to reduce the probability on traffic accidents and thereby improve ***traffic safety*** (AMS-PD-CITYSTREETS, 2017).

Pedestrians

Since the definition and use of walkability is influenced by the definition of a pedestrian, it is important to investigate how a pedestrian is defined in planning policy. Two definitions were found in the policy documents of the municipality of Amsterdam (see definitions below). The first definition originates from the national government, while the second definition originates from the knowledge institute CROW. Both definitions pay attention to ***disabled*** by including the words *"wheelchair"* and *"supported by aids"*. The first definition includes not only pedestrians but also other users with different ***purposes*** of the pedestrian space by the words *"skateboard"* and *"roller skates"*, while the second definition indicates walking takes place in public space.

> *"Persons who move on foot or with a wheelchair, skateboard, roller skates and the like fall under the provisions of the RVV (Traffic Rules and Traffic Signs 1990) for pedestrian"* (AMS-PD-GUIDELINE, 2016, p. 15).

> *"A pedestrian is "a person who moves on foot, whether or not supported by aids, in the public space" (CROW, 2012)"* (AMS-PD-PEDESTRIAN, 2017, p. 14).

The municipality of Amsterdam pays special attention to ***children***, ***elderly*** and ***disabled*** in pedestrian policy since the municipality aims to make these groups more self-dependent. AMS-PD-PUBLIC (2017) states public space should be ***accessible*** for children, elderly and disabled. AMS-PD-MOTION (2017) aims that pedestrian routes should have ***no conflicts with other traffic***, ***bridgeable height differences***, ***comfortable surface***, ***safe crossings*** and ***no obstacles***.

The municipality of Amsterdam emphasizes the great diversity of pedestrians with their behaviour and characteristics. Pedestrians have different ***purposes to walk***, different ***degrees of mobility*** and different ***knowledge about the surroundings*** (AMS-PD-PEDESTRIAN, 2017). Besides these characteristics, AMS-PD-PEDESTRIAN (2017) states that pedestrians show different behaviour in terms of ***walking pace***, ***walking distance***, ***walking lines*** and ***walking alone or with others***, which demands for different planning & design measures.

The municipality of Amsterdam defines a few walking purposes, which are linked to some walking needs. Three ***walking purposes*** are distinguished, which are ***moving*** as fast as possible from A to B to C (e.g. walking to work); walking for ***exercise*** (e.g. walking the dog); and ***staying*** or walking around (e.g. staying on a square) (AMS-PD-PEDESTRIAN, 2017). Figure 9 provides an overview of the walking purposes. Beside the previously mentioned purposes, AMS-PD-PEDESTRIAN (2017) makes also a distinction in three kinds of pedestrians: ***citizens***, ***commuters*** and ***tourists***.

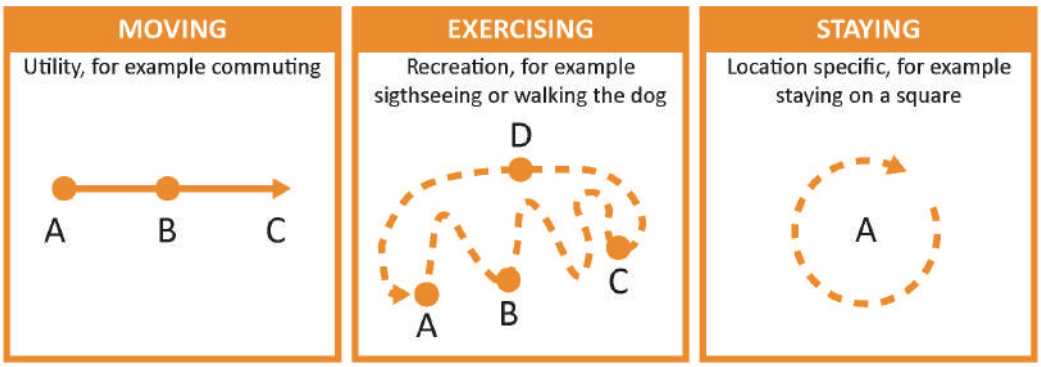

Figure 9: Walking purposes (AMS-PD-PEDESTRIAN, 2017) (layout adjusted).

Place

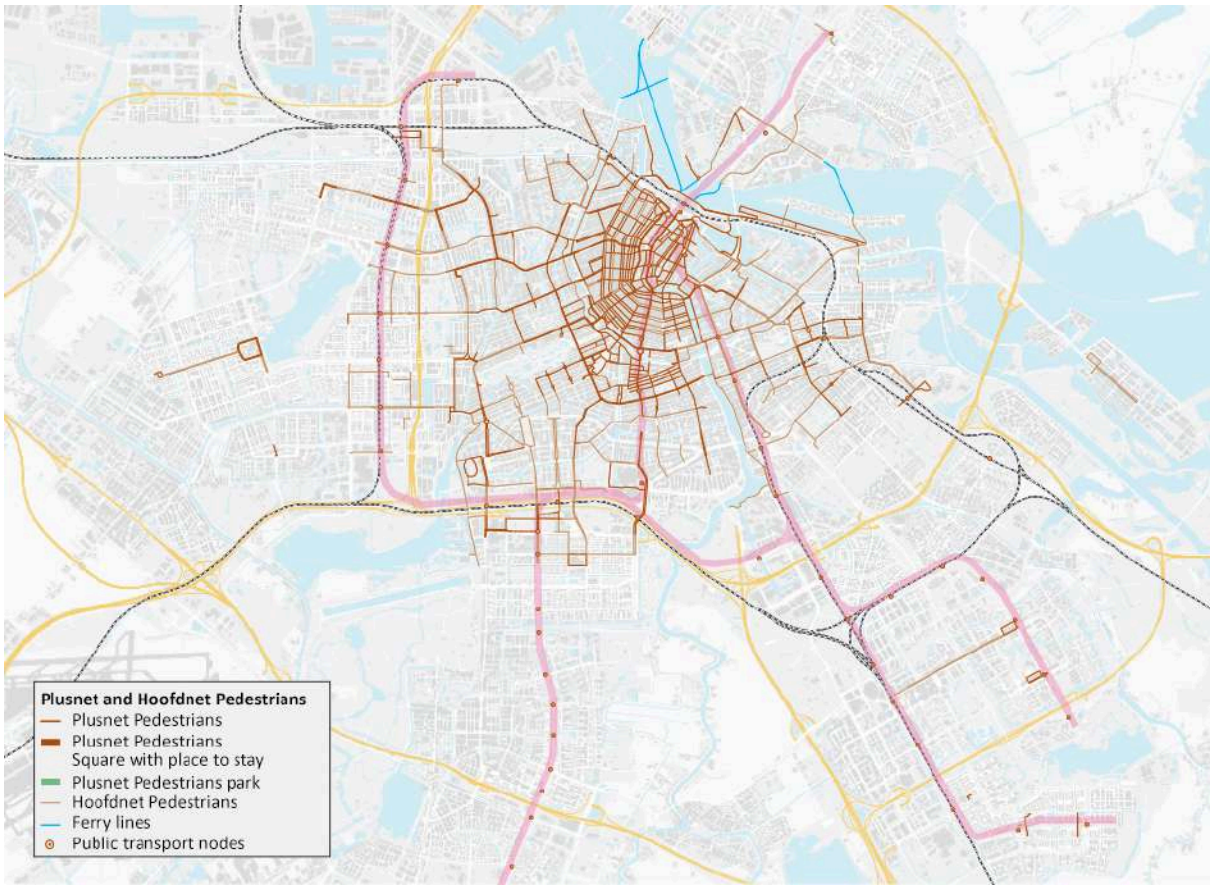

Figure 10: Pedestrian network city of Amsterdam (AMS-PD-TRAFFIC, 2018) (legend adjusted).

The municipality of Amsterdam developed a pedestrian network called: "PlusNet- en HoofdNet Voetganger" (translated: PlusNet and main net pedestrian) to ***prioritise pedestrians*** in certain streets. Figure 10 shows the pedestrian network of Amsterdam. The pedestrian network of Amsterdam consists of three kinds of pedestrian routes (AMS-PD-TRAFFIC, 2018). Firstly, *"PlusNet Voetganger"* consisting of streets and squares that function as a ***place to walk through*** and a ***place to stay***. This network benefits from relatively more ***space***, ***comfort*** and ***quality of stay***. Secondly, *"HoofdNet Voetganger"* consisting of ***walk through routes*** between for example educational facilities and public transport nodes. Thirdly, *"BasisNet Voetganger"* consisting of all other streets with living and work addresses.

The pedestrian network of Amsterdam is designed based on a number of place characteristics. Firstly, ***the space from façade to façade*** affects the amount of space, which is available for pedestrian. A street section of 36 meter width is needed when all modes of transport with their desired space are included, while many street sections in the inner city of Amsterdam are 24 meters or smaller (AMS-PD-MOBILITY, 2013). The narrow historical street sections demand for choices between different modes of transport and other spatial claims (AMS-PD-TRAFFIC, 2018). Secondly, the pedestrian network is based on ***facilities that attract crowds***, such as museums, parks, hospitals, shopping areas, public transport nodes and event areas, which demand for more pedestrian space (AMS-PD-TRAFFIC, 2018). Besides these place characteristics, the municipality of Amsterdam stresses the importance of ***customization*** for a redesign in each street due to the ***historical character***, ***presence of trees*** and ***street section width*** (AMS-PD-MOBILITY, 2013).

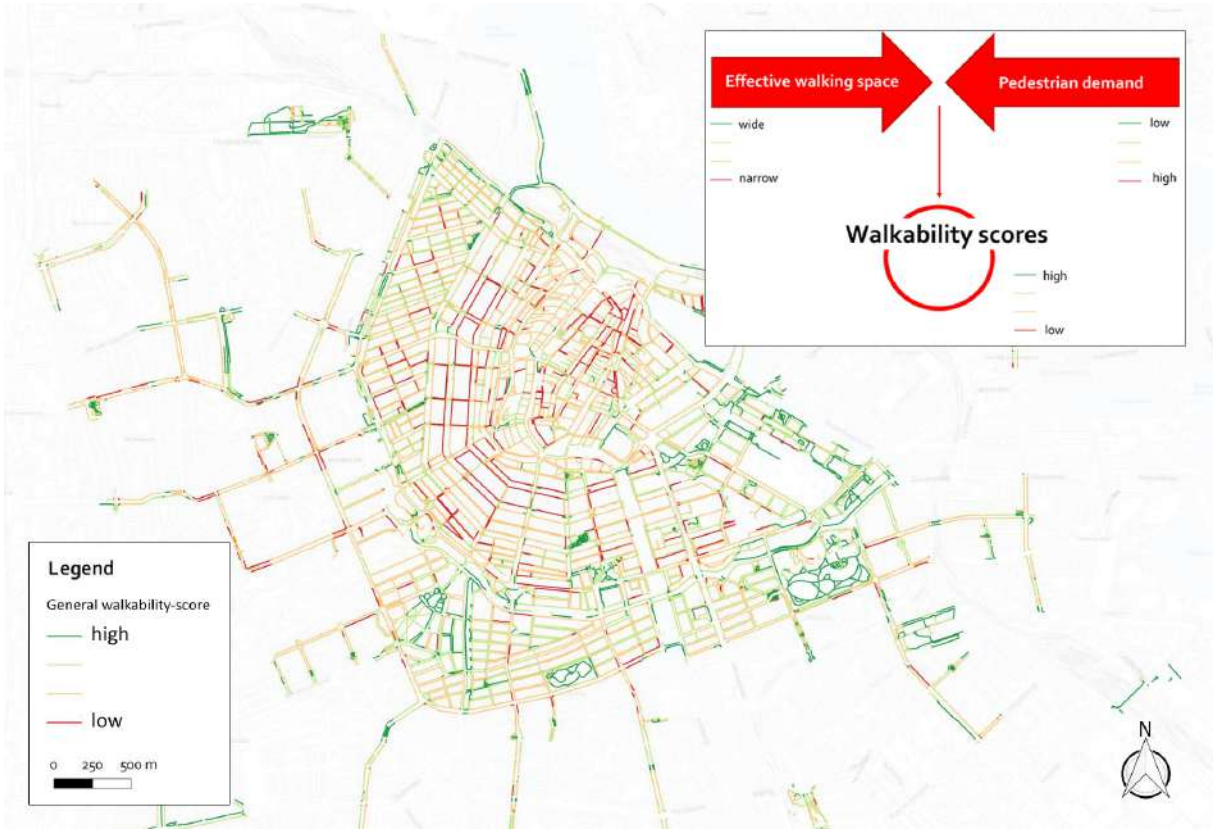

Figure 11: Walkability instrument (Municipality of Amsterdam, 2018b).
(legend translated and explanation added).

Besides the pedestrian network, the municipality of Amsterdam developed a walkability instrument in which a number of place characteristics are mentioned. Figure 11 provides an impression of the instrument. The instrument is based on two main factors: ***effective walking space*** and ***pedestrian demand*** (Municipality of Amsterdam, 2018b). The effective walking space is calculated by using data about ***path width*** and ***obstacles on sidewalks***, including bicycle parking facilities, street trees, street lights and traffic signs (Municipality of Amsterdam, 2018b). The pedestrian demand are estimated through use of data about the ***number of inhabitants***, ***employees***, ***visitors***, ***students, institutes***, ***educational facilities, the number of facilities*** and ***number of people using public transport*** (Municipality of Amsterdam, 2018b). Based on these factors and variables, the level of walkability can be calculated and it provides an overview on the map of the bottlenecks and the places that deserve attention (Municipality of Amsterdam, 2018b).

Although climate comfort is not explicitly linked to pedestrians, multiple measures to provide ***climate comfort*** are mentioned in the policy documents. The municipality pays attention to the consequences of climate change, such as warm periods without rain and intense precipitation. A number of measures are mentioned to provide ***coolness*** during warm temperatures, including the ***presence of trees*** and the ***presence of water*** (AMS-PD-CITY, 2011; AMS-PD-GREENERY, 2015). Additionally, policies for new high building development pay attention to ***wind nuisance*** and ***shadow effects*** (AMS-PD-CITY, 2011).

Walking needs + Planning & design

The policy documents of the municipality of Amsterdam contain many walking needs and planning & design measures. Some policy documents provide information about the most important walking needs and planning & design for pedestrians in Amsterdam. The mobility plan explains pedestrian quality with the terms ***safety***, ***comfort*** and ***attractiveness*** of the route (AMS-PD-MOBILITY, 2013). The public space plan states that public space should be ***safe, comfortable*** and ***accessible*** for everyone (AMS-PD-PUBLIC, 2017). Additionally, two policy documents provide a list of the most important walking needs and planning & design.

According to "Note State of affairs Pedestrians", a pleasant pedestrian climate is:

1. *"**Safe** (safety from crime, traffic safety, ease of crossing, low traffic speed, street lighting, sightlines, crowd management);*
2. ***Offers room for movement** (path width, type of pedestrian, number of pedestrians);*
3. ***Accessible** (path width, free of obstacles, priority to pedestrians, flexible use of space);*
4. ***Logical** (way finding, visibility, sightlines, signage, missing links);*
5. ***Fast when desired** (space, way finding, short wait times at crossings);*
6. ***Attractive** (clean, very beautiful, maintained, use of sustainable materials, climate resistance)"* (AMS-PD-PEDESTRIAN, 2017, p. 21-33).

The policy document of traffic network provides a list of the following conditions for pedestrians:

1. ***"Accessible, without nuisance from obstacles and difficult height differences;***
2. ***Ease of crossing, without traffic safety risk due to a difference in speed with other traffic;***
3. ***Logically connected, with connecting walking routes and public transport;***
4. ***Safety from crime, both subjective and objective;***
5. ***Beautiful, clean and not damaged;***
6. ***With good sight lines, which makes orientation easy;***
7. ***Comfort;***
8. ***Quality of stay;***
9. ***Directness"*** (AMS-PD-TRAFFIC, 2018, p. 15).

In the previous paragraph, the criteria for a well-designed pedestrian environment were introduced. In the following paragraphs, some of these walking needs are explained in more detail and some other walking needs and planning & design measures of other policy documents are introduced. The walking needs and planning & design measures will be explained using the walking needs *"accessibility", "safety from crime", "traffic safety", "comfort"* and *"pleasurability"*.

Accessibility

Since the municipality strives for the self-dependency of children, elderly and disabled, one of the main challenges in Amsterdam's pedestrian policy is to improve ***accessibility*** by making sidewalks ***free of obstacles*** and ***bridgeable height differences*** for disabled with a wheelchair. The number of objects on sidewalks, including parked bicycles, terraces, advertisement, trashcans, freight traffic, benches, and waste collection has increased (AMS-PD-PEDESTRIAN, 2017). Too many obstacles on sidewalks increase the perception of crowdedness and thereby discomfort (AMS-PD-PUBLIC, 2017).

In order to reduce the number of obstacles on sidewalks, a number of measures are proposed in the policy documents. According to AMS-PD-CITYSTREETS (2017), the obstacles that block sidewalks should be ***removed***, ***combined*** or ***displaced***. Furthermore, ***flexible space*** usage is promoted, such as areas that can be used for freight transport in the morning and for pedestrians for the rest of the day (AMS-PD-CITYSTREETS, 2017). A free pass on sidewalks will be created by reserving a ***service zone*** for objects, such as trash cans, street lights, bicycle parking and benches (AMS-PD-GUIDELINE, 2016; AMS-PD-PUCCINI, 2018).

Since many obstacles are linked to other policy areas, the municipality of Amsterdam uses an ***intersectoral policy approach*** to implement pedestrian policy. The policy areas playing a role in Amsterdam's pedestrian policy are ***bicycle policy***, ***maintenance policy, goods transport policy***, ***terrace policy,*** and ***advertisement policy*** (AMS-PD-PEDESTRIAN, 2017). Various measures are mentioned in these policies to reduce the number of obstacles. For example, ***parked bicycles*** on sidewalks will be reduced by new indoor and outdoor bicycle parking facilities (AMS-PD-MOBILITY, 2013).

Besides making streets free of obstacles and bridgeable height differences, the ***proximity*** of facilities, ***land use density*** and ***land use diversity*** are included in Amsterdam's planning policy. The municipality of Amsterdam has the intention to provide an inner city environment with short ***walking distances*** between living, work and other facilities (AMS-PD-PUBLIC, 2017). Land use density results in extra support for facilities, investments in public space, efficiency of transport and conservation of the surrounding landscape (AMS-PD-CITY, 2011). Besides, the diversity of facilities, invites people to exercise daily (AMS-PD-PUBLIC, 2017).

Besides densification and diversification of the city of Amsterdam, the municipality aims to improve proximity by ***reducing large physical barriers***. The municipality of Amsterdam states there will be ***no place for large introvert areas*** in the future***,*** such as allotment gardens, cemeteries and sport parks due to a growing number of inhabitants and visitors in the future (AMS-PD-CITY, 2011). Besides this, ***large infrastructural barriers***, such as highways and train tracks will be reduced by new tunnels or bridges (AMS-PD-CITY, 2011; AMS-PD-TRAFFIC, 2018).

Safety from crime

Although safety from crime is not frequently mentioned in planning policy, some walk needs and planning & design measures are linked to safety from crime. According to AMS-PD-PEDESTRIAN (2017), the sense of safety from crime can be provided by a sufficient amount of ***lighting*** and ***lines of sight***. Moreover, a few policy documents stress the importance of ***lively facilities in plinths of buildings***, which provides ***social surveillance*** on streets (AMS-PD-CITY, 2011; AMS-PD-CITYSTREETS, 2017; AMS-PD-MOTION, 2017). The previous mentioned planning & design measures to improve safety from crime can be linked to ***visibility***.

Traffic safety

As already mentioned in the list for a pleasant pedestrian climate, ***low traffic speed*** is considered as important to provide ***traffic safety*** for pedestrians. The municipality of Amsterdam aims to have a traffic speed of maximum 30 km/h on streets of the inner city (AMS-PD-AGENDA, 2015). AMS-PD-SAFETY (2016) mentioned some speed limiting measures, including ***traffic signs with speed limits***, ***speeds bumps*** and ***narrow lanes***.

In addition to low traffic speed, the municipality of Amsterdam considers ***ease of crossing*** as important for pedestrian's traffic safety due to the large percentage of traffic accidents on pedestrian crossings. According to AMS-PD-PEDESTRIAN (2017), crossings play a role in 42% of the traffic accidents with pedestrians. AMS-PD-GUIDELINE (2016) describes a number of measures to improve safety on pedestrian crossing, including improved ***visibility***, ***wide rest points***, ***understandable crossings*** and a ***limited number of lanes that have to be crossed***.

Comfort

As already mentioned, more room for movement or in other words ***creating more space*** for pedestrian is considered as important in Amsterdam's planning policy. The municipality of Amsterdam aims to increase the ***width of sidewalks***. Various planning & design measures are proposed to increase the sidewalk width for pedestrians in the policy documents. ***Choices between different modes of transport*** will be made to create more space for pedestrians (AMS-PD-TRAFFIC, 2018). The municipality aims to reduce car use in the inner city. One of the measures is ***banning cars*** in certain streets (AMS-PD-CITY, 2011). Another measure is to reduce the number of parking spaces on streets to create more space for pedestrians (AMS-PD-CITY, 2011; AMS-PD-PUBLIC, 2017). Also making ***one-way car traffic*** in streets is proposed as a measure (AMS-PD-AGENDA, 2015).

In addition to reducing different modes of transport in streets, a ***mix of traffic*** is proposed to create space for pedestrians. ***Car traffic is planned to drive on the tram track*** in some streets, which creates space for pedestrians (AMS-PD-AGENDA, 2015). ***Cycle streets*** will be created in streets with a high frequency of cyclists and a low frequency of cars (AMS-PD-AGENDA, 2015). Also pedestrians and cyclists will be mixed in so-called ***shared spaces*** (AMS-PD-TRAFFIC, 2018).

Pedestrian crowds in the inner city have received specific attention from the municipality of Amsterdam due to growth in the number of pedestrians. According to AMS-PD-GUIDELINE (2016), large facilities attracting crowds, such as museums, public transport nodes, educational institutions, hospitals, event areas, and shopping areas should have an ***obstacle free walking space of 3,6 meters***. During large events, such as Sail Amsterdam, the municipality of Amsterdam uses a ***crowd management system*** with large signs and camera's to regulate pedestrian flows (AMS-PD-AGENDA, 2015; AMS-PD-PEDESTRIAN, 2017).

Besides pedestrian crowds, the municipality of Amsterdam pays extra attention to ***way finding*** in terms of signs and maps, since many tourists visit Amsterdam. Way finding is used as a means to spread crowds over the city (AMS-PD-INNERCITY, 2018). AMS-PD-TRAFFIC (2018) argued that pedestrian routes should have good ***lines of sight***, which eases the ***orientation*** of pedestrians. According to AMS-PD-PEDESTRIAN (2017), pedestrians feel pleasant when routes are ***logical***, ***possess good lines of sight*** and good ***signs for way finding***.

Pleasurability

Although the inner city of Amsterdam with her iconic buildings and historic canals is attractive to walk, ***pleasurability*** is considered as important in Amsterdam's pedestrian policy. According to AMS-PD-PEDESTRIAN (2017), pedestrians route choices are influenced by the ***attractiveness*** of the surrounding, such as ***beautiful green routes*** for walking or the ***presence of historic canals and iconic buildings***. Several policy documents mentioned public space and walking routes should be attractive (AMS-PD-MOBILITY, 2013; AMS-PD-PUBLIC, 2017; AMS-PD-TRAFFIC, 2018).

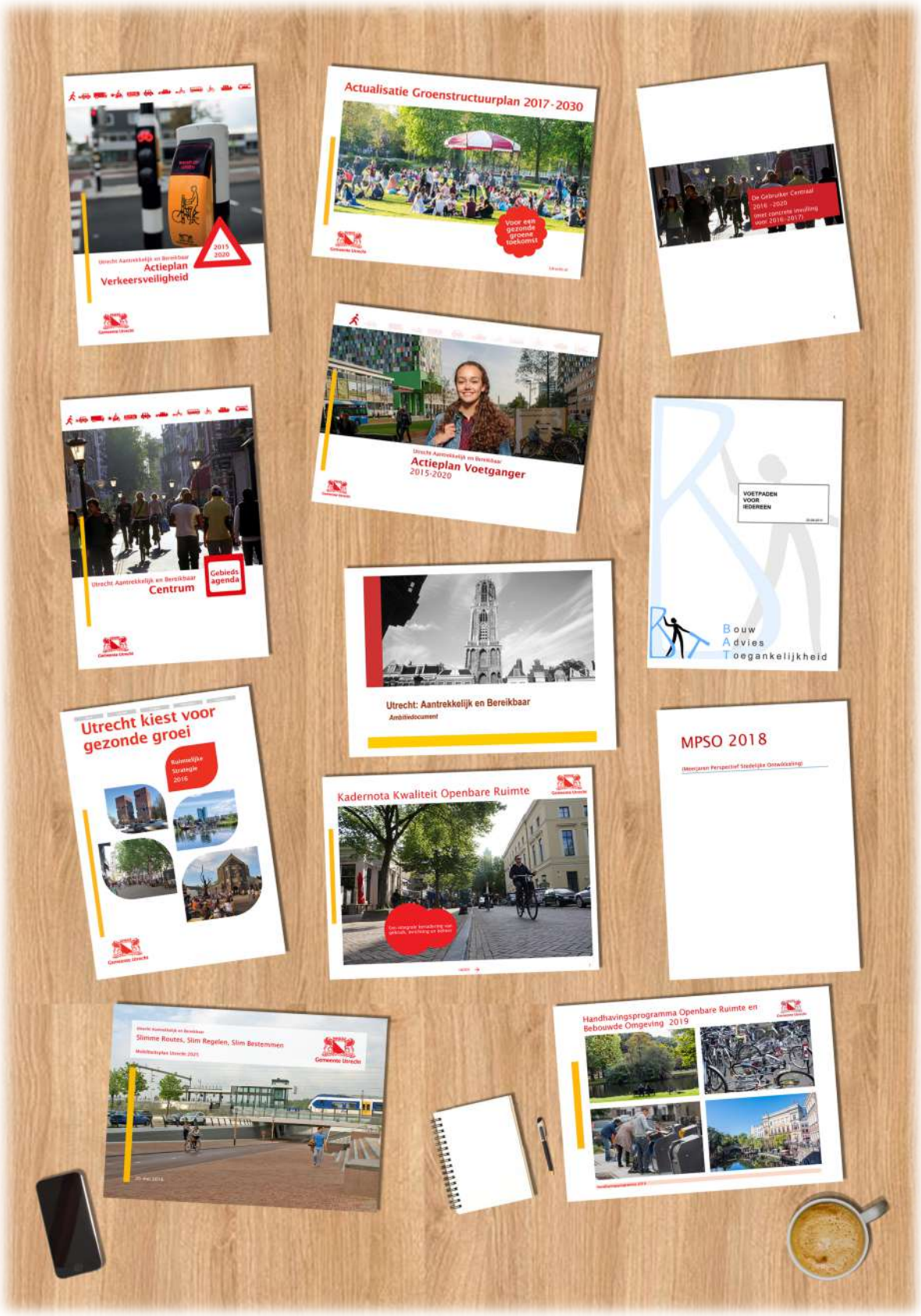

Figure 12: Impression policy documents of Utrecht.

4.3.2 Utrecht

The term walkability is not used in Utrecht's planning policy. The pedestrian policy document uses the Dutch words *"voetgangersvriendelijk"* (translated: pedestrian friendliness) and *"goed voetgangersklimaat"* (translated: good pedestrian climate) (UTR-PD-PEDESTRIAN, 2015). UTR-PD-MOBILITY (2016) mentioned also the term *"voetgangersvriendelijk"* and the term *"voetgangerskwaliteit"* (translated: pedestrian quality).

Interests

The municipality of Utrecht launched the pedestrian policy document: "Actieplan Voetganger" (translated: Action Plan Pedestrian) in 2015 (UTR-PD-PEDESTRIAN, 2015). Various reasons are mentioned for initiating pedestrian policy of which a few reasons can be considered as the main reasons. Multiple policy documents stress the importance of stimulating ***space efficient*** modes of transport (UTR-PD-PEDESTRIAN, 2015; UTR-PD-STRATEGY, 2016; UTR-PD-USER, 2016). Besides, improving walking conditions together with cycling and public transport may lead to a ***modal shift*** from automobile use to walking and cycling (UTR-PD-PEDESTRIAN, 2015). Moreover, inhabitants of surrounding neighbourhoods might go by foot instead of cycling, which reduces ***congestion on bicycle paths*** and ***bicycle parking spaces*** (UTR-PD-INNERCITY, 2015).

The municipality of Utrecht explains the benefits of walking and improved pedestrians conditions in the pedestrian policy document through use of *"People-Planet-Profit"*. From the perspective of *"people"*, walking contributes to ***physical and mental health***, ***safety from crime***, ***traffic safety***, ***social interaction*** and ***the accessibility of public space for everyone*** (UTR-PD-PEDESTRIAN, 2015). From the perspective of "*planet"*, improved walking conditions contribute to a ***modal shift*** from cars to walking, cycling and public transport and thereby ***less air and noise pollution*** and ***less use of space by cars*** (UTR-PD-PEDESTRIAN, 2015). From the perspective of *"profit"*, improved walking conditions contribute to the ***local economy***, including an increase of ***consumer expenditures, real estate values*** and to attract ***new companies and investments*** (UTR-PD-PEDESTRIAN, 2015).

Besides the benefits mentioned in the pedestrian policy document, some other reasons of improved pedestrian conditions are mentioned. The municipality of Utrecht sees improved pedestrian conditions also as a means to improve ***quality of life*** (UTR-PD-MOBILITY, 2016). Besides quality of life, UTR-PD-MOBILITY (2016) states walking and cycling require the least societal costs in comparison to other modes of transport. UTR-PD-MOBILITY (2016) shows improved pedestrian conditions ***prevent many societal costs***, such as the use of space, traffic safety, cost for infrastructure, air quality, noise nuisance, climate, energy use, public health and traffic congestion.

Pedestrians

The theoretical framework showed that pedestrian definitions influence the definition and use of walkability. However, none of the policy documents of the municipality of Utrecht contains a pedestrian definition.

The municipality of Utrecht aims public space should be accessible for ***everyone***. This means also ***vulnerable groups*** are included, such as ***children***, ***elderly*** and ***disabled***. According to UTR-PD-PEDESTRIAN (2015), everyone should be able to reach their facilities independently. The needs of disabled are leading for the designs of pedestrian environments (UTR-PD-PEDESTRIAN, 2015). The design of the public space should be ***lifecycle resistant*** and ***safe*** for people from approximately 8 until

80 years (UTR-PD-MOBILITY, 2016). The independence of elderly is stimulated by a ***sufficient amount of space*** and ***maintenance*** (UTR-PD-PEDESTRIAN, 2015). The municipality of Utrecht uses Agenda 22 to maintain the design requirements for disabled, which means a careful design and management process when ***height differences are bridged***, ***obstacle free zones*** and routes with tactile paving are designed (UTR-PD-PUBLIC, 2016). Besides, the municipality of Utrecht aims to stimulate walking by campaigns (UTR-PD-USER, 2016).

The municipality of Utrecht distinguishes a few ***walking purposes***. UTR-PD-PEDESTRIAN (2015) distinguishes three groups of pedestrians, which are ***inhabitants***, ***employees*** and ***tourists***. More specifically UTR-PD-PEDESTRIAN (2015) mentions the walking purposes ***consumers***, ***pedestrians who walk with a bicycle*** and ***pedestrians who walk for recreational purposes***. The walking purposes are included in the pedestrian network but are not the main guideline for the design of the pedestrian network.

Place

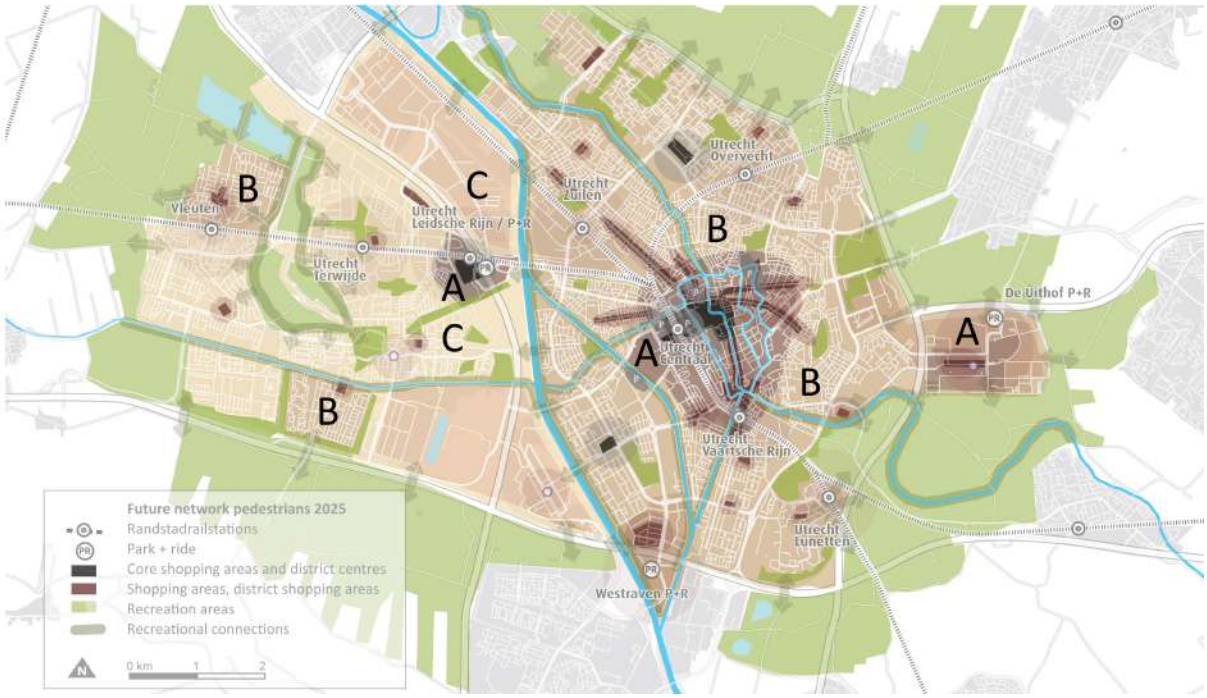

Figure 13: The pedestrian network of Utrecht (UTR-PD-MOBILITY, 2016).

Figure 13 shows the pedestrian network of Utrecht. The municipality of Utrecht developed a pedestrian network based on three types ***of economic zones***. The A-zones include places characterized by ***scarce traffic space*** and a demand for a ***high quality of stay***, which are the inner city, Leidsche Rijn centre and Science Park (UTR-PD-MOBILITY, 2016). Besides scarce traffic space, these places are characterized by ***short walking distances*** between ***different facilities*** (UTR-PD-PEDESTRIAN, 2015). Pedestrians and cyclists are main users and get ***priority*** (UTR-PD-MOBILITY, 2016). The B-zones include places characterized by more public space than the A zones, which are the area of the old city within the ring and the cores of Vleuten and De Meern (UTR-PD-MOBILITY, 2016). The balance between modalities will be recovered and pedestrians will get more space (UTR-PD-MOBILITY, 2016). The C-zones are characterized by a sufficient amount of space for all modes of transport, which is the area west of the Amsterdam-Rijnkanaal (UTR-PD-MOBILITY, 2016). The focus in these areas is to stimulate bicycle use and public transport (UTR-PD-MOBILITY, 2016).

Besides the place in the pedestrian network, the pedestrian conditions are influenced by some other place characteristics. According to UTR-PD-INNERCITY (2015), the design of mobility depends on the ***function in the network***, such as the function of a flow road for car traffic. Also different ***facilities*** around the walking routes influence the pedestrian conditions. For instance, walking routes to train stations should be ***logical***, ***recognizable*** and ***well-designed*** (UTR-PD-PEDESTRIAN, 2015). However, ***customization*** for each place is considered as important for a good pedestrian environment (UTR-PD-MOBILITY, 2016).

The municipality of Utrecht mentions various measures that influence ***climate comfort*** of pedestrians. Measures against the consequences of climate change are mentioned to provide ***coolness*** and ***prevent the city from flooding***, including the creation of more ***green***, stimulating ***water storage capacity*** and improving the ***flow of the water*** (UTR-PD-STRATEGY, 2016). The pedestrian policy document states pedestrians should be ***protected against the weather*** (UTR-PD-PEDESTRIAN, 2015). However, the pedestrian policy document does not explain how pedestrians could be protected against the weather. UTR-PD-CITY (2018) states nuisance of wind and noise should be considered when high buildings are developed. Besides weather protection, the ***shade and sun side*** should be taken into account when redesigning a street (UTR-PD-PEDESTRIAN, 2015). Although the municipality of Utrecht mentioned many measures to reduce the consequences of climate change, the planning policy of Utrecht provides limited measures that link pedestrians to climate comfort.

Walking needs + Planning & design

The municipality of Utrecht aims to influence the mobility choices of people by meeting their needs for walking in planning & design. According to UTR-PD-ACCESSIBLE (2012), it is about influencing peoples and companies behaviour in their mobility choices. Pedestrian environments should be designed according to ***behaviour*** and ***needs*** (UTR-PD-INNERCITY, 2015). The public space should be designed thinking from the ***psychology of the user*** and the ***desired use*** (UTR-PD-USER, 2016).

The municipality of Utrecht mentions in its policy documents multiple walking needs and planning & design measures that a pedestrian environment should meet. According to UTR-PD-ACCESSIBLE (2012), individuals do make choices ***based on their experiences*** and are looking for ***convenience***, ***comfort*** and ***speed*** (UTR-PD-ACCESSIBLE, 2012). The pedestrian policy document provides a list of requirements for a well-designed pedestrian environment. According to the pedestrian policy document, a pedestrian environment should meet the following requirements:

1. ***"A fine-grained network with direct and continuous routes*** *(human scale, short walking distance, proximity, understandable routes, follow wish lines, free of barriers, short cuts);*
2. ***A sufficient amount of space for the pedestrian*** *(maintenance, path width, type of pedestrians, number of pedestrians, free of obstacles);*
3. ***Physical comfort in the choice of materials*** *(shelter against weather and noise, equal non-slip and solid surface, free of obstacles, lighting);*
4. ***Traffic safety*** *(avoid conflicts, low traffic speed, low traffic volume, ease of crossing, mix of traffic, free of other traffic, short wait times at crossings, long green lights at crossings);*
5. ***Accessible, also for people with a disability*** *(bridgeable height differences);*
6. ***Attractive, inviting to stay*** *(experience, liveliness, quality of stay, presence of shade and sun, safety from crime, stairs, presence of activities;*
7. ***Good connection with other modalities, for example in approach routes"***

(UTR-PD-PEDESTRIAN, 2015, p. 7-11).

In the previous paragraph, the walking needs and planning & design measures of the criteria for a well-designed pedestrian environment were introduced. In the following paragraphs, some of these walking needs are explained in more detail and some other walking needs and planning & design measures of other policy documents are introduced. The walking needs and planning & design measures will be explained using the walking needs *"accessibility", "safety from crime", "traffic safety", "comfort"* and *"pleasurability"*.

Accessibility

As mentioned in the previous section, ***accessibility*** is one the requirements for a well-designed pedestrian environment in Utrecht's pedestrian policy. According UTR-PD-PEDESTRIAN (2015), accessibility means that everyone should be able to reach his or her destination through pedestrian infrastructure where the needs of disabled are leading for the design, such as ***bridgeable height differences*** for wheelchairs.

The ***proximity*** of facilities or in other words ***short walking distances*** to facilities is included in Utrecht's pedestrian policy. According to UTR-PD-PEDESTRIAN (2015), the city should be made on ***human scale***, which means that people have to walk short distances to facilities. Proximity of origin and destination should be a guideline for spatial policy when stimulating walking (UTR-PD-PEDESTRIAN, 2015). Proximity of facilities can be linked to ***land use diversity*** and ***land use density*** in Utrecht's pedestrian policy. According to UTR-PD-PEDESTRIAN (2015), a mixed land use pattern with proximity of facilities and an attractive living, working and shopping environment is crucial for Utrecht. People choose for walking or cycling more often in environments with a high land use density and diversity (UTR-PD-MOBILITY, 2016).

Besides proximity, ***connectivity*** is included in the policy documents of the municipality of Utrecht. ***A fine-grained network with direct and continuous routes*** and ***a good connection with other modalities*** are considered as important requirements for a well-designed pedestrian environment (UTR-PD-PEDESTRIAN, 2015). According to UTR-PD-PEDESTRIAN (2015), the connectivity between places could be improved by providing a ***crossable network without physical barriers***, such as infrastructral barriers (e.g. railway) and land use barriers (e.g. space consuming companies). The spatial strategy policy document of Utrecht states investments in ***bicycle and pedestrian bridges*** are needed for the connection with other areas (UTR-PD-STRATEGY, 2016).

Safety from crime

Although safety from crime is mentioned in Utrecht's pedestrian policy, the walking need is not extensively discussed in the policy documents. UTR-PD-PEDESTRIAN (2015) states attention should be paid to safety from crime when designing a walking route. However, the pedestrian policy document does not elaborate about how safety from crime should be provided to pedestrians. The pedestrian policy document mentions ***space for activities*** invites ***people*** to stay but does not link this to safety from crime (UTR-PD-PEDESTRIAN, 2015). Some other policy documents mentioned measures that influence safety from crime. The spatial strategy of Utrecht mentions ***avoiding vacancy in the plinth*** of buildings by creating attractive plinths, which creates social surveillance (UTR-PD-STRATEGY, 2016). Another measure providing social surveillance is that ***front doors of livings and facilities*** should have an ***orientation*** on pedestrian and cycle routes (UTR-PD-MOBILITY, 2016).

Traffic safety

Traffic safety is considered as important by the municipality of Utrecht and is much discussed in the policy documents. Traffic safety is one the requirements for a well-designed pedestrian environment (UTR-PD-PEDESTRIAN, 2015). The pedestrian policy document and the traffic safety plan aim to improve traffic safety for pedestrians by reducing the ***number of conflict points*** (e.g. crossings between pedestrians and cars), ***traffic speeds*** and ***traffic volumes*** (UTR-PD-PEDESTRIAN, 2015; UTR-PD-SAFETY, 2015).

The presence of busy motorways in the city of Utrecht resulted in attention to the ***safety of pedestrian crossings***. According to UTR-PD-PEDESTRIAN (2015), the ***safety of pedestrian crossings*** with busy and fast driving traffic is considered as one of the largest safety issues in the municipality of Utrecht. Various motorways are experienced as ***barriers*** and are ***hard to cross*** for slow pedestrians due to high traffic speeds (UTR-PD-SAFETY, 2015). ***Reducing traffic speeds*** and ***low traffic volumes*** are seen as the measures to improve safety of crossing (UTR-PD-MOBILITY, 2016). Additionally, the safety of crossings will be improved by ***short crossing lengths with rest points*** and ***short waiting times for traffic lights at crossings*** (UTR-PD-MOBILITY, 2016).

Providing traffic safety to pedestrians is linked to ***traffic volume*** in pedestrian policy, which is supported by various planning & design measures. According to UTR-PD-PEDESTRIAN (2015), the surrounding should be as much as possible ***free of traffic*** when there are ***large flows of pedestrians***. The traffic safety plan states a situation can be unsafe due to high traffic volumes and should be controlled by the ***spatial planning of the city***, which creates a balance between places with a high and low traffic volume (UTR-PD-SAFETY, 2015). Another measure that creates a balance between places with high and low traffic volume is the ***car traffic network*** (UTR-PD-MOBILITY, 2016). This network regulates traffic without an origin or destination via the ring, and traffic with an origin or destination via the right approach route (UTR-PD-MOBILITY, 2016).

Comfort

Since the municipality of Utrecht experiences a pressure on public space, one of the main challenges is to ***create more space*** for pedestrians. A sufficient amount of space for pedestrians is seen as one of the requirements for a well-designed pedestrian environment (UTR-PD-PEDESTRIAN, 2015). Besides the pedestrian document, a few other policy documents state that pedestrians should have more space in streets (UTR-PD-INNERCITY, 2015; UTR-PD-CITY, 2018; UTR-PD-STRATEGY, 2016).

The width of sidewalks is determined by a few factors in the policy documents. According to UTR-PD-PEDESTRIAN (2015), the ***number of pedestrians*** is the main principle for the width of side walks. Besides this, sidewalks frequently ***used by people with a walking aid, wheelchair or scoot mobile*** should be preferably 2.4 meter or more wide and at least 1.8 meter wide (UTR-PD-FOOTPATH, 2014). These footpath should be present in ***crowd attracting places***, such as shopping areas, around schools, recreation facilities, living facilities for elderly and disabled, activity facilities, and footpaths that connect neighbourhoods (UTR-PD-FOOTPATH, 2014).

The municipality of Utrecht aims to create more space for pedestrians by ***making choices between different modes of transport per location***. It prioritizes space efficient modes of transport by making these modes of transport ***number one priority*** depending on the location (UTR-PD-MOBILITY, 2016).

Since automobile traffic takes up a lot of space and leads to air and noise pollution, the municipality of Utrecht aims to create more space for pedestrians by ***reducing automobile traffic*** in the inner city. The municipality of Utrecht aspires to expand the pedestrian zones in the inner city by making a large part car free (UTR-PD-INNERCITY, 2015). The municipality of Utrecht aims to reduce street parking spaces and move these places to parking garages (UTR-PD-STRATEGY, 2016). Also concepts such as ***park & ride facilities*** are mentioned whereby drivers can park their cars on the edges of the city and can reach the inner city by public transport (UTR-PD-MOBILITY, 2016). Besides car parking garages, the municipality of Utrecht attempts to ***reduce car ownership*** by stimulating ***car sharing***, ***public transport***, ***bicycles use*** and ***shared bicycles*** (UTR-PD-ACCESSIBLE, 2012).

Besides widening the sidewalks, the municipality of Utrecht aims to create space by ***reducing the number of obstacles*** on sidewalks. A sidewalk free of obstacles is considered as important, because it guarantees the ***natural passage*** (UTR-PD-PEDESTRIAN, 2015). The design of obstacle free zones requires a careful ***design and management process*** (UTR-PD-PUBLIC, 2016). A number of planning & design measures are proposed to reduce the number of obstacles. Since walking is also seen as means to reduce bicycle use, the municipality of Utrecht aims to create more indoor and outdoor ***bicycle parking facilities***, which can reduce parked bicycles on sidewalks (UTR-PD-ACCESSIBLE, 2012). Moreover, a number of measures are proposed to reduce disturbances of goods transport, including ***loading and unloading places*** and ***special routes for goods transport*** (UTR-PD-MOBILITY, 2016).

Pleasurability

Although the inner city of Utrecht contains many historical buildings, canals, shops and bars, the ***pleasurability*** or attractiveness of pedestrian environments is part of Utrecht's pedestrian policy. ***Attractive and inviting to stay*** is one of the design requirements of the pedestrian policy in Utrecht (UTR-PD-PEDESTRIAN, 2015). The ***liveliness*** and ***experience*** of the pedestrian environment are considered as two walking needs influencing the attractiveness (UTR-PD-PEDESTRIAN, 2015). According to UTR-PD-PEDESTRIAN (2015), the ***quality of public space*** influences the usage intensity and spaces invite to stay when there is the ***opportunity to sit in the sun or shadow on benches or stairs*** and there is place to organise ***activities***.

4.3.3 Comparison

First of all, the word walkability is rarely used in planning policy of large Dutch cities. The municipality of Amsterdam developed an instrument in QGIS in which the *"walkability score"* is calculated (Municipality of Amsterdam, 2018b). The direct translation of walkability: *"beloopbaarheid"* officially does not exist in the Dutch language. Both municipalities are using the word: *"voetgangersklimaat"* (translated: pedestrian climate).

Interests

The large number of interests mentioned by both municipalities shows that both municipalities view pedestrian policy as a means that contributes to a solution for a variety of problems in different policy areas. The municipality of Utrecht explains the benefits of walkability extensively through use of *"People-Planet-Profit",* while the municipality of Amsterdam explains the interests of walkability in a concise way.

The main reason for both municipalities to pay more attention to pedestrian policy is the ***pressure on public spaces***. As a result of ***population growth and increasing visitor numbers***, ***the amount of traffic*** and other ***spatial claims*** in the inner city have increased while the ***amount of public space from façade to façade*** is still the same (AMS-PD-MOBILITY, 2013; UTR-PD-MOBILITY, 2016). As a response to these developments, both municipalities prioritise ***space efficient*** modes of transport, such as walking and cycling (AMS-PD-MOBILITY, 2013; UTR-PD-MOBILITY, 2016).

Besides the pressure on public space, both municipalities view walkability as a means to ***stimulate a modal shift*** and ***reduce automobile use***. Automobile use in the inner city resulted in ***traffic congestion***, ***air and noise pollution*** and ***traffic accidents*** (AMS-PD-MOBILITY, 2013; UTR-PD-PEDESTRIAN, 2015). Both municipalities attempt to discourage automobile use by improved walking conditions in combination with public transport (AMS-PD-MOBILITY, 2013; UTR-PD-PEDESTRIAN, 2015). Besides less automobile use, the municipality of Utrecht sees improved pedestrians conditions as a means to reduce bicycle use, and thereby congestion on bicycle paths and parked bicycles in the inner city (UTR-PD-INNERCITY, 2015).

Walkability is also seen as a means to stimulate the ***local economy***. Both municipalities explained through use of studies about ***consumer expenditures*** in streets that expenditures by pedestrians are higher than other modes of transport (AMS-PD-MOBILITY, 2013; UTR-PD-PEDESTRIAN, 2015). Besides consumer expenditure, investments in the quality of public space are seen as a means to improve the ***international economic position*** (AMS-PD-MOBILITY, 2013; UTR-PD-PEDESTRIAN, 2015).

Besides the local economy, walkability is seen as a means to improve ***self-reliance*** and ***social equity***. Both municipalities stress the importance of walkability for the increasing number of ***elderly*** and ***disabled*** to stimulate self-reliance (UTR-PD-PEDESTRIAN, 2015; AMS-PD-PUBLIC, 2017). Besides this, both municipalities mention the independence of ***children*** who can walk to school independently as a reason to improve walking conditions (UTR-PD-PEDESTRIAN, 2015; AMS-PD-MOTION, 2017).

Pedestrians

The municipality of Amsterdam follows the national definitions of a pedestrian of CROW (2012) and Traffic Rules and Traffic Signs (1990), which are both present in the policy documents. Remarkably, the municipality of Utrecht did not include a pedestrian definition in the analysed policy documents.

The municipalities of Amsterdam and Utrecht pay special attention to ***children***, ***elderly*** and ***disabled***. Walking routes should be ***life cycle resistant*** to make sure everyone can walk (UTR-PD-MOBILITY, 2016; AMS-PD-PEDESTRIAN, 2017). Both municipalities stress the importance of ***safe*** school environments for ***children*** to stimulate children walking to school independently (AMS-PD-SAFETY, 2016; UTR-PD-PEDESTRIAN, 2015). Besides this, pedestrian environments should be ***accessible***, ***free of obstacles*** and ***with bridgeable height differences*** for ***elderly*** and ***disabled*** (UTR-PD-PEDESTRIAN, 2015; AMS-PD-PEDESTRIAN, 2017).

Besides the previous mentioned groups, both pedestrian policies pay some attention to ***walking purposes***. The municipality of Amsterdam distinguishes three walking purposes with their own walking patterns and walking needs, which are ***moving***, ***exercising*** and ***staying*** (AMS-PD-PEDESTRIAN, 2017). Besides this, the municipality of Amsterdam divided pedestrians in the groups of ***citizens***, ***commuters*** and ***tourists*** (AMS-PD-PEDESTRIAN, 2017). The municipality of Utrecht makes a similar division of walking purposes into ***inhabitants***, ***employees*** and ***tourists*** (UTR-PD-PEDESTRIAN, 2015). Although walking purposes are included in pedestrian policy, the walking purposes are not the main guidelines for the designs of both pedestrian policies and pedestrian networks.

In addition to these pedestrian characteristics, the municipality of Amsterdam describes the pedestrian characteristics more in detail. AMS-PD-PEDESTRIAN (2017) elaborates on the ***behaviour of pedestrians*** in terms of ***walking speed***, ***walking distance***, ***walking lines*** and ***walking alone or in company***, while the municipality of Utrecht rarely describes these pedestrian characteristics.

Place

Both municipalities developed a ***hierarchical pedestrian network***, which is linked to certain walking needs and planning & design measures. While the municipality of Amsterdam developed a pedestrian network based on different ***streets*** (e.g. city streets and shopping streets), the municipality of Utrecht developed a pedestrian network based on different ***zones*** (e.g. city centre and post-war neighbourhoods). The pedestrian network of Amsterdam is designed based on ***facilities that attract pedestrian crowds***, while the pedestrian network of Utrecht is designed based on the ***amount of public space*** in a certain zone. Although the pedestrian networks are important guidelines for the design of pedestrian environments, both municipalities stress the importance of ***customization*** when a street will be redesigned (AMS-PD-MOBILITY, 2013; UTR-PD-PEDESTRIAN, 2015).

Besides the place characteristics that influence the design of the pedestrian networks, both municipalities mention some other ***topographical characteristics***. Both municipalities argue that ***public space in the streets of the inner city is scarce*** (UTR-PD-MOBILITY, 2016; AMS-PD-TRAFFIC, 2018). The walkability instrument of Amsterdam is based on two main factors: ***effective walking space*** (calculated by using data about ***path width*** and ***obstacles on sidewalks***), and ***pedestrian demands*** (calculated by using data about the ***number of inhabitants***, ***employees***, ***visitors***, ***students, institutes***, ***educational facilities, the number of facilities*** and ***number of people using public***

transport) (Municipality of Amsterdam, 2018b). The municipality of Utrecht does not use an instrument like this to measure walkability and rarely discusses these factors. However, the width of the sidewalk is also based on the number of pedestrians (UTR-PD-PEDESTRIAN, 2015). Besides, UTR-PD-INNERCITY (2015) states the design of mobility depends on the ***function in the network***, such as the function of a flow road for car traffic.

Both municipalities mention weather protection or climate comfort in their pedestrian policy. The municipality of Utrecht states that pedestrians should be ***protected against the weather*** and public space should have a good ***balance between shade and sun*** (UTR-PD-PEDESTRIAN, 2015). The municipality of Amsterdam considers ***climate comfort*** in streets as important for pedestrians (AMS-PD-PEDESTRIAN, 2017). However, both pedestrian policy documents do not go further into detail how to provide climate comfort to pedestrians. The other policies do mention a number of planning & design measures that contribute to climate comfort for pedestrians. Both municipalities are working on the consequences of ***climate change***, including warm periods without rain and intense precipitation (AMS-PD-CITY, 2011; UTR-PD-STRATEGY, 2016). Additionally, both municipalities pay attention to ***wind nuisance*** around high buildings (AMS-PD-CITY, 2011; UTR-PD-CITY, 2018).

Walking needs + Planning & design

The municipality of Amsterdam presented two lists of conditions for a successful pedestrian environment and the municipality of Utrecht presented one list of criteria for a well-designed pedestrian environment. Table 9 (next page) provides an overview of the lists from both municipalities together with other walking needs and planning & design measures. Table 9 (next page) shows multiple findings of the comparison between both municipalities. The findings of the table and other findings will be explained using the walking needs *"accessibility", "safety from crime", "traffic safety", "comfort"* and *"pleasurability"*.

Table 9: Comparison between walking needs + planning & design of Amsterdam and Utrecht.

Sources: Amsterdam: 1: (AMS-PD-PEDESTRIAN, 2017, p. 21-33); 2: (AMS-PD-TRAFFIC, 2018, p. 15). Utrecht: (UTR-PD-PEDESTRIAN, 2015, p. 7-11). **Legend:** the exact same colours indicate similarities between both municipalities. For example: "traffic safety" is a similarity, because they have the same shade of green. The colour indicates a category that can be linked to other criteria. For example: "traffic safety" (green) can be linked to "ease of crossing" and "low traffic speed".

#	MUNICIPALITY OF AMSTERDAM		#	MUNICIPALITY OF UTRECHT	
	WALKING NEEDS	PLANNING & DESIGN		WALKING NEEDS	PLANNING & DESIGN
1.	**Safe** (1)	Street lighting (1)	1.	**A fine-grained network with direct and continuous routes**	Follow wish lines
	Ease of crossing (1)	Good sightlines (1)		Human scale	Free of barriers
	Low traffic speed (1)	Crowd management (1)		Short walking distance	Short cuts
	Traffic safety (1)			Proximity	
	Safety from crime (1)			Understandable routes	
2.	**Offers room for movement** (1)	Path width (1)	2.	**A sufficient amount of space for pedestrians**	Path width
		Type of pedestrian (1)			Type of pedestrian
		Number of pedestrians (1)		Maintenance	Number of pedestrians
					Free of obstacles
3.	**Accessible** (1)	Path width (1)	3.	**Physical comfort**	Equal, non-slip and solid surface
		Free of obstacles (1)		Shelter against weather and noise	Free of obstacles
		Priority to pedestrians (1)			Street lighting
		Flexible use of space (1)			
4.	**Logical** (1)	Good sightlines (1)	4.	**Traffic safety**	Mix of traffic
	Way finding (1)	Signage (1)		Avoid conflict points	Free of other traffic
		Missing links (1)		Low traffic speed	Short wait times at crossings
	Visibility (1)			Low traffic volume	Long green lights at crossings
				Ease of crossing	
5.	**Fast when desired** (1)	Short wait times at crossings (1)	5.	**Accessible, also for people with a disability**	Bridgeable height differences
	Space (1)				
	Way finding (1)				
6.	**Attractive (clean, very beautiful)** (1)	Use of sustainable materials (1)	6.	**Attractive, inviting to stay**	Benches
		Climate resistance (1)		Experience	Stairs
	Maintenance (1)			Liveliness	Presence of activities
				Quality of stay	
				Presence of shade and sun	
				Safety from crime	
7.	**Accessible** (2)	Free of obstacles (1)	7.	**Good connection with other modalities**	-
		Bridgeable height differences (1)		Safety	
				Comfort	
8.	**Ease of crossing** (2)	-	8.	-	-
	Traffic safety (2)				
	Low traffic speed (2)				
9.	**Logically connected** (with other walking routes and public transport) (2)	-	9.	-	-
10.	**Safety from crime** (both subjective and objective) (2)	-	10.	-	-
11.	**Beautiful, clean and not damaged** (2)	-	11.	-	-
12.	**Orientation** (2)	Good sightlines (1)	12.	-	-
13.	**Comfort** (2)	-	13.	-	-
14.	**Quality of stay** (2)	-	14.	-	-
15.	**Directness** (2)	-	15.	-	-

Accessibility

Table 9 (previous page) shows both municipalities include ***accessibility*** in their criteria for a well-designed pedestrian environment. The municipality of Amsterdam regards the planning & design measures ***path width***, ***absence of obstacles***, ***bridgeable height differences, priority to pedestrians*** and ***flexible use of space*** as part of accessibility (see table 11). Similar to Amsterdam, the municipality of Utrecht considers bridgeable height differences as part of accessibility (see table 9). A path free of obstacles is considered as a comfort aspect by the municipality of Utrecht (see table 9).

Besides the accessibility on sidewalks, both municipalities included ***walking distance*** in their planning policies. The municipality of Utrecht focuses on short walking distances by including the walking needs **a** ***fine-grained network with direct and continuous routes***, ***human scale*** and ***proximity*** (see table 9). The municipality of Amsterdam attempts to shorten walking distances by realising ***missing links*** in the pedestrian network, while the municipality of Utrecht aims to follow ***wish lines*** of pedestrians, making ***short cuts*** and making the city ***free of barriers*** (see table 9). Besides, both municipalities aim to shorten walking distances through ***densification*** of the city (AMS-PD-PUBLIC, 2017; UTR-PD-PEDESTRIAN, 2015) and increasing ***land use diversity*** (AMS-PD-CITY, 2011; UTR-PD-MOBILITY, 2016).

In addition to short walking distances, both municipalities attempt to influence ***perceived walking distance*** by improving the ***connectivity*** between places. Especially the municipality of Amsterdam focuses on ***logical walking routes*** with ***sightlines*** and ***signage***, while the municipality of Utrecht states walking routes should be ***understandable*** (see table 9).

Safety from crime

Table 9 shows that both municipalities include safety from crime in their pedestrian policies. However, the municipality of Amsterdam considers safety from crime as one the criteria for a well-designed pedestrian environment, while the municipality of Utrecht shortly mentions it in the pedestrian policy document. According to AMS-PD-PEDESTRIAN (2017), the sense of safety from crime can be provided by a sufficient amount of ***lighting*** and ***lines of sight***. The municipality of Utrecht does not mention how safety from crime could be provided in the analysed policy documents.

Although both municipalities lack an extensive explanation of how to provide safety from crime to pedestrians, some planning & design measures are mentioned to provide safety from crime. Both municipalities stress the importance of ***lively facilities in plinths of buildings***, which provides ***social surveillance*** on streets (AMS-PD-CITY, 2011; UTR-PD-STRATEGY, 2016). The municipality of Utrecht states ***front doors of livings and facilities*** should have an ***orientation*** on pedestrian routes to provide social surveillance (UTR-PD-MOBILITY, 2016).

Traffic safety

Table 9 shows both municipalities include ***traffic safety*** in their lists of design criteria for a well-designed pedestrian environment. Both municipalities link traffic safety to ***low traffic speed*** and ***ease of crossing*** (see table 9). Besides these walking needs, the municipality of Utrecht also links traffic safety to ***traffic volume*** and ***the number of conflict points*** between different modes of transport (see table 9). The municipality of Amsterdam states public space should be ***calm*** and ***structured*** after a redesign to provide ***visibility*** on streets, while the municipality of Utrecht rarely discusses visibility.

Both municipalities propose various planning & design measures to improve traffic safety, including measure to reduce traffic speeds and traffic volumes and measures to improve ease of crossing. The municipality of Amsterdam mentioned some speed limiting measures, including ***traffic signs with speed limits***, ***speeds bumps*** and ***narrow lanes*** (AMS-PD-SAFETY, 2016). Both municipalities attempt to reduce traffic volumes in the inner city through a ***car traffic network*** where cars will be concentrated on the main roads (AMS-PD-CITY; UTR-PD-MOBILITY, 2016). The ease and safety crossing is in both municipalities seen as one the main challenges in traffic safety and will be improved by ***short crossing lengths*** and ***short waiting times for traffic lights at crossings*** (AMS-PD-GUIDELINE, 2016; UTR-PD-MOBILITY, 2016).

Comfort

Table 9 shows ***comfort*** is included in the design criteria of both municipalities. The municipality of Utrecht means by comfort ***the quality of the surface***, a sidewalk ***free of obstacles***, ***street lighting*** and ***shelter against weather and noise*** (see table 9). The municipality of Amsterdam states walking routes should be comfortable but does not explain how comfort will be provided (see table 9).

One of the main challenges in both pedestrian policies is ***creating space*** for pedestrians. Table 9 also shows that both municipalities strongly focus on ***creating space*** for pedestrians. Both municipalities aim to create more room for pedestrians by increasing ***path width*** depending on the ***type of pedestrians*** and ***number of pedestrians*** using the street (see table 9). The municipality of Utrecht links a sufficient amount of space for pedestrians also to sidewalks ***free of obstacles*** and ***maintenance*** to keep the sidewalks free of obstacles (see table 9).

Both municipalities propose a number of planning & design measures to create more space. ***Choices between different modes of transport*** will be made in each street to create more space for pedestrians (AMS-PD-TRAFFIC, 2018; UTR-PD-MOBILITY, 2016). A large part of the measures consists of measures to ***reduce automobile traffic*** in the inner city, including ***removing car-parking spaces*** on streets (AMS-PD-CITY, 2011; UTR-PD-STRATEGY, 2016) and ***banning cars*** in certain streets (AMS-PD-CITY, 2011; UTR-PD-INNERCITY, 2015). The municipality of Amsterdam also mentions to ***mix traffic*** in streets to create space for pedestrians, such as car traffic that drives on the tram track (AMS-PD-AGENDA, 2015).

Besides the sidewalk width and the number of obstacles, both municipalities attempt to influence pedestrian crowds. Mainly, the municipality of Amsterdam tries to improve safety and comfort of pedestrians by ***crowd management***, such as controlling pedestrian crowds during events and a pedestrian counting system (AMS-PD-PEDESTRIAN, 2017).

Pleasurability

Similar to the municipality of Utrecht, the municipality of Amsterdam states walking routes should be ***attractive*** by mentioning that walking routes should be ***beautiful, clean and not damaged*** (see table 9). These words can be also linked to ***maintenance***, which is linked to pedestrian policy in both municipalities (see table 9). Table 9 also shows both municipalities pay attention to the ***quality of stay*** of pedestrians. Besides this, Utrecht's pedestrian policy states the ***experience*** and ***liveliness*** of a place are important (see table 9).

Summary

The most important findings of the policy document analysis are written down below for each domain.

INTERESTS
Pedestrian policy is seen as an instrument that contributes to a solution for various urban problems and as an instrument that provides opportunities on different policy areas. The benefits of walking were mentioned in both planning policies for environment, public health, economy and social level. The main reasons for applying pedestrian policy are listed below. • **Environmental:** walking is a space efficient means of transport and improving pedestrian environments can help to reduce the pressure on public space. • **Environmental:** improving pedestrian environments can help to stimulate a modal shift, which reduces automobile use, air and noise pollution, use of space, traffic congestion and traffic accidents. • **Economic:** improving pedestrian environments can help to stimulate the local economy in the city by improved consumer expenditures and improved international economic positions. • **Social:** improving pedestrian environments improves social equity and stimulates self-reliance of children, elderly and disabled.
PEDESTRIANS
• **Age + disability:** both municipalities state public space should be accessible for everyone, including children, elderly and disabled. • **Walking purpose:** although both municipalities made a distinction in different walking purposes (citizens, commuters and tourists), the walking purposes are not the main guidelines for the designs of both pedestrian policies and pedestrian networks.
PLACE
• **Topography:** both municipalities argue public space in the inner city is scarce due to the narrow historical street sections, which were never designed for the large amount of traffic and other spatial claims. • **Topography:** Amsterdam designed a hierarchical pedestrian network based on the functions in different streets, while Utrecht developed a hierarchical pedestrian network based on the amount of space in different economic zones. • **Topography:** both municipalities stress the importance of customization when redesigning a pedestrian environment. • **Climate:** although some attention goes to planning & design measures for coolness and wind nuisance, the walking need of climate comfort is barely linked to pedestrian policy of both municipalities.
WALKING NEEDS + PLANNING & DESIGN
• **Accessibility:** walkability is understood as making public space accessible for everyone, including disabled using a walking aid, through providing bridgeable height differences, a sufficient path width and sidewalks free of obstacles. • **Accessibility:** a short walking distance is part of walkability and included in planning policy by land use density, land use diversity and a city free of barriers. • **Accessibility:** wayfinding is considered as part of walkability and is included by sightlines, signages and logical walking routes. • **Safety from crime:** although safety from crime is considered as part of walkability, both municipalities pay little attention to the walking needs and design measures that affect safety from crime. • **Traffic safety:** traffic safety is considered as important in walkability and is offered by various planning & design measures to reduce traffic speeds and improve ease of crossing but lacks attention to traffic volume, visibility and distance between pedestrians and vehicular traffic. • **Comfort:** creating space for pedestrians is seen as one of the main challenges in pedestrian policy and is pursued by reducing the number of obstacles, making choices between different modes of transport in each street (e.g. less car parking spaces on the street) and mixing traffic (e.g. tram and car traffic on one lane). • **Pleasurability:** the attractiveness is considered as part of walkability but is not extensively discussed in planning policy.

4.4 Walkability in planning practice

The results in this paragraph are presented to answer the third research question: *"how is walkability applied in planning practice of large Dutch cities?"* The cities of Amsterdam and Utrecht will again be used as case studies. Firstly, the results of walkability in planning practice of Amsterdam will be presented. Subsequently, the results of Utrecht in planning practice will be outlined. Finally, the results of both cities in planning practice will be compared.

4.4.1 Amsterdam

Based on the case study selection in the methodology chapter, the mini cases of Vijzelgracht (nr. 1), Haarlemmerstraat (nr. 2), Oude Turfmarkt (nr. 3) and Herenstraat (nr. 4) emerged as the most suitable mini cases. Figure 14 shows the location of the mini cases.

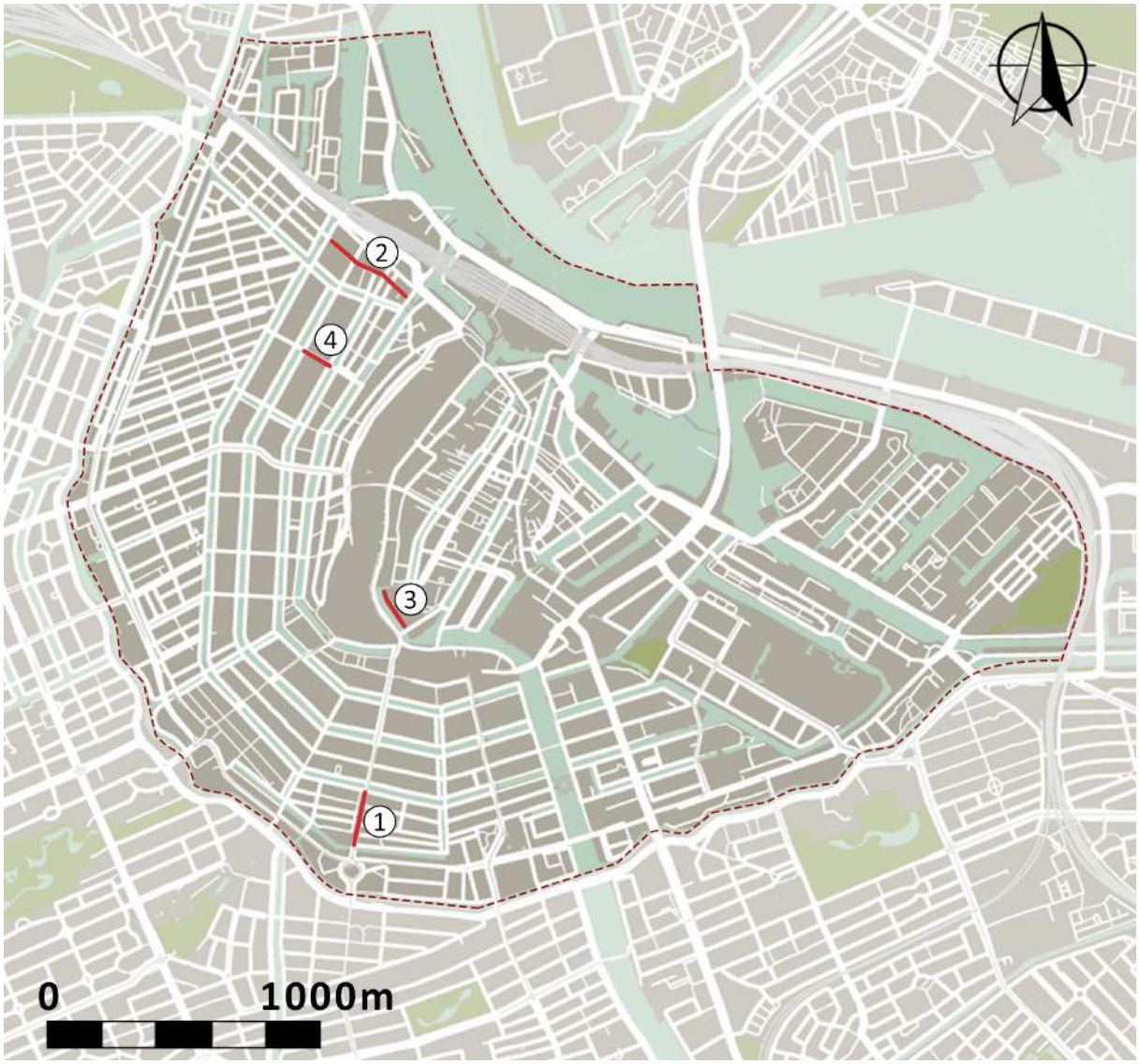

Figure 14: Location mini cases Amsterdam (Map information Google, 2019).

Mini case 1: Vijzelgracht

Figure 15: Panorama Vijzelgracht.

Figure 16: Vijzelgracht before redesign (May, 2008).
Figure 17: Sidewalks with service zone.

Place

The Vijzelgracht is ***located in the central south of the inner city*** and functions as a ***main traffic road*** between the south of Amsterdam and the core of the inner city. The street has a ***street section of 32 meters*** wide. On both sides of the street ***historical buildings*** are present of ***three or four storeys***. ***Stores, bars, restaurants*** and ***apartments*** are located on the east side of the street, while ***dwellings*** and ***offices*** are located on the west side of the street. The street is located on the route of the North-south metro line and contains a ***metro station***. Besides a metro station, the street contains a ***tram station***.

Interests

The Vijzelgracht is part of the public space project "Rode Loper" of the municipality of Amsterdam. This project consists of multiple streets on the North-south metro line route and aims to improve the quality of public space and the conditions for pedestrians and cyclists (Beemster, 2015). The appearance of the ***North-south line metro station*** on the Vijzelgracht can be seen as the initiator of the pedestrian project. In addition, the Vijzelgracht was first a heavy traffic road with small sidewalks as is shown in figure 16. This indicates ***traffic safety*** might have been also a reason to improve pedestrian conditions. Furthermore, the presence of stores, bars and restaurants might be one of the reasons to improve walking conditions since this can stimulate ***local economy*** in the street.

Pedestrians

The wide sidewalks are almost ***free of obstacles*** due to a ***service zone*** for parked bicycles, loading and unloading spaces, terraces and garbage containers. However, some garbage still cluttered the street view. The presence of a service zone makes sidewalks ***accessible*** for ***disabled*** using a wheelchair. Due to the presence of ***greenery***, ***benches***, ***terraces*** and ***stores***, the Vijzelgracht is designed for pedestrians

that walk for ***recreation, tourism*** and ***staying*** (see figure 15 and 17). In addition, pedestrians who walk for ***transportation*** are served by ***connectivity*** between places due to the presence of a ***pedestrian zone***, ***wide sidewalks*** and ***signage with travel information***.

Walking needs + Planning & design

The ***combination of tram and automobile traffic on two lanes*** results in a sufficient amount of space for pedestrians and low traffic speeds (see figure 17). The ***distance between pedestrians and other traffic*** also provides ***traffic safety*** for pedestrians. Another design measure providing traffic safety is the ***presence of buffers***, which are present on both sides of the street through a hedge and a service zone. The lack of car parking and the low number of fixed objects contributes to sufficient ***visibility*** for pedestrians. Table 10 provides an overview of the domains.

Table 10: The domains of Vijzelgracht.

MINI CASE 1: VIJZELGRACHT				
INTERESTS	**PEDESTRIANS**	**PLACE**	**WALKING NEEDS**	**PLANNING & DESIGN**
North-south line	Disabled	Location: central south	Accessibility	Pedestrian zone
Traffic safety	Recreation	Function: traffic road	Traffic safety	Wide sidewalks
Local economy	Transportation	Street width: 32 meters	Low traffic speed	Free of obstacles
	Tourism	Stores, bars and restaurants	Distance to traffic	Service zone (flexible use of space)
	Shopping	Tram and metro station	Visibility	Mix of tram and car traffic
	Staying		Connectivity	Presence of buffer (hedges)
			Pleasurability	Greenery
				Signage
				No street car parking spaces

Mini case 2: Haarlemmerstraat

Figure 18: Panorama Haarlemmerstraat.

Figure 19: Bicycle parking zone Haarlemmerstraat.
Figure 20: Loading and unloading space Haarlemmerstraat.

Place

The Haarlemmerstraat is located in the ***Northwest of the inner city*** and serves as an important ***connection for bicycle traffic*** between Amsterdam-West and the inner city. The street has a narrow historical ***street section of 10 meters wide***. On both sides of the street ***historical buildings*** are present of ***four or five storeys***. The street contains many ***stores, bars and restaurants*** with ***apartments*** above. The densely built environment and the large number of facilities resulted in a large number of ***spatial claims***, such as bicycles, cars, terraces and goods transport.

Interests

The narrow street section in combination with the large number of spatial claims and the large amount of traffic resulted in a ***pressure on public space***, which seems to be the main interest to improve pedestrian conditions. The pressure on public space resulted also in unsafe traffic situations and poor accessibility for disabled (Het Parool, 2013). ***Traffic safety*** and ***accessibility*** can be therefore seen as two other reasons to improve pedestrian conditions in the Haarlemmerstraat. Moreover, the ***local economy*** can be seen as a reason due to the presence of many stores, bars and restaurants.

Pedestrians

The Haarlemmerstraat is mainly used for ***recreational purposes***, such as ***tourism*** and ***shopping***. The street provides some opportunities for ***staying***, such as terraces and benches. The presences of bicycles that partly block sidewalks make the street sometimes less accessible for ***disabled*** using a wheelchair. In addition, the large amount of traffic and the false sense of traffic safety on pedestrian crossings make the street hard to cross for disabled.

Walking needs + Planning & design

The planning & design measures taken in the street were mainly measures to create more space for pedestrians and improve traffic safety. The introduction of ***one-way automobile traffic*** resulted in more space for pedestrians and reduced ***traffic speed and volume***. Besides, traffic speed was reduced through a ***narrow lane width*** and ***speed bumps***. Another traffic safety measure is the attention to ***ease of crossings*** through ***low sidewalk edges*** and ***elevated pedestrian crossings***. However, the large amount of traffic and speed differences make the street still hard to cross (Het Parool, 2017a). In addition, a number of measures were taken to reduce the number of obstacles on sidewalks. The service zone on one side of the road serves as ***buffer*** between pedestrians and cars, and keeps the walking passages largely free of obstacles. White lines mark the zones of ***flexible bicycle-parking spaces*** and ***loading and unloading space*** for goods transport (see figure 19 and 20). However, the street still experiences problems with parked bicycle due to a lack of bicycle parking places as is shown in figure 18. Table 11 provides an overview of the domains.

Table 11: The domains of Haarlemmerstraat.

MINI CASE 2: HAARLEMMERSTRAAT				
INTERESTS	**PEDESTRIANS**	**PLACE**	**WALKING NEEDS**	**PLANNING & DESIGN**
Pressure on public space	Disabled	Location: North-west	Space	Free of obstacles
Traffic safety	Shopping	Function: bicycle route	Traffic safety	Service zones
Local economy	Tourism	Street section: 10 meters	Low traffic speed	One-way car traffic
	Recreation	Stores, bars and restaurants	Low traffic volume	Lane width + speed bumps
	Staying	Apartments	Ease of crossing	Presence of buffer
		Many spatial claims	Pleasurability	Flexible bicycle parking
				Load and unloading places
				Flexible use of space

Mini case 3: Oude Turfmarkt

Figure 21: Panorama Oude Turfmarkt.

Figure 22: Oude Turfmarkt (Google Streetview, 2014).
Figure 23: Bicycle parking zone Oude Turfmarkt.

Place

The Oude Turfmarkt is ***located in the middle of the inner city,*** which is mainly used by tourists. The street is located ***parallel to a main traffic road*** along the canal. The ***street section from façade to the edge of the canal is 13 meters***. The large historical buildings on the Oude Turfmarkt contain ***educational facilities, a museum*** and ***health facilities***. Besides, ***a boat terminal for tour boats*** is located in this street. The Oude Turfmarkt is ***located nearby the North-south metro line station*** of Rokin.

Interests

Similar to the Vijzelgracht, the Oude Turfmarkt is part of the public space project "Rode Loper" (Het Parool, 2017b). The initiator of the pedestrian project on the Oude Turfmarkt is thus the ***North-south metro line***. Besides, the ***presence of many tourists*** might have been a reason for the municipality to create more space for pedestrians on the Oude Turfmarkt. Additionally, the car-free pedestrian zone contributes to the aim of the municipality to ***reduce automobile use*** in the inner city. Before, the Oude Turfmarkt was dominated by cars and other spatial claims (see figure 22).

Pedestrians

The main focus at the Oude Turfmarkt is on the pedestrian group of ***tourists***. The presence of ***benches***, a large deck to sit along the ***water***, the location on the ***sun side*** of the street and the ***presence of greenery*** make it an inviting ***place to stay*** (see figure 21 and 23). Moreover, ***information maps*** and ***signages*** on the metro stations provide tourists ***orientation***. Besides tourists, the large amount of pedestrian space and the smooth surface make the place ***accessible*** for ***disabled*** using a wheelchair.

Walking needs + Planning & design

The street was turned into a car-free ***pedestrian zone***, which is only accessible for goods transport between 07:00 and 11:00 in the morning. ***Traffic safety*** is provided through the creation of a ***large distance*** between pedestrians and vehicles. The pedestrians only have to share the street with ***cyclists***. During the observation, no conflicts were observed between pedestrians and cyclists. Possible reasons for this are that the Oude Turfmarkt is not located on an on-going cycle route and the large amount of free space. The ***large amount of space*** and the ***visibility*** ensure there are no conflicts between pedestrians and cyclists. The bicycles are parked in the marked flexible bicycle-parking zones at the beginning of the pedestrian zone. Due to these ***service zones***, the pedestrian zone is ***free of obstacles***. Table 12 provides an overview of the domains.

Table 12: The domains of Oude Turfmarkt.

MINI CASE 3: OUDE TURFMARKT				
INTERESTS	**PEDESTRIANS**	**PLACE**	**WALKING NEEDS**	**PLANNING & DESIGN**
North-south line	Disabled	Location: middle of inner city	Accessibility	Pedestrian zone (car free)
Tourism	Tourism	Function: staying	Traffic safety	Service zones (bicycles)
Reduce car use	Staying	Street width: 13 meters	Distance to other traffic	Free of obstacles
		Along the canal	Visibility	Loading and unloading times
		Along main traffic road	Pleasurability	Signage
		Metro station	Way finding	Benches and greenery
			Climate comfort	Sunny side

Mini case 4: Herenstraat

Figure 24: Panorama Herenstraat.

Figure 25: Herenstraat (Amsterdaminsite, n.d.).
Figure 26: Loading and unloading blocks sidewalk.

Place

The Herenstraat is ***located in west of the inner city*** in between the canals, which means that the street is not located in the touristic area. The street is mainly passed by ***destination traffic*** and ***cyclists***. The street has a ***narrow street section width of 10 meters*** and is surrounded by ***historical buildings of four or five storeys***. The ground floor of these buildings consists of ***stores, restaurants and livings***. The floors above contain ***apartments***.

Interests

Since a large number of entrepreneurs are located in the street, stimulating ***the local economy*** seems to be the main interest to improve walking conditions in the Herenstraat. As is shown in figure 24, the sidewalks are ***free of obstacles***, which could indicate that entrepreneurs are aware of the importance of walking conditions for their business. Besides, the ***pressure on public space*** could have played a role due to the presence of parked cars and other spatial claims in a narrow street as is shown in figure 25.

Pedestrians

The street is accessible for ***disabled with a wheelchair*** due to the ***wide sidewalks without obstacles*** and the ***smooth surface***. Looking from the perspective of ***walking purposes***, the street is redesigned for ***pedestrians who are shopping*** through the presence of ***wide sidewalks*** and ***low side walk edges***, which makes it ***easy to cross the street*** and go to another store. Besides shopping pedestrians, the street is designed as a ***place to stay*** due to the ***presence of terraces***, ***seats*** and ***greenery***.

Walking needs + Planning & design

The focus in this street seems to be on ***creating more space*** for pedestrians by a ***narrow lane width*** and ***services zones*** to ***avoid obstacles*** on walking passages. Besides more ***space*** for pedestrians, ***one-way car traffic***, ***a narrow lane width*** and ***the presence of speed bumps*** might have contributed to a ***low traffic speed*** and ***low traffic volume,*** and thereby ***traffic safety***. Moreover, ***the small number of objects***, ***the lack of parking spaces*** and the ***presence of services zone*** in the street resulted in a ***clear traffic situation*** providing a good ***visibility***. Although the lack of parking spaces provides space for pedestrians, vehicles that load and unload their goods sometimes block the sidewalk or the road (see figure 26). Table 13 provides an overview of the domains.

Table 13: The domains of Herenstraat.

MINI CASE 4: HERENSTRAAT				
INTERESTS	**PEDESTRIANS**	**PLACE**	**WALKING NEEDS**	**PLANNING & DESIGN**
Local economy	Shopping	Location: west of city	Space	Wide sidewalks
Pressure on public space	Staying	Function: shopping	Accessibility	Service zones
	Tourism	Street section: 10 meters	Traffic safety	Free of obstacles
	Disabled	Stores and restaurants	Low traffic speed	Benches and greenery
		Apartments	Ease of crossing	No street car parking spaces
			Visibility	Speed bumps
				Narrow lane width
				One-way car traffic

4.4.2 Utrecht

Based on the case study selection in the methodology chapter, the mini cases of St. Jacobsstraat (nr. 1), Twijnstraat (nr. 2), Zadelstraat (nr. 3) and Oudkerkhof (nr. 4) were selected. Figure 27 shows the location of the mini cases.

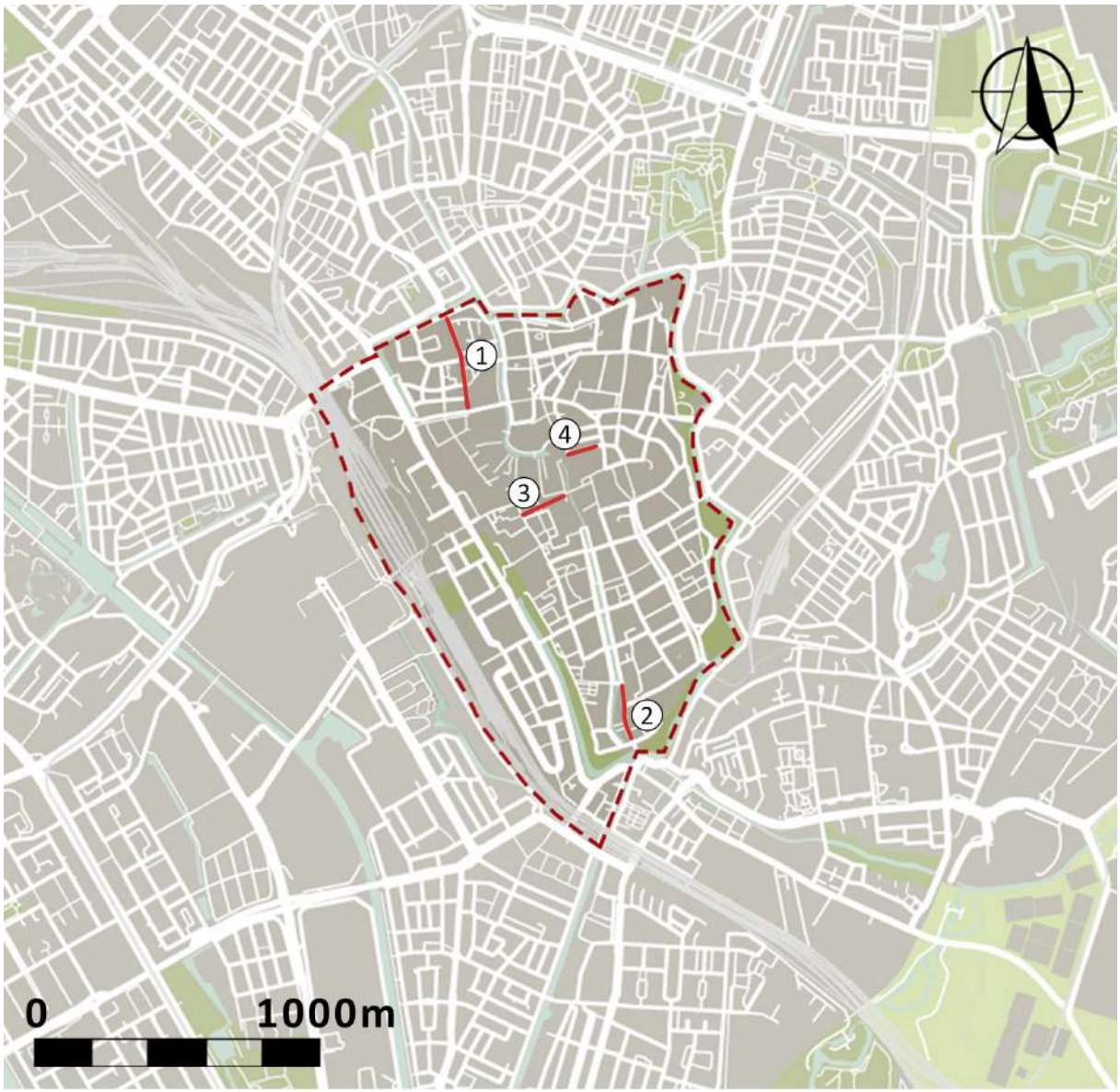

Figure 27: Location mini cases Utrecht (Map information Google, 2019).

Mini case 1: St. Jacobsstraat

Figure 28: Panorama St. Jacobsstraat.

Figure 29: Presence of a service zone.
Figure 30: Good transport blocks bicycle path.

Place

The St. Jacobsstraat is located in the ***north of the inner city*** and functions as an important ***bus connection between the train station and the north of Utrecht***. The street is used by multiple bus lines and is partly closed for other car traffic. The St. Jacobsstraat has a ***wide street section of 25 meters***. The street contains mainly ***large post-war buildings*** with inside ***shops, offices, a parking garage, store storage and apartments***.

Interests

The design report of the St. Jacobsstraat mentioned a number of reasons for the redesign of the street. The main reason that is mentioned is to solve the problem of ***traffic congestion*** in the street (Municipality of Utrecht, 2014). In addition, a number of other reasons were mentioned including ease of crossing for pedestrians, quality of stay, ***economic vitality*** and ***real estate values*** (Municipality of Utrecht, 2014).

Pedestrians

The street is mainly used by ***commuters***, ***consumers*** and ***inhabitants***. The wide sidewalks of 2,4 meter make sure people with different ***walking speeds*** can pass each other. Besides this, the wide sidewalks are ***free of obstacles*** and do not disturb ***disabled*** with a wheelchair. ***Visual impaired*** are served by tactile paving on the bus stops. Although some ***benches***, ***greenery*** and ***a terrace*** are present, the street is mainly used to ***walk for transportation*** and not for staying.

Walking needs + Planning & design

Since the St. Jacobsstraat connects the middle of the inner city with the north of Utrecht, ***connectivity*** is provided by ***wide and obstacle free sidewalks***. The street section from left to right consists of a sidewalk, a bicycle path, a service zone, two lanes, a service zone, a bicycle path and a sidewalk (see figure 28). The presence of a ***service zone*** for bicycle parking, waste collection, ***loading and unloading space*** and trees reduces the ***number of obstacles*** on the sidewalks (see figure 29). However, transport still blocks the bicycle path, as is shown in figure 30. Besides, the service zone functions as a ***buffer*** between automobile traffic and slow traffic. Apart from a buffer, some other design measures were taken to provide ***traffic safety*** in the street. Vehicles have a ***small lane width***, which resulted in more ***space*** for pedestrians and ***reduction of traffic speed***. In addition, the street is partly accessible for bus traffic only, which reduces the ***traffic volume*** in the street. Besides low traffic speeds and traffic volumes, the ***crossings with rest points*** contribute to the ***ease and safety of crossing***. Table 14 provides an overview of the domains of the St. Jacobsstraat.

Table 14: The domains of St. Jacobsstraat.

MINI CASE 1: ST. JACOBSSTRAAT				
INTERESTS	**PEDESTRIANS**	**PLACE**	**WALKING NEEDS**	**PLANNING & DESIGN**
Traffic safety	Commuters	Location: North of the inner city	Traffic safety	Wide sidewalks
Economic vitality	Inhabitants	Function: traffic connection road	Ease of crossing	Service zone (free of obstacles)
Real estate values	Shopping	Street width: 25 meters	Traffic volume	Narrow lane width
	Disabled	Post-war architecture	Traffic speed	Loading and unloading places
	Visual impaired	Offices, shops and apartments	Connectivity	Flexible bicycle parking spaces
		Parking garages and store storage	Quality of stay	Presence of buffer

Mini case 2: Twijnstraat

Figure 31: Panorama Twijnstraat.

Figure 32: Transport blocks sidewalk.
Figure 33: Bicycle-parking zone.

Place

The Twijnstraat is characterized by its ***historical small street section***, ***presence of many stores*** and the ***large amount of traffic***. The street is located in the ***south of the inner city*** and serves as an important ***connection for pedestrians between train station Vaartsche Rijn and the heart of the inner city***. The ***street section width varies between 6 and 13 meters***. Besides the presence of many shops, the street also contains some ***apartments*** and ***restaurants***.

Interests

The design report of the Twijnstraat mentioned a number of reasons for the redesign of the street. The municipality of Utrecht aims to ***spread pedestrian crowds*** by expanding the main shopping area to other areas, such as the Twijnstraat (Municipality of Utrecht, 2015). Besides this, the ***new train station Vaartsche Rijn*** is seen as a reason to improve the pedestrian conditions, since this will lead to a flow of pedestrians from the station to the core inner city (Municipality of Utrecht, 2015). The increase of pedestrians in the street and the large number of spatial claims might result in a ***pressure on public space***. Moreover, the ***economic vitality*** and ***traffic safety*** of the street is seen as a reason to redesign the street (Municipality of Utrecht, 2015).

Pedestrians

The main pedestrian groups using the Twijnstraat are ***consumers***, ***tourists*** and ***inhabitants***. Although space is limited, the street is mostly designed as a ***place to stay*** for these groups, as can be seen in the presence of ***benches*** and space for pedestrians. Although sidewalks are widened, there are still places that seem too small for ***disabled using a wheelchair*** (see figure 32 and 33).

Walking needs + Planning & design

The main focus in the redesign of the Twijnstraat is to reduce the ***number of obstacles*** to create more ***space*** for pedestrians. A ***service zone*** for ***bicycle-parking spaces***, ***car-parking spaces***, ***loading and unloading space*** and terraces was created on one side of the street (see figure 31 and 33). However, large vehicles still block sidewalks due to a shortage of loading and unloading spaces, as is shown in figure 32. ***Traffic signs***, ***street name signs*** and ***streetlights*** are as much as possible positioned on walls of buildings. Besides the reduction of obstacles, other design measures have been taken to ***create more space*** for pedestrians. The ***lane width has been narrowed*** to provide more space to pedestrians and other spatial claims. The street has been turned into ***one-way traffic*** and cars and cyclists are mixed on one lane. In addition, ***parking spaces were removed*** to create space for pedestrians and other spatial claims. Besides creating more space, attention was paid to ***traffic safety***. ***Traffic speeds*** were reduced by mixing traffic and narrowing the roadway. The ***ease of crossing*** is improved through use of ***low sidewalk edges*** and improved ***visibility*** due to fewer obstacles. Table 15 provides an overview of each domain.

Table 15: The domains of Twijnstraat.

MINI CASE 2: TWIJNSTRAAT				
INTERESTS	**PEDESTRIANS**	**PLACE**	**WALKING NEEDS**	**PLANNING & DESIGN**
Spreading crowds	Shopping	Between inner city and station	Space	One-way car traffic
New train station	Tourists	Function: traffic and shopping	Connectivity	Service zones (flexible use)
Number of pedestrians	Inhabitants	Street width: 6 - 13 meter	Quality of stay	Free of obstacles
Pressure on public space	Disabled	Historical architecture	Traffic safety	Low sidewalk edges
Economic vitality	Staying	Stores, bars and restaurants	Ease of crossing	Removed parking spaces
Traffic safety		Apartments	Low traffic speed	Loading and unloading places

Mini case 3: Zadelstraat

Figure 34: Panorama Zadelstraat.

Figure 35: Zadelstraat before redesign (Japiot, 2007).
Figure 36: Pedestrian zone.

Place

The Zadelstraat is characterized by its small street section width, ***historical buildings*** of ***three or four storeys***, the large number of shops and its ***sight line*** to the Dom church. The main function of the street is ***shopping***. The street connects the central station with the core shopping area of Utrecht. The ***street section width varies from 5 until 8 meters***. Besides ***stores***, the street contains ***restaurants*** and ***apartments***.

Interests

Due to the location of the Zadelstraat on the route between the central station and the core shopping area, one of the main interests to improve walking conditions might be the ***economic vitality***. Besides, the narrow street section width and the road for car traffic in the past marked by poles resulted in a ***pressure on public space*** (see figure 35). The presence of pedestrians, cyclists and cars in the street may have resulted in unsafe situations. ***Traffic safety*** might have been also a reason for the redesign of the street.

Pedestrians

Consumers, ***tourists*** and ***inhabitants*** are the main users of the Zadelstraat. The ***presence of benches***, ***historical buildings, a terrace*** and some ***greenery*** make the street attractive for these pedestrian groups. The ***sight line*** to the Dom church makes it an attractive place for tourists (see figure 34). The street is accessible for ***disabled using a wheelchair*** due to the large amount of pedestrian space without obstacles.

Walking needs + Planning & design

Various walking needs and planning & design measures were taken into account when improving the walking conditions in the Zadelstraat. The pedestrian zone with a large amount of space provides ***accessibility***, ***traffic safety*** and ***comfort***. The street is ***free of obstacles*** due to a marked ***service zone*** on each side of the street, which contains terraces, waste collection, street advertisement and some greenery (see figure 34 and 36). Besides, bicycle parking takes place in the side streets of the Zadelstraat, which resulted in a street without parked bicycles. Additionally, the attachment of traffic signs, street name places and streetlights to the façades reduced obstacles. Moreover, pedestrians are provided with ***comfort*** through a smooth ***surface***. Table 16 provides an overview of the factors and variables of each domain in the Zadelstraat.

Table 16: The domains of Zadelstraat.

MINI CASE 3: ZADELSTRAAT				
INTERESTS	**PEDESTRIANS**	**PLACE**	**WALKING NEEDS**	**PLANNING & DESIGN**
Local economy	Shopping	Location: middle of the city	Space	Pedestrian zone
Pressure on public space	Staying	Function: shopping	Accessibility	Service zone
Traffic safety	Disabled	Street width: 5 - 8 meter	Comfort	Free of obstacles
	Tourism	Historical architecture	Traffic safety	Smooth surface
		Stores and restaurants	Quality of stay	Line of sight
		Apartments	Visibility	Benches

Mini case 4: Oudkerkhof

Figure 37: Panorama Oudkerkhof.

Figure 38: Oudkerkhof before redesign (Reinink, 1976).
Figure 39: Bicycle parking and garbage.

Place

The Oudkerkhof is ***located between three squares*** and connects the City hall quarter with the Museum quarter and the University quarter. The street is characterized by a ***street section width of 11 to 15 meters***, historical buildings of three or four storeys and a large number of facilities. The street is popular by tourists and pedestrians who are shopping and contains ***stores, bars and restaurants***. Apartments are located at the upper levels of the buildings.

Interests

The redesign report of Oudkerkhof mentioned a number of reasons for the redesign of the street. The location of Oudkerkhof near the crowded shopping area of the inner city resulted in the interest of the municipality to attract pedestrians from the main shopping area to Oudkerkhof in order to ***spread crowds*** throughout the inner city (Municipality of Utrecht, 2016). In addition, the municipality aims to have an ***attractive connection*** between the core shopping area, Museum quarter and University quarter (Municipality of Utrecht, 2016). Moreover, the municipality aims to improve ***quality of stay*** and improve the ***economic vitality*** of the street (Municipality of Utrecht, 2016).

Pedestrians

The main pedestrian groups using this street are ***consumers***, ***tourists*** and ***inhabitants***. Consumers and tourists are served by the walking needs of ***experience***, ***quality of stay*** and ***attractiveness*** of the street. The presence of ***lively plinths***, ***terraces***, ***benches*** and ***greenery*** make the street inviting for these groups. ***Disabled*** are taken into account through sufficient ***sidewalk widths*** and ***low side walk edges***.

Walking needs + Planning & design

The municipality of Utrecht has taken multiple design measures to create more space for pedestrians in the street, which contributes to ***accessibility***, ***traffic safety*** and ***comfort***. The street has a ***narrow lane width***, ***cyclists and cars are mixed*** and the street is ***one-way car traffic***. The ***mix of bicycle and car traffic*** ensures a reduction of ***traffic speeds***. Besides these measures, ***service zones*** are present, which include car-parking spaces, ***loading and unloading spaces***, ***flexible bicycle parking spaces***, ***terraces***, ***trees*** and ***benches*** (see figure 37 and 39). The service zone reduces the ***number of obstacles*** in the walking area and serves as a ***buffer*** between pedestrians and other traffic. Although the street contains a service zone, bicycles and garbage sometimes block the sidewalks due to a shortage of bicycle parking spaces and a lack of waste collection points (see figure 39). Besides a low traffic speed, traffic safety is also provided by the ***ease of crossing***, through ***low sidewalk edges*** and the ***reduction of street parking spaces***. In the past, the street was dominated by cars (see figure 38). Nowadays, the number of cars has been reduced but the number of spatial claims, including parked bicycles, terraces and good transport have increased. Table 17 provides an overview of each domain.

Table 17: The domains of Oudkerkhof.

MINI CASE 4: OUDKERKHOF				
INTERESTS	**PEDESTRIANS**	**PLACE**	**WALKING NEEDS**	**PLANNING & DESIGN**
Spread pedestrian crowds	Shopping	Location: in-between squares	Space	One-way car traffic
Attractive connection	Staying	Function: traffic + shopping	Traffic safety	Parking for goods transport
Quality of stay	Tourists	Street width: 11-15 meters	Ease of crossing	No street parking spaces
Economic vitality	Disabled	Stores, bars and restaurants	Low traffic speeds	Service zones as buffers
		Apartments	Experience	Low side walk edges
			Quality of stay	Flexible bicycle parking
			Attractiveness	Mix of traffic

4.4.3 Comparison

When comparing the mini cases of both cities, differences and similarities in planning practice can be discovered. Firstly, the differences and similarities between the mini cases will be discussed through the use of the five domains. Subsequently, the main findings of walkability in planning practice will be outlined.

Interests

A number of reasons to redesign the streets and improve pedestrian conditions are frequently mentioned. In a large part of the cases (e.g. Haarlemmerstraat, Herenstraat, Twijnstraat and Zadelstraat), the main reason to redesign the street is the ***pressure on public space***. In some cases (e.g. Haarlemmerstraat, Twijnstraat and Zadelstraat), the pressure on public space goes together with a lack of traffic space and thereby unsafe traffic situations. When situations start to be unsafe and traffic accidents occur, municipalities are forced to intervene. ***Traffic safety*** of pedestrians can therefore also be seen as an important interest of the municipality to improve pedestrian conditions. In addition, the presence of stores, bars and restaurant in almost all cases make the ***economic vitality*** of streets an important reason to improve pedestrian conditions. Moreover, in the cases of Vijzelgracht, Oude Turfmarkt and Twijnstraat, the appearance of a ***new train or metro station*** and thereby an ***increase of pedestrians*** was the reason for redesigning the street.

Pedestrians

In a majority of the cases, the design requirements of ***elderly and disabled*** using for example a wheelchair are taken into account. This will be explained in the paragraph of accessibility. Besides elderly and disabled, different ***walking purposes*** are included. Most cases (e.g. Oude Turfmarkt, Zadelstraat and Oudkerkhof) are part of the shopping area and touristic area. As a result of this, walking for recreational purposes, including tourism and shopping, are taken into account by ***benches***, ***greenery***, ***sight lines***, ***terraces, signage*** and ***lively plinths***. In addition, ***wide sidewalks*** and ***signage*** serve pedestrians who walk for transportation in the cases with public transport stations, such as Vijzelgracht, Oude Turfmarkt and St. Jacobsstraat.

Place

A number of topographical place characteristics affected the redesign of the street. The pressure on public space can be linked to the place characteristics ***narrow street section width***, ***high land use density***, ***high land use diversity, large amount of traffic*** and a ***large number of spatial claims***. These characteristics are present in many cases (e.g. Haarlemmerstraat, Twijnstraat and Oudkerkhof) and typical for inner cities. Besides topographical place characteristics, the design of the pedestrian environment is partly based on climate characteristics. In the case of the Oude Turfmarkt, the ***sun and shadow side*** of the street are taken into account by locating places to stay on the sun side. In multiple cases (e.g. Oude Turfmarkt, Vijzelgracht and St. Jacobsstraat), ***greenery*** is included, which provides shadow and coolness.

Walking needs + Planning & design

Accessibility

Most streets have a ***sufficient amount of space*** that is ***free of obstacles*** with ***bridgeable height differences*** and in some cases ***tactile paving***. However, in the Haarlemmerstraat, Oudkerkhof Twijnstraat, the amount of space for wheelchairs is in some places limited due to vehicles, garbage or

bicycles that block sidewalks. In some cases (e.g. Vijzelgracht, Haarlemmerstraat and Oudkerkhof), ***maintenance signs*** are present that tell cyclists to only park in bicycle parking zones. These signs help to avoid parked bicycles on sidewalks to a certain extent. In most cases the ***surface was smooth,*** except for the cases of Zadelstraat and Oudkerkhof where the surface was sometimes partly damaged.

Safety from crime

The safety from crime for pedestrians seems to be of less relevance in the inner city due to the presence of people on the street, social surveillance from livings, the presence of streetlights, and security cameras. The cases rarely contain planning & design measures to provide safety from crime. In all cases, sidewalks are free of obstacles, which contribute to the ***visibility*** of the streets and thereby to the perceived safety from crime. In most cases, the street was ***well maintained*** and free of litter, except the cases of Vijzelgracht, St. Jacobstraat and Oudkerkhof where garbage was present on the street.

Traffic safety

Many planning & design measures have been taken to provide pedestrian traffic safety in the cases. A large part of these measures are ***speed-limiting measures***, such as ***mixing car and bicycle traffic*** (e.g. Haarlemmerstraat, Herenstraat, Twijnstraat and Oudkerkhof) and ***the narrowing of the roadway*** (e.g. St. Vijzelgracht, Herenstraat and Twijnstraat). Speed limiting measures also contribute to the ***ease of crossing***. Besides, ease of crossing is improved by ***low sidewalk edges*** (e.g. Herenstraat, Twijnstraat and Oudkerkhof). In addition, a ***buffer*** between pedestrians and vehicular traffic, created through a service zone or hedge, is also present in the cases of Vijzelgracht, St. Jacobsstraat and Oud Kerkhof. Moreover, the ***removal of obstacles*** contributes to the ***visibility*** for pedestrians. However, some streets, including Haarlemmerstraat and Oud Kerkhof, are still full of parked cars, bicycles and other spatial claims, which affect the visibility in these streets.

Comfort

A number of planning & design measures were taken to create more space for pedestrians, which is the main focus in all cases. The main design measure to create more space is making sidewalks free of obstacles through a ***service zone*** for object, such as terraces, bicycle parking and car parking (e.g. in the cases of Vijzelgracht, Haarlemmerstraat, Twijnstraat, and Oud Kerkhof). The ***loading and unloading of goods*** takes place in flexible marked zones that are often part of the service zone (e.g. Haarlemmerstraat, Twijnstraat and Oud Kerkhof). In the cases Haarlemmerstraat, Herenstraat, Twijnstraat and Oudkerkhof, ***one-way car traffic*** was created, which resulted in ***wider sidewalks***. Besides, the ***mix of car and tram traffic on one lane*** resulted in wider sidewalks as can be seen in the case of Vijzelgracht. Moreover, more space for pedestrians was created through the reduction of car parking spaces on streets as was observed in the cases Herenstraat, Oudkerkhof and Twijnstraat.

Pleasurability

Although both cities already possess qualities of pleasurability, such as historical buildings, street design and shop windows, some planning and design measures were taken to improve the pleasurability of the street. In the cases Vijzelgracht, Oude Turfmarkt, Herenstraat and Oudkerkhof, ***greenery*** was added to the street. In addition, the ***street design*** in terms of ***paving stones*** improved the attractiveness of the street (e.g. Vijzelgracht, Oudkerkhof and Zadelstraat).

Appendix VII provides a flowchart of walkability in planning policy and practice. This overview attempts to show how the domains, factors and variables in planning policy and practice are related to each other.

Summary

The most important findings of the observations are written down below for each domain.

INTERESTS
• **Environmental:** the pressure on public space goes often together with unsafe traffic situations and is a direct reason to take action and improve pedestrian conditions. • **Environmental:** the opening of a new train or metro station is often a driver to improve pedestrian conditions due to the increase of pedestrians and the construction side of the station. • **Economic:** stimulating the local economy in streets is frequently mentioned as a reason why municipalities would like to improve the walking conditions in the redesign documents of streets.
PEDESTRIANS
• **Age + Disability:** although bicycles, vehicles and garbage sometimes block sidewalks, disabled were in most cases well served by a sufficient width of sidewalks, bridgeable height differences, ease of crossing and tactile paving. • **Purpose:** walking for transportation was well served by a sufficient path width and signage in a majority of the cases. In addition, benches, greenery, sight lines, terraces and signage were present in the cases for the purpose of recreation.
PLACE
• **Topography:** the pressure on public space can be linked to the place characteristics: narrow street section width, high land use density, high land use diversity, large amount of traffic and a large number of spatial claims, which are present in many cases and typical for the inner city. • **Climate:** although some climate comfort measures are taken into account, including greenery, and the sun and shadow side of a street, the redesigns of the cases include little planning & design measures to provide weather protection.
WALKING NEEDS + PLANNING & DESIGN
• **Accessibility:** most streets have a sufficient amount of space that is free of obstacles with bridgeable height differences and in some cases tactile paving. • **Safety from crime:** the safety from crime for pedestrians seems to be of less relevance in the redesigns of the cases due to the presence of people on street, social surveillance from livings, the presence of streetlights and the presence of security cameras. • **Traffic safety:** much attention is paid to traffic safety of pedestrians through planning & design measures leading to low traffic speeds, ease of crossing, visibility, and distance between pedestrians and vehicular traffic. • **Comfort:** the main focus is on creating space through the reduction of obstacles, creating one-way car traffic, mixing traffic, the reduction of street parking spaces and the narrowing of lane widths. • **Comfort:** the number of obstacles is reduced by a service zone consisting of loading and unloading places, car parking spaces, flexible bicycle parking places, waste collection, terraces and greenery. • **Pleasurability:** some planning and design measures were taken to improve attractiveness, including creating greenery and use of red bricks.

5. Discussion

5.1 Introduction

In this chapter, the results will be discussed in the light of the theoretical framework, research questions and the methodology. Firstly, the results will be discussed for each sub-research question through use of the five domains. Subsequently, the limitations of the methodology will be discussed. Finally, the case study selection of this research will be discussed.

5.2 Sub-research question 1

In this section, the first sub-research question: *"what are the current walkability trends in international scientific literature?"* will be discussed and answered by means of the results and the theoretical framework. In the following paragraphs, the results will be discussed by use of the domains: interests, pedestrians, place, walking needs and planning & design.

Interests

As is shown in the results (p. 30 and 31), each discipline has its own interests and reasons to conduct research into walkability. Planning and urban design scientists consider walkability as a means to ***reduce automobile use*** and thereby ***less air and noise pollution*** and ***less energy consumption***. Besides, these results link walkability to improved ***physical and mental health, social equity*** and ***safety from crime.*** According to Alfonzo (2005), planners and architects believe increased walking rates affect sense of community and quality of life. The first mentioned is in line with the results of social equity, but quality of life was rarely mentioned in the quantitative analysis.

According to Cao, Handy and Mokhtarian (2006), transportation scientists are interested in walkability as a means to reduce motorized traffic, traffic congestion, air pollution and other environmental consequences. The results indicated transportation scientists are interested in ***less automobile use***. However, the benefits of less air pollution, noise pollution and energy consumption were rarely mentioned. Besides less automobile use, the results expressed transportation scientists linked walkability to ***physical and mental health***, ***traffic safety*** and ***cost savings***.

Public health scientists were mainly interested in the influence of walking rates and the physical environment on ***physical and mental health***. This is confirmed by Cao, Handy, & Mokhtarian (2006) who argued public health scientists are interested in walking for exercise resulting in increased public health and thereby lower health care costs. Besides, the results showed public health scientists are interested in ***less automobile use***, ***air pollution*** and ***noise pollution***. This corresponds to the words of Alfonzo (2005), who stated public health scientists have become more interested since walking rates have dropped and motorized traffic negatively affects cities.

The results showed the economic discipline is interested in walkability due to the possible increase of ***real estate value*** and ***cost savings***. The theoretical framework showed some economists are interested in the impact of walkability on real estate value (e.g. Cortright, 2009; Pivo and Fisher, 2011; Tolley, 2011). In addition, the results showed economists are interested in ***less automobile use, less air and noise pollution, less energy consumption, increased physical and mental health, greater quality of life*** and ***improved social capital***. These interests may have an influence on real estate value and societal costs, which might declare why economists frequently mentioned these interests.

According to the results of social discipline, social scientists are interested in ***physical and mental health*** and ***social capital***. Alfonzo (2005) argued social scientists view the presence of pedestrians on streets as a means to create a sense of community and quality of life. The first mentioned corresponds to the result of social capital. However, the results showed quality of life was rarely mentioned by social scientists. Besides, social equity and safety from crime were not mentioned by sociologists.

Looking at all disciplines, the results showed walkability is frequently mentioned as an instrument to ***reduce automobile use***, ***reduce air and noise pollution***, ***reduce energy consumption***, ***improve physical and mental health***, and ***save societal costs***. These interests are in line with the thoughts of Southworth (2005) and Moura, Cambra and Gonçalves (2017) who both considered walkability as the basis of the sustainable city.

Pedestrians

Age, ***gender*** and ***walking purposes*** are frequently mentioned by planning and urban design, transportation and public health scientists as is shown in the results (p. 32). Besides, the group of ***disabled*** is frequently mentioned by planning and urban design scientists. Remarkably, public health scientists rarely included the disabled in their research. In contrast to this study, Alfonzo (2005) found many other factors affecting walking behaviour, which are *"psychological factors"* (e.g. attitudes and awareness); *"demographic factors"* (e.g. age and gender); *"biological factors"* (e.g. weight); *"sociological factors"* (e.g. levels of social support); and *"cultural factors"* (e.g. informal culture of neighbourhoods). This study conducted research into demographic and biological factors but lacks the categories of psychological, sociological and biological factors. Furthermore, Forsyth (2015) showed a distinction could be made for walking purposes in walking for transportation, exercise and recreation. However, this study lacks a quantitative analysis of different walking purposes.

Place

As is shown in the results (p. 33), the categories of ***climate*** and ***topography*** were frequently mentioned by planning and urban design, transportation and economic scientists. Remarkably, the scientists of public health rarely mentioned the category of climate, since temperature affects public health (Gasparrini et al. 2015). The categories of climate and topography are confirmed by Alfonzo (2005) who conducted a literature study into the regional-level characteristics. Besides, Alfonzo (2005) found many factors of the category geography that are frequently mentioned as important determinants to walk. This study looked only at climate and topography. However, it lacks the category of geography and more detailed place characteristics, such as different types of climate or presence of water.

Walking needs + Planning & design

Accessibility

The results (p. 33-38) showed there is a major interest in walking needs as well as planning & design measures that can be linked to ***short walking distances***. For instance, the ***accessibility***, ***connectivity*** and ***proximity*** of walking routes are frequently mentioned in almost all disciplines. Proximity is affected by ***land use diversity***, ***land use density*** and ***free of physical barriers***, which are frequently mentioned by all disciplines, except transportation. The previous mentioned factors largely correspond to what Alfonzo (2005) means by accessibility. Alfonzo (2005) links accessibility to *"the pattern, quantity, quality, variety and proximity of activities present"*, *"connectivity between uses"* and *"walking related infrastructure"*.

Safety from crime

As is shown in the results (p. 33-38), ***safety from crime*** is frequently mentioned by planning and urban design, transportation and economic scientists. However, planning and urban design scientists seem to be most interested in the factors affecting safety from crime. The walking needs of ***visibility*** and ***maintenance*** were linked to safety from crime by many planning and urban design scientists. In addition, these scientists linked safety from crime to the planning & design measures of ***land use type***, ***street lighting***, ***urban form*** and ***windows visible from the street***. These findings are in line with the findings of Mehta (2008) who found safety from crime is affected by "*physical condition"*, *"maintenance"*, "*the configuration of street spaces"*, *"the type of land use"*, *"the alternation of environments"*, and *"the presence or absence of people"*. Although design measures related to visibility (e.g. land use type) are mentioned, visibility was not mentioned by Mehta (2008).

Traffic safety

The results (p. 33-38) showed ***traffic safety*** is mainly discussed in the disciplines of planning and urban design, transportation and public health. The walking needs that are frequently mentioned in scientific literature and affect traffic safety are ***low traffic speed***, ***low traffic volume***, ***distance between pedestrians and vehicular traffic*** and ***visibility***. Alfonzo (2005) found perceived traffic safety is influenced by *"traffic calming features"*, *"traffic volume"* and *"the presence of buffers"*, which corresponds to the findings of this study. According to Mehta (2008), scientists stress the importance of *"traffic calming features"*, *"separation of pedestrians from fast moving traffic" and "safety of street crossings"*. The first two factors of Mehta (2008) were found, but this study lacks analysis of *"safety of street crossings"*. Remarkably, both scientists did not mention visibility.

Comfort

Scientists of planning and urban design, transportation and sociology frequently mentioned ***comfort*** as is shown in the results (p. 33-38). Comfort was often linked to the planning & design measures ***path width***, ***surface*** and ***street furniture***. Besides, comfort can be linked to ***climate comfort***, which is often linked to the walking needs of ***coolness***, ***shade*** and ***shelter*** by planning and urban design scientists. Besides *"path width"* and *"paving",* Southworth (2005) considers way finding and the context of walking routes as part of comfort by the words *"signing"* and *"landscaping"*. Alfonzo (2005) understands comfort as design measures that can be linked to traffic safety (e.g. *"traffic calming measures"*), the pedestrian walkway system (e.g. *"width of sidewalks", "street trees"*) and urban design amenities (e.g. "*street furniture", "arcades", "canopies"*). The findings of this study largely correspond to the findings of Alfonzo (2005), except traffic safety.

Pleasurability

Mainly planning and urban design, and public health scientists view ***pleasurability*** as a part of walkability as is shown in the results (p. 33-38). Planning and urban design scientists link pleasurability to ***experience***, ***complexity***, ***liveliness*** and ***aesthetics***. Remarkably, ***aesthetics*** is frequently mentioned in all disciplines. Additionally, multiple planners and urban designers link pleasurability also to ***architecture***, ***urban design*** and ***outdoor activities***. These walking needs correspond to the findings of Mehta (2008) who found that planners and urban designers are interested in the sensorial qualities that make places attractive to walk. According to the framework of Alfonzo (2005), pleasurability is affected by the factors *"diversity"*, *"complexity"*, *"liveliness"*, "*architectural coherence"* and *"aesthetics"*. Except architectural coherence, the findings of Alfonzo (2005) correspond with the walking needs that were found in the results of this study.

Reflection on methodology

A quantitative data analysis was used to find the walkability trends in scientific literature. A number of limitations can be mentioned when reflecting on the methodology of this research question.

- The results largely matched with what was discussed in the theoretical framework. However, as is shown in the previous paragraphs, there is a mismatch between the results and theory in some cases.
- The analysis of the domains *"pedestrians"* and *"place"* can be considered as incomplete. The quantitative analysis of these domains includes only categories and lacks detailed factors and variables, such as different walking purposes and different types of climate.
- The credibility of some outcomes can be taken into consideration. For instance, less air and noise pollution, and less energy consumption were rarely mentioned by transportation scientists. Besides, social equity and safety from crime were not mentioned by scientists of sociology.
- The question can be asked from which occurrence a walkability factor or variable can be considered as a trend. A factor or variable was considered as a trend when it was mentioned five times or more in the disciplines of planning and urban design. However, three times or more can be also considered as a trend.
- The number of scientific papers of planning and urban design (20 papers) and public health (20 papers) is larger than the number of scientific papers of transportation (10 papers), economy (5 papers) and sociology (5 papers). It can be questioned whether conclusions can be drawn from the disciplines of economy and sociology where only five papers were found for both.
- Some papers contained a walkability instrument and discussed many walkability factors, while other papers discussed only a few factors. This influences the number of times a factor or variable is mentioned in a discipline. For instance, the discipline of planning and urban design contains many walkability instruments resulting in many walkability trends, while the discipline of sociology contains almost no walkability instruments.
- Whether a walkability factor or variable is considered as important in a paper can be interpreted differently. For instance, it can be questioned whether a factor or variable is considered as important by scientists when it is quoted once in a paper.

5.3 Sub-research question 2

In this section, the second sub-research question: *"how is walkability defined and used in planning policies of large Dutch cities?"* will be discussed and answered by means of the results and the semi-structured interviews. In the following paragraphs, walkability in planning policy will be discussed by use of the domains: interests, pedestrians, place, walking needs and planning & design.

Interests

The domain of interests (p. 54) showed pedestrian policy was mainly initiated due to the ***pressure on public space*** as a result of increased traffic, pedestrian rates and other spatial claims. The pressure on public space forced both municipalities to shift their focus to space efficient modes of transport, such as walking. This is confirmed by AMS-IN-Terpstra (2019) and UTR-IN-Tsakmakis&Ditewig (2019) who both explained pedestrians had little space due to the large amount of traffic, the large number of spatial claims and a scarcity of public space. For years, the main focus of both municipalities was on public transport, automobile use and cyclists (AMS-IN-Terpstra, 2019). Pedestrians were almost forgotten, and the remaining space went to pedestrians (AMS-IN-Olsthoorn, 2019). Nowadays, pedestrians gain more attention and are together with cyclists as the number one priority in both municipalities (AMS-IN-Terpstra, 2019; Tsakmakis and Ditewig, 2019).

As is mentioned in the results (p. 54), walkability is seen as an instrument that contributes to a solution for various city problems and as an instrument that provides benefits for different policy areas. Three other interests from different perspectives were identified as the main reasons. Pedestrian policy is seen as a means to stimulate a ***modal shift*** from automobile use to walking in combination with public transport, since ***less automobile use*** results in ***less air and noise pollution***, ***traffic congestion*** and ***traffic accidents***. In addition, pedestrian policy is seen as a means to stimulate the ***local economy*** by the improvement of ***consumer expenditures*** and ***international economic position*** from an economic perspective. Moreover, pedestrian policy is seen as a means to stimulate ***social equity*** and ***self-reliance*** of vulnerable groups from a social perspective. In contrast to the findings of this study, UTR-IN-Tsakmakis&Ditewig (2019) also mentioned congestion on bicycle paths and bicycle parking spaces as one of the main reasons to initiate pedestrian policy.

Pedestrians

The results (p. 55) of pedestrians showed both municipalities stress the importance of public space that is accessible for everyone, and that meets the minimum design requirements for ***children***, ***elderly*** and ***disabled***. Besides, the results showed that the municipality of Amsterdam mentioned the disabled in its pedestrian definition, while the municipality of Utrecht did not include a pedestrian definition in the analysed policy documents. However, UTR-IN-Tsakmakis&Ditewig (2019) declared the municipality of Utrecht follows the national definition of a pedestrian, which includes the disabled.

As is shown by the results (p. 55), both municipalities mentioned different ***walking purposes***, including ***citizens***, ***commuters*** and ***tourists***. AMS-IN-Terpstra (2019) explained the walking purposes are not the main guidelines for the design of the pedestrian policy, because the municipality of Amsterdam did not make a pedestrian policy document. The pedestrian policy of Utrecht is also not designed based on walking purposes due to the fine grained pedestrian network, which makes it complicated to link walking purposes to certain places (UTR-IN-Tsakmakis&Ditewig, 2019). However, the interviewees of both municipalities argued that walking purposes are included in the pedestrian networks because the networks are designed based on place characteristics.

Place

As is shown in the results (p. 55-56), a number of place characteristics were mentioned by both municipalities that affect the design of both pedestrian environments. Both municipalities mentioned the ***scarcity of public space*** due to ***narrow historical street sections***. The streets in both inner cities were never designed for large amounts of traffic and other spatial claims. According to AMS-IN-Terpstra (2019) and UTR-IN-Tsakmakis&Ditewig (2019), the narrow historical street sections demand for choices between different modes of transport and other spatial claims. Besides, the results (p. 57-58) showed that the municipality of Amsterdam designed a hierarchical pedestrian network based on the ***functions*** in ***different streets***, while the municipality of Utrecht developed a hierarchical pedestrian network based on the ***amount of space*** in ***different economic zones***.

As explained in the policy document analysis (p. 55-56), the walkability instrument of Amsterdam is based on two factors: free walking space (calculated by using data about path width and obstacles on sidewalks), and pedestrian crowds (calculated by using data such as the number of inhabitants, and the number of facilities). A number of differences and similarities can be derived when the walkability instrument of Amsterdam is compared with international instruments, such as Walk Score (2014) and Walkability Index (Frank et al., 2009). In contrast, the walkability instrument of Walk Score is based

on the shortest walking distance to certain destination (e.g. public transport and shopping), the block length, and the intersection density around the origin (Walk Score, 2014). Similar to the instrument of Walk Score, the walkability instrument of Frank et al. (2009) focuses on walking distances also using intersection density, and other factors to measure walking distances, including the entropy index, floor area ratio and the household density index. The walkability instrument of Amsterdam focuses on the comfort and space of pedestrians on sidewalks, while Walk Score (2014) and Frank et al. (2009) focus on the walking distance of pedestrians. It is important to note, the instruments of Walk Score and Frank et al. (2009) were more developed for residential neighbourhoods, while the walkability instrument of Amsterdam is developed more for the inner city.

The results (p. 56) showed some attention goes to planning & design measures for coolness and wind nuisance but the walking need of ***climate comfort*** is barely linked to the pedestrian policy of both municipalities. According to AMS-IN-Terpstra (2019), climate comfort plays a role in the redesign but is considered as less important than other walking needs. Similararly AMS-IN-Terpstra (2019), Tsakmakis&Ditewig (2019) argued climate comfort is taken into account when redesigning the street, such as sun and shadow side but is not much discussed in pedestrian policy.

Walking needs + Planning & design

Accessibility

As is shown in the results (p. 58), walkability is partly understood as making public space ***accessible*** for everyone, including disabled using a walking aid, through providing ***bridgeable height differences***, ***a sufficient path width*** and ***sidewalks free of obstacles***. This is confirmed by UTR-IN-Tsakmakis&Ditewig (2019) who stated pedestrian policy is more and more approached from the perspective of accessibility for different kinds of pedestrians. Pedestrian policy is regulated by a number of national programs including Agenda 22, which is about accessibility for disabled (UTR-IN-Tsakmakis&Ditewig, 2019). According to UTR-IN-Tsakmakis&Ditewig (2019), much attention goes to making sidewalks free of obstacles, tactile paving and making public transport accessible for disabled in pedestrian policy.

Safety from crime

The results (p. 58) showed that both municipalities consider ***safety from crime*** as one the criteria for a successful pedestrian environment. Although policy documents mentioned design measures such as ***lively plinths***, ***lines of sight***, ***orientation of buildings*** and ***street lighting***, both municipalities pay little attention to how to provide safety from crime. This is confirmed by UTR-IN-Tsakmakis&Ditewig (2019) who argued safety from crime is mentioned in Utrecht's pedestrian policy but not extensively explained. However, the new publication from the knowledge institute for traffic (CROW) will be used as a guideline to provide safety from crime on pedestrian routes in the future (UTR-IN-Tsakmakis&Ditewig, 2019). Besides, safety from crime is also described in other policy documents, such as the economic policy documents (UTR-IN-Tsakmakis&Ditewig, 2019).

Traffic safety

The results of traffic safety in planning policy (p. 58-59) showed ***traffic safety*** is included in both pedestrian policies and is linked to various planning & design measures to ***reduce traffic speeds*** and improve ***ease of crossing***. However, both pedestrian policies rarely paid attention to traffic volume, visibility and distance between pedestrians and vehicular traffic. This is confirmed by AMS-IN-

Terpstra (2019) who argued these aspects of traffic safety are not explicitly mentioned in planning policy but are considered when a street is redesigned. Besides, a buffer to create distance between pedestrians and vehicular traffic is not mentioned in pedestrian policy, because there is not always an opportunity to create a buffer in the street due to space constraints (AMS-IN-Terpstra, 2019). UTR-IN-Tsakmakis&Ditewig (2019) confirmed these aspects of traffic safety are not explicitly mentioned in policy but are considered in practice.

Comfort

The walking need of ***comfort*** is included in both lists for a well-designed pedestrian environment as is mentioned in the results (p. 59). The results showed that ***creating space*** for pedestrians is seen as one of the main challenges in pedestrian policy. This is pursued by reducing the ***number of obstacles***, ***making choices between modalities*** in each street (e.g. car free streets) and ***mixing traffic*** (e.g. bicycle and car traffic on one lane). Similar to the policy document analysis, all interviewees of both municipalities and AMS-IN-Molster (2019) view the creation of space for pedestrians as one of the main challenges in the inner city. According to AMS-IN-Terpstra (2019) and AMS-IN-Olsthoorn (2019), the municipality of Amsterdam focusses on reducing car parking spaces on the street, making streets one-way traffic and mixing traffic. UTR-IN-Tsakmakis&Ditewig (2019) also mentioned the reduction of street parking spaces and emphasized the trend towards a car-free inner city.

Pleasurability

As is shown in the results (p. 59), the ***attractiveness*** of the pedestrian environment is considered as a part of walkability but is not extensively discussed in planning policy. The municipality of Amsterdam links attractiveness to ***beautiful, clean, not damaged, maintenance, sustainable materials and climate resistance,*** while the municipality of Utrecht links it to ***quality of stay***, ***experience***, ***liveliness***, ***benches***, ***presence of activities***, ***stairs***, ***presence of sun and shade*** and ***safety from crime***. According to AMS-IN-Terpstra (2019), pedestrian policy is about the function of traffic versus the function of an attractive place to stay. UTR-IN-Tsakmakis&Ditewig (2019) explained by use of the pedestrian bridge Moreelsebrug that a pedestrian route should be attractive otherwise pedestrians do not use it.

General

It is important to note ***both municipalities started quite recently***, around 2015, with the implementation of pedestrian policy (UTR-PD-PEDESTRIAN, 2015; AMS-PD-PEDESTRIAN, 2017). Both municipalities are still working on the improvement of their pedestrian policies (AMS-IN-Olsthoorn, 2019; AMS-IN-Terpstra, 2019; UTR-IN-Tsakmakis&Ditewig, 2019).

The results showed both municipalities stress the importance of ***customization*** when redesigning a pedestrian environment due to the differences in place characteristics of each street. According to UTR-IN-In der Maur (2019), the way of making choices between modalities in redesigns is more customization than policy. Policy is mostly general and what is being pursued, while customization is much more accurate and adapted to the place (UTR-IN-In der Maur, 2019).

Reflection on methodology

A number of limitations can be mentioned when reflecting on the policy document analysis.

- Three policy documents more were analysed for Amsterdam than for Utrecht due to the number of policy documents that met the criteria for data selection. This difference in data might have some influence on the outcome of this research.
- The municipality of Utrecht has an official pedestrian policy document (UTR-PD-PEDESTRIAN, 2015), while the municipality of Amsterdam only has a note state of affairs about pedestrians (AMS-PD-PEDESTRIAN, 2017). The presence of a comprehensive pedestrian policy documents resulted in more information linked to pedestrians for Utrecht than for Amsterdam.
- The policy areas are classified in different ways in both municipalities, which resulted in differences between the analysed policy documents of both municipalities. For instance, the municipality of Amsterdam has a policy document for city streets, while the municipality of Utrecht does not have a policy document for this topic. These differences between policy documents of certain topics might have moved the outcomes of this study in a certain direction.
- The documents AMS-PD-MOTION (2018) and UTR-PD-FOOTPATH (2014) are made by consultancy firms. It can be questioned to which extent these documents are representative for the pedestrian policies of both municipalities.
- UTR-IN-Tsakmakis&Ditewig (2019) explained policy documents are also affected by politics. The words, sentences, structures and amounts of texts used in policy documents depend on the political colours and the discourse from the moment the policy document was created (UTR-IN-Tsakmakis&Ditewig, 2019). The political landscape shifts every four years, which has an impact on pedestrian policy (UTR-IN-Tsakmakis&Ditewig, 2019). The definition and use of planning policy can change over the years, which means the validity of this research depends on changes in the political landscapes of both municipalities.
- Some factors and variables of walkability are included in planning policy but are not directly linked to pedestrians. For instance, densification is included in the spatial policy of Amsterdam and Utrecht but is not linked to pedestrian policy. The question is to which extent these factors and variables are considered as part of walkability in planning policy.

5.4 Sub-research question 3

In this section, the third sub-research question: *"how is walkability applied in planning practice of large Dutch cities?"* will be discussed and answered by means of the results and the semi-structured interviews. In the following paragraphs, walkability in planning practice will be discussed by use of the domains: interests, pedestrians, place, walking needs and planning & design.

Interests

As is shown in the results (p. 75), the ***pressure on public space*** often goes together with ***unsafe traffic situations*** and is a direct reason to take action and improve pedestrian conditions. This is confirmed by AMS-IN-Molster (2019) who explained a lack of space goes together with unsafe traffic situations. When traffic situations turn out to be dangerous, it is considered as a problem and action is taken by the municipality (AMS-IN-Molster, 2019). In addition, the appearance of a ***new train or metro station*** and thereby an ***increase of pedestrians*** was the reason for improving pedestrian conditions in some cases. According to AMS-IN-Molster (2019), the presence of a tram or metro station might lead to an increas of walking ranges, which makes walking routes arround these tram and metro stations important.

Pedestrians

The results of pedestrians (p. 75) showed different walking purposes are represented in the design of the pedestrian environment. For instance, ***tourists and consumers*** were served in shopping streets by benches, greenery, sight lines, terraces, signage and lively plinths. UTR-IN-Dalmeijer (2019) believes inhabitans should be the first priority and tourists should not be facilitated too much by the municipality. A wide sidewalk served ***walking for transportation purposes*** around metro and tram stations. According to AMS-IN-Molster (2019), a societal problem is that most people are often in a hurry, which makes wide sidewalks to pass each other more and more important. Moreover, AMS-IN-Molster (2019) explained there are also conflicting interests between different pedestrian groups. For instance, disabled need a flat non-slip surface, while pedestrian who walk for recreational purposes prefer a gravel path. This was not observed during the observations.

Place

As is shown in the results (p. 75), the pressure on public space can be linked to the place characteristics of ***narrow street section width***, ***high land use density***, ***high land use diversity***, ***large amount of traffic*** and ***a large number of spatial claims***, which are present in many cases and typical for the inner city. UTR-IN-In der Maur (2019) argued there is always a limited amount of space from façade to façade in which space is needed for various traffic flows and spatial claims. AMS-IN-Molster (2019) believes space is the main issue in the inner cities of Amsterdam and Utrecht due to the large number of spatial claims and traffic.

The results showed (p. 75) some ***climate characteristics*** are taken into consideration when designing a pedestrian environment, such as sunny and shadow places, and coolness by greenery. However, the redesign of the cases include little measures to provide climate comfort. According to UTR-IN-In der Maur (2019), the installation of roofs and spraying systems would be a waste of the historic inner city. AMS-IN-Molster (2019) believes climate comfort is an aspect of comfort and should be considered as less important than other aspects of pedestrian policy. However, it can be considered as important in regard wind nuisance around high buildings, because this can influence pedestrian's safety (AMS-IN-Molster, 2019).

Walking needs + Planning & design

Accessibility

The results (p. 75-76) showed the accessibility for ***disabled*** was in most cases well served by a sufficient width of sidewalks, bridgeable height differences, ease of crossing and tactile paving. AMS-IN-Molster (2019) believes the accessibility of public space in Amsterdam is sufficient but could go a step further in for instance tactile paving (e.g. roughness of paving) and a sufficient crossing time at crossings with traffic lights. According to UTR-IN-In der Maur (2019), accessibility in general of Utrecht is sufficient except in some temporary situations, such as construction sites.

As is shown in the results (p. 76), ***bicycles, vehicles and garbage blocked the sidewalks*** in some cases. The bicycle parking problem is confirmed by UTR-IN-Dalmeijer (2019) and AMS-IN-Van Soest (2019) who argued parked bicycles ruin the view and sometimes block sidewalks. Besides bicycle parking, UTR-IN-Dalmeijer (2019) confirmed the problem of temporarily parked vehicles blocking sidewalks. According to AMS-IN-Molster (2019), municipalities are aware of these problems but are unable to solve these problems quickly.

Safety from crime

The results (p. 76) showed ***safety from crime*** for pedestrians is offered to a large extent by the characteristics of the inner city, including the presence of people on the street, functional mix, urban form, streetlights and security cameras. This is confirmed by AMS-IN-Molster (2019) who argued presence of people, social surveillance of buildings and functional mix contribute to the perception of safety in the inner city. However, the presence of coffee shops and other land use types attracting certain groups might discourage people to walk (AMS-IN-Molster, 2019). The cases rarely contain planning & design measures to provide safety from crime. In all cases, the number of obstacles were reduced, which contributes to the ***visibility*** in the streets.

Traffic safety

Both municipalities have taken several measures to improve road safety in the inner city. As is shown in the results (p. 76), a large part of these measures for traffic safety are ***speed-limiting measures***, such as ***mixing traffic*** and ***narrowing of the roadway***. Besides, many cases showed attention is paid to ***ease of crossing*** by ***low traffic speeds*** and ***low sidewalk edges***. However, AMS-IN-Molster (2019) argued ease of crossing could be improved by longer green lights at crossings. Besides, the results also showed a ***buffer*** between pedestrians and vehicular traffic is present in some cases due to a service zone or hedge. Moreover, AMS-IN-Van Soest (2019), UTR-IN-Dalmeijer (2019) and UTR-IN-In der Maur (2019) explained pedestrians and cyclists often cross each other's path, which leads to dangerous situations in for instance pedestrian zones. This was not observed during the observation. Although not observed, ***the conflict between pedestrians and cyclists*** can be considered as one of the challenges in traffic safety.

Comfort

The results (p. 76) showed the main design measure to create more space is making sidewalks free of obstacles through a ***service zone for objects***, such as terraces, bicycle parking, car parking and loading and unloading. In addition, wide sidewalks were created by ***one-way car traffic*** and ***the mix of traffic on one lane***. In the past, the reduction of obstacles resulted into conflicts between different policy areas. For instance, the conflict between pedestrian and bicycle policy when bicyle parking spaces had to be removed for pedestrian space (UTR-IN-Tsakmakis&Ditewig, 2019). However, employees of different policy areas in the municipality of Utrecht pay more attention to pedestrian policy since the launch of the pedestrian policy document (UTR-IN-Tsakmakis&Ditewig, 2019).

The results (p. 76) showed more space for pedestrians was created by ***reducing the number of car parking spaces on streets***. Around five years ago, the municipality of Utrecht had a complex discussion to reduce street parking spaces to make space for pedestrians (UTR-IN-Tsakmakis&Ditewig, 2019). Entrepreneurs preferred to have parking spaces in front of their stores so that customers could easily reach the store by car (UTR-IN-Tsakmakis&Ditewig, 2019). After some successful implementations of zones with more space for pedestrians and less car parking spaces, entrepreneurs and inhabitants came to the municipality for more pedestrian space (UTR-IN-Tsakmakis&Ditewig, 2019). This shows that experimenting on a small scale with parking-free streets and more space for the pedestrian is a successful formula to gain more support for improved pedestrian conditions.

Pleasurability

According to AMS-IN-Molster (2019), pleasurability or attractiveness of the pedestrian environment is already present in the cities of Amsterdam and Utrecht due to the presence of historical buildings, canals and old trees. Similar to AMS-IN-Molster (2019), UTR-IN-Dalmeijer (2019) emphasized the uniqueness of a city with the historical buildings, canals, wharf cellars and greenery. The results (p. 76) showed not much attention is paid to the attractiveness, since this is already sufficient due to the original characteristics. The attractiveness of the street was mainly improved by ***greenery***, ***street design*** and ***paving stones***. However, the crowd of the inner city was negatively experienced by AMS-IN-Van Soest (2019), UTR-IN-Dalmeijer (2019) and UTR-IN-In der Maur (2019).

General

According to AMS-IN-Molster (2019), UTR-IN-Tsakmakis&Ditewig (2019) and UTR-IN-In der Maur (2019), pedestrian policy should be supported by an ***ambassador of the municipality*** who encourages and informs municipal employees about the importance of pedestrians in design. AMS-IN-Molster (2019) and UTR-IN-In der Maur (2019) suggested the presence of a pedestrian ambassador might be more important than the presence of a pedestrian policy document.

Reflection on methodology

Walkability in planning practice of large Dutch cities was investigated through use of on-street observations. A number of limitations can be mentioned for the use of observations.

- The purpose of the observation was to find planning & design measures that were taken in the street. The new situation was analysed through use of observations and compared with the old situation by photographs from the past. However, photographs from the past were not always available or photographs did not give the view needed to make the comparison.
- The domain of pedestrians was hard to analyse through use of observations. Whether certain pedestrian groups are served in public space is not always observable. Besides, this domain is also based on opinion of different pedestrian groups. On-street interviews with different pedestrian groups might have been a more suitable methodology to analyse the domain of pedestrians.
- The interests of the redesigns and the planning processes were analysed through use of policy documents, newspapers and other sources. However, a semi-structured interview with the designers and planners of the redesign projects would have been more valuable to analyse the interests, planning process and declare certain choices in the walking design.

5.5 Reflection on the cases

It is important to ask to which extent the inner cities of Amsterdam and Utrecht can be compared. A number of reasons can be mentioned why walkability of Amsterdam differs from that of Utrecht. According to UTR-IN-In der Maur (2019), distances in the inner city of Amsterdam might be longer than in the inner city of Utrecht due to the size of both inner cities and the large number of canals, which can function as barriers. However, AMS-IN-Molster (2019) argued that the excellent metro network of Amsterdam resulted in an increase of the walkability scale and might result in longer walking distances than in the municipality of Utrecht. Besides, the inner city of Amsterdam might be more crowded than Utrecht, partly because of the large number of tourists (UTR-IN-In der Maur, 2019). In conclusion, the inner cities of Amsterdam and Utrecht have similarities and differences, which should be taken into account when considering the findings of this research.

The cases of Amsterdam and Utrecht were selected to find how walkability is defined and used in planning policies and practices of large Dutch cities. It is important to mention the findings of this research are to a certain extent valid for the other cities due to differences in local characteristics between the inner cities. A number of local characteristics that influence the validity of this research for other large cities can be mentioned when comparing the inner cities of Amsterdam, Utrecht, Rotterdam and The Hague. Table 18 shows differences in inhabitants, size, density and tourists between the inner cities. The table shows that the inner cities of Amsterdam and The Hague are more densely populated than the inner cities of Utrecht and Rotterdam. Another difference between the cities is the number of tourists. The city of Amsterdam is visited by a larger number of tourists than the other cities. This might influence the number of spatial claims and traffic in the streets.

Table 18: Comparison between the large Dutch cities.

LOCAL CHARACTERISTICS					
CHARACTERISTICS	INNER CITY:	AMSTERDAM	UTRECHT	ROTTERDAM	THE HAGUE
Inhabitants inner city (CBS, 2017)		86.395	17.925	33.995	19.695
Area of the inner city (CBS, 2017)		8,04 km2	2,71 km2	4,88 km2	2,05 km2
Inhabitants per square kilometer		10.746	6.614	6.966	9.607
Number of tourists per year (NOS, 2018)		5.979.000	183.000	489.000	473.000

Besides the previously mentioned characteristics, some other local characteristics of the inner cities can be mentioned. The inner city of Rotterdam with its skyscrapers, boulevards and architecture differs from the other inner cities with their historical medieval buildings. Rotterdam contains many streets that have a wide street section, such as Coolsingel (60 meters wide), West-Blaak (58 meters wide) and Van Oldenbarneveldstraat (18 meters wide) (Google, 2017). This research found that the pressure on public space is one of the main interests to improve walkability and creating more space for pedestrians is one of the main challenges in the inner cities of Amsterdam and Utrecht. This might be of less relevance for the inner city of Rotterdam due to the wide street sections. This is confirmed by AMS-IN-Molster (2019) who suggested that the main reason to improve walkability of cities, such as Rotterdam and Eindhoven, might be to make the city more enjoyable, while the municipalities of Amsterdam and Utrecht aim to improve walkability due to the pressure on public space.

In comparison to the inner city of Rotterdam, the inner city of The Hague can be seen as more similar to the inner cities of Amsterdam and Utrecht. Similar to Amsterdam and Utrecht, the inner city of The Hague contains historical medieval buildings. In contrast to Amsterdam and Utrecht, The Hague has few canals that run through the inner city. The presence of canals might lead to barriers and thereby longer walking distances in the inner city. This research found that reducing the number of barriers and shortening walking distance was important in both planning policies. This might be of less relevance for the inner city of The Hague due to the low number of canals. Similar to Rotterdam, the inner city of The Hague contains a district with skyscrapers and modern architecture. In conclusion, the findings of this research are to some extent relevant for inner cities of Rotterdam and The Hague.

Summary

This summary provides an answer on the sub-research questions and summarizes the reflection on the case studies. The reflection on methodologies can be found at the end of each sub-research question in this chapter.

SUMMARY

Q1: ***What are the current walkability trends in international scientific literature?***

- Walkability is mainly seen as an instrument to reduce automobile use, reduce air and noise pollution, reduce energy consumption, improve physical and mental health, and save societal costs.
- Planning and urban design, transportation and economic scientists are interested in the factors influencing climate comfort of pedestrians, including coolness, shade and shelter.
- Walkability in scientific literature is largely approached from the planning & design measures influencing walking distance, including land use density, land use diversity and a land use pattern free of physical barriers.
- Accessibility is much discussed in various disciplines and can be linked to the large number of pedestrian characteristics used in walkability instruments, including age, gender, disability and walking purpose.
- Safety from crime is mainly discussed by planning and urban design scientists and is often linked to planning & design measures providing visibility and maintenance.
- Traffic safety is linked to low traffic speed, low traffic volumes, visibility, and distance between pedestrians and other traffic, and is much discussed by planning and urban design, transportation and public health scientists.
- Mainly planning and urban design, transportation and sociology scientists are interested in the comfort aspects of walkability, including path width, surface and street furniture.
- The attractiveness of the walking environment receives attention from planning and urban design and public health scientists and is linked to the walking needs of experience, complexity, liveliness and aesthetics.

Q2: ***How is walkability defined and used in planning policies of large Dutch cities?***

- Pedestrian policy is mainly seen as a means to reduce the pressure on public space, reduce automobile use, stimulate the local economy and stimulate self-reliance.
- Walkability is understood as making public space accessible for everyone, including children, elderly and disabled through providing bridgeable height differences, sufficient path widths and sidewalks free of obstacles.
- Although both municipalities made a distinction between different walking purposes (citizens, commuters and tourists), the walking purposes are not the main guidelines for the designs of both pedestrian policies and networks.
- Walkability is mainly seen as creating more space for pedestrians by reducing the number of obstacles, making choices between modalities in each street and mixing traffic.
- The walking needs of accessibility, safety from crime, traffic safety, comfort and attractiveness are considered as part of pedestrian policy. However, safety from crime and traffic safety lack some factors and variables that explain how these walking needs are provided.
- Customization is considered as an important aspect of walkability since each street has different characteristics, which demands for a different design.

Q3: ***How is walkability applied in planning practice of large Dutch cities?***

- The pressure on public space goes often together with unsafe traffic situations and is often a direct reason to take action and improve pedestrian conditions.
- The pressure on public space is affected by the place characteristics: street section width, land use density, land use diversity, amount of traffic, number of pedestrians and number of spatial claims.
- Bicycles, vehicles and garbage are still blocking the sidewalks in some cases, which makes some streets less accessible for disabled using a wheelchair.
- The presence of cyclists in pedestrian zones resulted in dangerous situations and can be considered as one of the challenges in traffic safety of pedestrians.
- Experimenting on a small scale with car parking-free streets and more space for the pedestrian is a successful formula to gain more support for improved pedestrian conditions.

Reflection on the cases:

- The inner cities of Amsterdam and Utrecht have similarities and differences, which should be taken into account when considering the findings of this research.
- The findings of this research are to some extent relevant for the inner cities of Rotterdam and The Hague.

6. Conclusion

6.1 Introduction

The final chapter of this report consists of four parts. Firstly, the main research question will be answered based on the discussion and the results. Secondly, the scientific objective of this research will be discussed. Subsequently, the practical application of this research will be debated. Finally, recommendations for future research will be proposed.

6.2 The main research question and the scientific objective

The main research question of this research was: *how is walkability defined and used in planning policies and practices of large Dutch cities in comparison to international trends in scientific literature?* In the following paragraphs, the results of walkability in scientific literature, planning policies and planning practices will be compared through use of the domains and a conclusion will be drawn.

First of all, the results of walkability in scientific literature and walkability in planning policy showed that the term walkability is mainly used in scientific literature and is rarely used in planning policy. Instead, terms such as *"pedestrian policy"*, *"pedestrian climate"* and *"pedestrian friendly"* are used. In addition, it is important to mention both municipalities started quite recently in regards to paying more attention to pedestrians and implementing policy into practice is a time-consuming process.

Interests

Regarding the interests, it can be concluded that the interests of scientists who conducted research into walkability and the interests of both municipalities to improve walkability largely correspond to each other. The results of the scientific literature and planning policy showed that both view walkability as an instrument that contributes to a solution for various urban problems and that provides several benefits for environmental, public health, economy and social purposes. Looking at the main reasons why both sides are interested in walkability, it can be argued that scientific literature views walkability as an instrument to achieve a sustainable environment, while both municipalities regard walkability as a means to reduce the pressure on public space in the inner city, improve traffic safety, enhance social equity and stimulate the local economy. The results indicated that scientists are mainly interested in walkability for the benefits of less automobile use, less air and noise pollution, less energy consumption, physical and mental health, and saving societal costs. These are mainly benefits focussed on achieving a sustainable environment. In contrast to the scientific literature, the results of planning policy expressed that pedestrian policy is mainly seen as an instrument to reduce the pressure on public space, reduce automobile use, improve consumer expenditure, enhance the international economic position and stimulate self-reliance of vulnerable groups. In addition, walkability in planning practice showed that unsafe traffic situations are often a direct reason to take action and improve pedestrian conditions.

Pedestrians

The results of walkability in scientific literature indicated that age, gender, disability and walking purposes are often included in walkability instruments. However, a comparison between the results and the literature study of Alfonzo (2005) showed that the results of this study lack psychological factors (e.g. attitudes and awareness), sociological factors (e.g. levels of social support) and biological factors (e.g. informal culture of neighbourhoods). The investigation of pedestrian characteristics in

scientific literature can therefore be considered as incomplete. The policy document analysis found pedestrian policy is mainly approached from the minimal design requirements of the age groups children and elderly, disabled using a walking aid, visual impaired and different walking purposes. Except that gender is not included in pedestrian policy, these pedestrian characteristics largely matched with what was found in scientific literature. Based on these results and factors influencing walking behaviour of Alfonzo (2005), it can be concluded that planning policy is more approached from the perspective of demographic factors (e.g. age and gender) and biological factors (e.g. disability), while scientific literature approaches walkability also from psychological, sociological and cultural factors.

Regarding walking purposes, it can be concluded that scientific literature, as well as planning policies considered walking purposes as important, but both pedestrian policies are not designed based on walking purposes. The results of walkability in scientific literature found walking purposes can be considered as a trend in scientific literature. However, this study lacks quantitative analysis of different walking purposes. Forsyth (2015) showed a distinction could be made for walking purposes in walking for transportation, exercise and recreation. These walking purposes are also mentioned in the planning policy of both municipalities. However, the results of planning policy showed that walking purposes are not the main guidelines for the designs of the pedestrian policies and pedestrian networks of both municipalities.

Place

The results indicated climate and topography could be considered as a trend in scientific literature. However, the discussion showed it lacks the category of geography and more detailed place characteristics, such as different types of climate and the presence of water. The investigation of place characteristics in scientific literature can, therefore, be considered as incomplete. The results of walkability in planning policy expressed a few topographical factors that influence the definition of walkability in planning policy, including the scarcity of public space as a result of narrow street section widths in both inner cities, presence and type of facilities and function of the street in the network. Besides, the results of planning policy showed climate comfort is barely linked to the pedestrian policy of both municipalities. Based on the results of planning policy and the findings of Alfonzo (2005), it can be concluded that the definition of walkability in planning policy is mainly influenced by topographical factors and rarely by climate factors, while walkability in scientific literature is affected by topography, geography and climate.

Walking needs + Planning & design

Various scientists conducted research on the factors influencing walking distances, such as land use diversity, land use density and a land use pattern free of barriers as is shown by the results of walkability in scientific literature. Both municipalities included these factors of accessibility in their policy documents. However, walking distances are not considered most important since Dutch inner cities are characterized by a high density and a great functional mix. In contrast to the scientific literature, accessibility in planning policy is more seen as making public space accessible for everyone through providing bridgeable height differences, sufficient path width and sidewalks free of obstacles. Based on these results, it can be concluded that accessibility for everyone is considered as important in scientific literature and planning policy, but the scientific literature is mainly focussed on short walking distances, while planning policy and practice are more focussed on accessible sidewalks.

It can be concluded that safety from crime is considered as an essential element of walkability in scientific literature, while it is rarely discussed and linked to pedestrians in the planning policies of both municipalities. The scientific literature links safety from crime to planning & design measures providing visibility and maintenance. However, planning policies of both municipalities lack an explanation of the factors and variables that influence perceived safety from crime. This can be explained by the fact safety from crime is provided by the current place characteristics of the inner city, including the presence of people on the street, functional mix, urban form, streetlights and security cameras as is shown in planning practice.

Concerning traffic safety, it can be concluded that some factors influencing traffic safety in scientific literature are lacking in the planning policy of both municipalities. The scientific literature mentioned low traffic speed, low traffic volume, ease of crossing, distance between pedestrians and vehicular traffic, and visibility as the factors that influence traffic safety. In contrast to scientific literature, both planning policies mentioned only the factors of low traffic speed and ease of crossing. Besides, the municipality of Utrecht also mentioned traffic volume. However, walkability in planning practice showed that the factors that are linked to traffic safety in scientific literature are implemented in the redesign projects, including the presence of a buffer.

One of the conclusions that can be drawn is that the main challenge of both municipalities in pedestrian policy is to create more space for pedestrians. The results of walkability in planning policy showed that various planning & design measures were proposed to create more space, including reducing the number of obstacles, making choices between different modes of transport and mixing traffic. In contrast, the scientific literature is more focussed on other aspects of comfort, including type of surface, street furniture and climate comfort.

Finally, it can be argued that attractiveness is considered as part of walkability in scientific literature and the planning policy of both municipalities. The results showed attractiveness of the walking environment is much debated in scientific literature and is linked to the walking needs of experience, complexity, liveliness and aesthetics. Although the results indicated that attractiveness is mentioned in planning policy, attractiveness is rarely discussed in planning policy since this is considered as sufficient due to the original characteristics of both inner cities.

Main research question

In short, the main research question can be answered as follows: *walkability in planning policies and practices of large Dutch cities (Amsterdam and Utrecht) is viewed as making public space accessible, safe and comfortable by especially creating more space for pedestrians, which reduces the pressure on public space, stimulates a modal shift, encourages self-reliance and improves the local economy, while walkability in scientific literature is understood as an instrument to measure the accessibility, safety, comfort and attractiveness of different environments, which contributes to a sustainable environment.* It can be concluded that scientific literature largely corresponds with what was found in the planning policies of Amsterdam and Utrecht. However, planning policies of both municipalities lack some factors that affect safety from crime and traffic safety. In addition, it can be concluded that the planning & design measures mentioned in planning policy largely correspond with was found in planning practice. However, the results of the observations showed a large number of spatial claims in streets, which resulted in bicycles, garbage and vehicles that still block sidewalks.

Scientific objective

The scientific objective of this research was: *1) understanding and declaring the definition and use of the term walkability in large Dutch cities; and 2) analyse how walkability in planning policy is implemented in planning practice.* This research showed which walkability factors and variables are considered as important in planning policy and practices in Amsterdam and Utrecht. As debated in the discussion chapter, the findings of this research are to some extent relevant for the inner cities of Rotterdam and The Hague. It can be argued that the first objective of this research is partly fulfilled. The second objective of this research can be also judged as partly fulfilled. The policy document analysis provides an extensive overview of walkability in planning policy. However, the use of observations alone is inadequate to measure walkability in planning practice as argued in the discussion chapter.

6.3 Practical application

A theoretical model was developed for this study consisting of the domains: interests, pedestrians, place, walking needs and planning & design. The theoretical model of this study showed how different domains of walkability influence each other. The theoretical model can be used by municipalities as a guideline to construct a pedestrian policy and to substantiate their choices in walkability.

It is recommended for municipalities to include and revise perceived safety from crime. The results of scientific literature indicated perceived safety from crime is affected by the presence of people on streets, visibility, maintenance, urban form, land use type, lively plinths and social surveillance. Policy documents in both cities lack an explanation of the factors that affect perceived safety from crime. Including these factors in pedestrian policy would help to make policy makers and other actors more aware and it can avoid that these walking needs or design measures of safety from crime are forgotten.

In addition to safety from crime, the outcomes of this study on perceived traffic safety in planning policy can also be useful for municipalities. Although factors such as low traffic speed, low traffic volume and ease of crossing are mentioned in planning policies, these documents lack an explanation of the other factors that influence perceived pedestrian safety, including visibility and distance to other traffic. Including these factors in pedestrian policy plans and traffic safety plans would help to make policy makers and other actors more aware and it can avoid that certain walking needs or design measures of traffic safety are forgotten.

Moreover, it could be useful for large Dutch cities to implement more pedestrian characteristics in their planning policy. Although it is hard to link different kinds of pedestrians to the network, the pedestrian network could be further customized to different kinds of pedestrians. In particular the walking purposes could be better linked to certain routes in the pedestrian network. A pedestrian network linked to different kinds of pedestrians (e.g. children, elderly, disabled) and various walking purposes (e.g. transportation, recreation and exercise) would be beneficial for both municipalities.

6.4 Recommendations for future research

The discussion of the cases showed the outcomes of this research are to a certain extent valid for the other large Dutch cities of Rotterdam and The Hague. The results of planning practice showed that the domain of place characteristics has a large influence on the definition of walkability. More research into the influence of local characteristics on the definition of walkability in other large Dutch cities is needed to further understand the definition and use of walkability in large Dutch cities.

The theoretical model contains the domains: interests, pedestrians, place, walking needs and planning & design. However, the factors of these domains are not the only factors that affect walkability. Walkability of large Dutch cities is also affected by different kinds of knowledge, since policy documents use different knowledge to understand walkability. This domain can be explained by asking a question, such as "what knowledge do they use to make their pedestrian policy?". In addition to knowledge, the definition and use of walkability in large Dutch cities might be affected by power, since the semi-structured interviews showed pedestrian policy is also affected by the political landscape. This domain can be explained by the question: "how do different interest groups affect the definition and use of walkability?" The theoretical model of this research could be expanded with these domains, which might help to further understand walkability in planning policy and practice.

Moreover, it might be interesting to conduct research into the correlation between the factors of street section width, land use density, land use diversity, amount of traffic and number of spatial claims. These factors have an influence on the pressure on public space. It might be interesting to know from which values discomfort is experienced by pedestrians. This can help municipalities to understand when to take action in certain streets.

Summary

SUMMARY

MQ: How is walkability defined and used in planning policies and practices of large Dutch cities in comparison to international trends in scientific literature?

- *Walkability in planning policies and practices of large Dutch cities (Amsterdam and Utrecht) is viewed as making public space accessible, safe and comfortable by especially creating more space for pedestrians, which reduces the pressure on public space, stimulates a modal shift, encourages self-reliance and improves the local economy, while walkability in scientific literature is understood as an instrument to measure the accessibility, safety, comfort and attractiveness of different environments, which contributes to a sustainable environment.*
- It can be concluded that scientific literature largely correspond with what was found in planning policies. However, both planning policies lack some factors that affect safety from crime and traffic safety.
- It can be concluded that the factors and variables found in planning policy largely correspond with was found in planning practice. However, the results of the observations showed a large number of spatial claims in streets, which resulted in bicycles, garbage and vehicles that still block sidewalks.
- The findings of this research are mainly valid for the inner cities of Amsterdam and Utrecht and to a certain extent applicable on the other large Dutch cities Rotterdam and The Hague.

Practical application:

- The theoretical model can be used by municipalities as a guideline to construct a pedestrian policy and to substantiate their choices in walkability.
- Including factors that influence safety from crime and traffic safety of pedestrians in planning policy would help to make policy makers and other actors more aware of these walking needs when redesigning a public space.
- It can be useful for both municipalities to design a pedestrian network based on different pedestrian groups and walking purposes that can be linked to certain planning & design measures.

Recommendation for future research:

- More research into the influence of local characteristics on the definition of walkability in other large Dutch cities is needed to further understand the definition and use of walkability in large Dutch cities.
- The theoretical model of this research lacks the domains of knowledge and power. Investigating these domains might help to further understand walkability in planning policy and practice of large Dutch cities.
- This research found that the pressure on public space is affected by the variables of street section width, land use density, land use diversity, amount of traffic and number of spatial claims. It might be interesting to know from which values discomfort or pressure on public space is experienced by pedestrians, because this can help municipalities to understand when to take action in certain streets.

Bibliography

Literature, reports and websites

Abley, S. (2005) *Walkability Scoping Paper*, *Transport*. Available at: http://www.levelofservice.com/walkability-%0Aresearch.pdf.

Alfonzo, M. A. (2005) 'To walk or not to walk? The hierarchy of walking needs', *Environment and Behavior*, 37(6), pp. 808–836. doi: 10.1177/0013916504274016.

Algemeen Dagblad (2017) *St. Jacobsstraat dicht deze zomer*. Available at: https://www.ad.nl/utrecht/st-jacobsstraat-dicht-deze-zomer~a92880dd/ (Accessed: 13 August 2019).

Amsterdaminsite (n.d.) Herenstraat seen from bridge Herenstraat-Prinsenstraat on the crossing with Keizersgracht (odd). Available at: http://amsterdaminsite.nl/grachtw.en/J1306602.HTM.

Anderson, H. R., Spix, C., Medina, S., Schouten, J. P., Castellsague, J., Rossi, G., ... & Bacharova, L. (1997). 'Air pollution and daily admissions for chronic obstructive pulmonary disease in 6 European cities: results from the APHEA project', *European Respiratory Journal*, 10(5), pp. 1064–1071. doi: 10.1183/09031936.97.10051064.

Appleyard, D., Gerson, M. S. and Lintell, M. (1982) *Livable Streets*. University of California Press. Available at: https://books.google.nl/books?id=pfreUQKD%5C_4QC%7D.

Bandini, S., Gorrini, A. and Nishinari, K. (2016) *Crossing Disciplinary Borders Through Studying Walkability*, *8th International Conference of Cross-Cultural Design 2016*. doi: 10.1007/978-3-319-40093-8 49.

Beemster, W. (2015) 'De Rode Loper in Amsterdam: meer ruimte voor fietsers en voetgangers', *Stedenbouw & Architectuur*, September, pp. 44–47.

Blečić, I., Cecchini, A., Congiu, T., Fancello, G., & Trunfio, G. A. (2015) 'Evaluating walkability: a capability-wise planning and design support system', *International Journal of Geographical Information Science*. Taylor & Francis, 29(8), pp. 1350–1374. doi: 10.1080/13658816.2015.1026824.

Ramirez, L. K. B., Hoehner, C. M., Brownson, R. C., Cook, R., Orleans, C. T., Hollander, M., ... & Petersmarck, K. (2006) 'Indicators of Activity-Friendly Communities. An Evidence-Based Consensus Process', *American Journal of Preventive Medicine*, 31(6), pp. 515–524. doi: 10.1016/j.amepre.2006.07.026.

Cao, X., Handy, S. L. and Mokhtarian, P. L. (2006) 'The influences of the built environment and residential self-selection on pedestrian behavior: Evidence from Austin, TX', *Transportation*, 33(1), pp. 1–20. doi: 10.1007/s11116-005-7027-2.

CBS (2017) *Kerncijfers wijken en buurten 2017*. Available at: https://www.cbs.nl/nl-nl/maatwerk/2017/31/kerncijfers-wijken-en-buurten-2017 (Accessed: 27 August 2019).

CBS (2018) *Bevolking; ontwikkeling in gemeenten met 100.000 of meer inwoners*. Available at: https://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=70748NED&D1=0,2,4,16,18,20,22,24&D2=a&D3=0&D4=a&D5=l&HD=090707-1905&HDR=T&STB=G4,G2,G1,G3 (Accessed: 22 November 2018).

CBS (2019) *Gemeentegrootte en stedelijkheid*. Available at: https://www.cbs.nl/nl-nl/onze-diensten/methoden/classificaties/overig/gemeentegrootte-en-stedelijkheid.

Cerin, E., Saelens, B. E., Sallis, J. F., & Frank, L. D. (2006) 'Neighborhood environment walkability scale: Validity and development of a short form', *Medicine and Science in Sports and Exercise*, 38(9), pp. 1682–1691. doi: 10.1249/01.mss.0000227639.83607.4d.

Cerin, E., Macfarlane, D. J., Ko, H. H., & Chan, K. C. A. (2007) 'Measuring perceived neighbourhood walkability in Hong Kong', *Cities*, 24(3), pp. 209–217. doi: 10.1016/j.cities.2006.12.002.

Cervero, R. and Kockelman, K. (1997) 'Travel demand and the 3Ds: Density, diversity, and design', *Transportation Research Part D: Transport and Environment*, 2(3), pp. 199–219. doi: 10.1016/S1361-9209(97)00009-6.

City of Sydney (2017) *Walking Strategy and Action Plan Sydney*. Available at: https://www.cityofsydney.nsw.gov.au/__data/assets/pdf_file/0013/233320/Walking_Strategy_FINAL_for_web.pdf.

City of Toronto (2013) *Toronto Walking Strategy*. Available at: http://conf.tac-atc.ca/english/annualconference/tac2013/session4/toronto.pdf.

Cortright, J. (2009) *Walking the Walk: how Walkability Raises Home Values in U.S. Cities*. doi: 10.1187/cbe.06-05-0163.

DiPietro, L. (2001) 'Physical Activity in Aging: Changes in Patterns and Their Relationship to Health and Function', *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 56(Supplement 2), pp. 13–22. doi: 10.1093/gerona/56.suppl_2.13.

Doyle, S. *et al.* (2006) 'Active community environments and health: The relationship of walkable and safe communities to individual health', *Journal of the American Planning Association*, 72(1), pp. 19–32. doi: 10.1080/01944360608976721.

DUIC (2016) *Het Oudkerkhof gaat weer de glans krijgen die het verdient*. Available at: https://www.duic.nl/algemeen/oudkerkhof-gaat-weer-glans-krijgen-verdient/ (Accessed: 13 August 2019).

DUIC (2017) *Herinrichting Oudkerkhof: Gezelligere stoepen ondanks parkeerplekken*. Available at: https://www.duic.nl/algemeen/herinrichting-oudkerkhof-volgende-week-start/ (Accessed: 13 August 2019).

Duncan, D. T., Aldstadt, J., Whalen, J., Melly, S. J., & Gortmaker, S. L. (2011) 'Validation of Walk Score® for estimating neighborhood walkability: An analysis of four US metropolitan areas', *International Journal of Environmental Research and Public Health*, 8(11), pp. 4160–4179. doi: 10.3390/ijerph8114160.

Ewing, R., Handy, S., Brownson, R. C., Clemente, O., & Winston, E. (2006) 'Identifying and measuring urban design qualities related to walkability', *Journal of Physical Activity and Health*, 3(1), pp. S223–S240. Available at: http://journals.humankinetics.com/doi/abs/10.1123/jpah.3.s1.s223.

Ewing, R., Greenwald, M. J., Zhang, M., Walters, J., Feldman, M., Cervero, R. & Thomas, J. (2009) *Measuring the impact of urban form and transit access on mixed use site trip generation rates—Portland pilot study.* Washington, DC.

Ewing, R. and Cervero, R. (2010) 'Travel and the built environment', *Journal of the American Planning Association*, 76(3), pp. 265–294. doi: 10.1080/01944361003766766.

Ewing, R. and Handy, S. (2009) 'Measuring the Unmeasurable: Urban Design Qualities Related to Walkability', *Journal of Urban Design*, 14(1), pp. 65–84. doi: 10.1080/13574800802451155.

Ferrer, S. and Ruiz, T. (2018) 'The impact of the built environment on the decision to walk for short trips: Evidence from two Spanish cities', *Transport Policy*, 67(April 2017), pp. 111–120. doi: 10.1016/j.tranpol.2017.04.009.

Flyvbjerg, B. (2006) 'Five Misunderstandings About Case-Study Research', *Qualitative Inquiry*, 12(2), pp. 219–245. doi: 10.1177/1077800405284363.

Forsyth, A. (2015) 'What is a walkable place? The walkability debate in urban design', *Urban Design International*. Nature Publishing Group, 20(4), pp. 274–292. doi: 10.1057/udi.2015.22.

Frank, L. D., Sallis, J. F., Saelens, B. E., Leary, L., Cain, K., Conway, T. L., & Hess, P. M. (2009) 'The Development of a Walkability Index: Application To the Neighborhood Quality of Life Study', *BMJ Publishing Group Ltd*, (February), pp. 1–39.

Frank, L. D., Andresen, M. A. and Schmid, T. L. (2004) 'Obesity relationships with community design, physical activity, and time spent in cars', *American Journal of Preventive Medicine*, 27(2), pp. 87–96. doi: 10.1016/j.amepre.2004.04.011.

Frank, L., Engelke, P. and Schmid, T. (2003) *Health and community design: the impact of the built environment on physical activity*. First. Washington: Island Press.

Fruin, J. J. (1971) 'Designing for pedestrians: A level-of-service concept', *Highway Research Record*, (355), pp. 1–15.

Gardner, K. *et al.* (1996) *Developing a pedestrian strategy for London. In European transport conference proceedings, association for european transport*. London: PTRC Education and Research Services Limited.

Gasparrini, A., Guo, Y., Hashizume, M., Lavigne, E., Zanobetti, A., Schwartz, J., ... & Leone, M. (2015) 'Mortality risk attributable to high and low ambient temperature: a multicountry observational study', *www.thelancet.com*, 386, p. 369. doi: 10.1016/S0140-6736(14)62114-0.

Gilderbloom, J. I., Riggs, W. W. and Meares, W. L. (2015) 'Does walkability matter? An examination of walkability's impact on housing values, foreclosures and crime', *Cities*. Elsevier Ltd, 42(PA), pp. 13–24. doi: 10.1016/j.cities.2014.08.001.

Google Earth (2017) Available at: http://www.google.com/earth/index.html (Accessed: 19 August 2019).

Google Streetview (2014) Oude Turfmarkt. Available at: https://www.google.com/maps/@52.3677592,4.8939058,3a,75y,329.83h,80.88t/data=!3m6!1e1!3m4!1s92dLtjCl87NP3AYqiflnGA!2e0!7i13312!8i6656.

Habibian, M. and Hosseinzadeh, A. (2018) 'Walkability index across trip purposes', *Sustainable Cities and Society*. Elsevier, 42(July), pp. 216–225. doi: 10.1016/j.scs.2018.07.005.

Hajna, S., Ross, N. A., Joseph, L., Harper, S., & Dasgupta, K. (2015) 'Neighbourhood walkability, daily steps and utilitarian walking in Canadian adults', *BMJ Open*, 5(11), pp. 1–10. doi: 10.1136/bmjopen-2015-008964.

Hall, C. M. and Ram, Y. (2018) 'Walk score® and its potential contribution to the study of active transport and walkability: A critical and systematic review', *Transportation Research Part D: Transport and Environment*. Elsevier, 61(December 2017), pp. 310–324. doi: 10.1016/j.trd.2017.12.018.

Handy, S. (1996) 'Methodologies for exploring the link between urban form and travel behavior', *Transportation Research Part D: Transport and Environment*, 1(2), pp. 151–165. doi: 10.1016/S1361-9209(96)00010-7.

HarperCollins Publishers (2018) *Definition: topography*. Available at: https://www.collinsdictionary.com/dictionary/english/topography (Accessed: 8 January 2019).

Hart, J. (2009) 'The Health Benefits of Walking', *Alternative and Complementary Therapies*, 15(1), pp. 7–10. doi: 10.1089/act.2009.15105.

Heijmans (2014) *Herinrichting Damrak - De Rode Loper van Amsterdam | Heijmans N.V.* Available at: https://www.heijmans.nl/nl/projecten/herinrichting-damrak/ (Accessed: 13 August 2019).

Henson, C. (2000) 'Levels of service for pedestrians', *ITE Journal (Institute of Transportation Engineers)*, 70(9), pp. 26–30.

Het Parool (2013) *Meer ruimte voor voetgangers en fietsparkeren Haarlemmerstraat*. Available at: https://www.parool.nl/nieuws/meer-ruimte-voor-voetgangers-en-fietsparkeren-haarlemmerstraat~b61dbc29/ (Accessed: 13 August 2019).

Het Parool (2017a) *Nieuwe fietsroute moet druk van Haarlemmerstraat halen*. Available at: https://www.parool.nl/nieuws/nieuwe-fietsroute-moet-druk-van-haarlemmerstraat-halen~b91c9972/ (Accessed: 15 August 2019).

Het Parool (2017b) *Zonder getoeter over de opgefriste Oude Turfmarkt kuieren*. Available at: https://www.parool.nl/nieuws/zonder-getoeter-over-de-opgefriste-oude-turfmarkt-kuieren~b50762f3/ (Accessed: 14 August 2019).

Het Parool (2018a) *De Amstel is nu ook het terrein van voetgangers en fietsers*. Available at: https://www.parool.nl/nieuws/de-amstel-is-nu-ook-het-terrein-van-voetganger-en-fietser~b370320d/ (Accessed: 13 August 2019).

Het Parool (2018b) *Vijzelgracht geopend: voetgangers zijn de winnaar*. Available at: https://www.parool.nl/nieuws/vijzelgracht-geopend-voetgangers-zijn-de-winnaar~b6f1212e/ (Accessed: 14 August 2019).

Hoedl, S., Titze, S. and Oja, P. (2010) 'The Bikeability and Walkability evaluation table: Reliability and application', *American Journal of Preventive Medicine*. Elsevier Inc., 39(5), pp. 457–459. doi: 10.1016/j.amepre.2010.07.005.

Hooi, E. and Pojani, D. (2019) 'Urban design quality and walkability: an audit of suburban high streets in an Australian city', *Journal of Urban Design*. Routledge, 00(00), pp. 1–25. doi: 10.1080/13574809.2018.1554996.

Japiot (2007) Zadelstraat Utrecht. Available at: https://nl.wikipedia.org/wiki/Bestand:Zadelstraat_Utrecht.jpg.

Jaskiewicz, F. (2000) *Pedestrian Level of Service Based on Trip Quality*, *Transportation Research Circular*. Available at: http://www.urbanstreet.info/2nd_sym_proceedings/Volume 1/Ec019_g1.pdf%5Cnhttp://onlinepubs.trb.org/onlinepubs/circulars/ec019/ec019.pdf.

Kahn, E. B. *et al.* (2010) 'The Effectiveness of Interventions to Increase Physical Activity: A Systematic Review', *American Journal of Preventive Medicine*, 22(02), pp. 73–107. doi: 10.1016/S0749-3797(02)00434-8.

Kelly, C. E., Tight, M. R., Hodgson, F. C., & Page, M. W. (2011) 'A comparison of three methods for assessing the walkability of the pedestrian environment', *Journal of Transport Geography*. Elsevier Ltd, 19(6), pp. 1500–1508. doi: 10.1016/j.jtrangeo.2010.08.001.

KiM (2016) *Cycling and Walking: the grease in our mobility chain*. The Hague. Available at: http://english.kimnet.nl.

KiM (2017) *Mobiliteitsbeeld 2017*. The Hague. Available at: https://www.rijksoverheid.nl/documenten/rapporten/2017/10/23/kim-publicatie-mobiliteitsbeeld-2017.

King, A. C., Stokols, D., Talen, E., Brassington, G. S., & Killingsworth, R. (2002) 'Theoretical approaches to the promotion of physical activity', *American Journal of Preventive Medicine*, 23(2), pp. 15–25. doi: 10.1016/S0749-3797(02)00470-1.

De kracht van Utrecht (2013) *Herinrichting Domstraat en Korte Jansstraat: ruimte voor fiets en voetganger*. Available at: http://www.krachtvanutrecht-initiatief.nl/joomla/nieuws-2/336-herinrichting-domstraat-en-korte-jansstraat-ruimte-voor-fiets-en-voetganger (Accessed: 13 August 2019).

Kumar, R. (2014) *Research methodlogy. A step-by-step guide for beginners.* Fourth edi. Edited by K. Metzler. London: SAGE Publications Ltd.

Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., Katzmarzyk, P. T., & Lancet Physical Activity Series Working Group. (2012) 'Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy', *The Lancet*, 380(9838), pp. 219–229. doi: 10.1016/S0140-6736(12)61031-9.

Lee, I. and Buchner, D. M. (2008) 'The Importance of Walking to Public Health', *Medicine & Science in Sports & Exercise*, 40(Supplement), pp. S512–S518. doi: 10.1249/MSS.0b013e31817c65d0.

Lee, S. and Talen, E. (2014) 'Measuring Walkability: A Note on Auditing Methods', *Journal of Urban Design*. Taylor & Francis, pp. 368–388. doi: 10.1080/13574809.2014.890040.

Leslie, E., Saelens, B., Frank, L., Owen, N., Bauman, A., Coffee, N., & Hugo, G. (2005) 'Residents' perceptions of walkability attributes in objectively different neighbourhoods: A pilot study', *Health and Place*, 11(3), pp. 227–236. doi: 10.1016/j.healthplace.2004.05.005.

Leslie, E., Coffee, N., Frank, L., Owen, N., Bauman, A., & Hugo, G. (2007) 'Walkability of local communities: Using geographic information systems to objectively assess relevant environmental attributes', *Health and Place*, 13(1), pp. 111–122. doi: 10.1016/j.healthplace.2005.11.001.

Leslie, E., Butterworth, I. and Edwards, M. (2006) *Measuring the walkability of local communities using Geographic Information Systems data*, *Walk21-VII*. Geelong. Available at: http://www.walk21.com/papers/m 06 leslie, butterworth and edwards measuring the walkability of local communities using geographic information systems data.pdf.

Leyden, K. M. (2003) 'Social Capital and the Built Environment: The Importance of Walkable Neighborhoods', *American Journal of Public Health*, 93(9), pp. 1546–1551. doi: 10.2105/AJPH.93.9.1546.

Litman, T. (2018) *Economic Value of Walkability*. 1828. Washington DC. Available at: www.vtpi.org/walkability.pdf.

Lo, R. H. (2009) 'Walkability: What is it?', *Journal of Urbanism*, 2(2), pp. 145–166. doi: 10.1080/17549170903092867.

Maslow, A. H. (1954) 'The Instinctoid Nature of Basic Needs', *Journal of Personality*, 22(3), pp. 326–347. doi: 10.1111/j.1467-6494.1954.tb01136.x.

Mayor of London (2010) *Pedestrian comfort guidance for London*. London. Available at: http://content.tfl.gov.uk/pedestrian-comfort-guidance-technical-guide.pdf.

May, I. (2008) Vijzelgracht in Amsterdam, werkzaamheden voor metro. Available at: https://nl.m.wikipedia.org/wiki/Bestand:Vijzelgracht1.jpg.

Mehta, V. (2008) 'Walkable streets: Pedestrian behavior, perceptions and attitudes', *Journal of Urbanism*, 1(3), pp. 217–245. doi: 10.1080/17549170802529480.

Moudon, A. V. and Lee, C. (2003) 'Walking and Biking: An Evaluation of Environmental Audit Instruments', *Americal Journal of Health Promotion*, 18(No. 1), pp. 21–37. doi: 10.4278/0890-1171-18.1.21.

Moura, F., Cambra, P. and Gonçalves, A. B. (2017) 'Measuring walkability for distinct pedestrian groups with a participatory assessment method: A case study in Lisbon', *Landscape and Urban Planning*, 157, pp. 282–296. doi: 10.1016/j.landurbplan.2016.07.002.

Municipality of Amsterdam (2018a) *Gebiedsplan Centrum West 2018 - Gemeente Amsterdam*. Available at: https://www.amsterdam.nl/bestuur-organisatie/stadsdelen/gebiedsgericht/gebiedsplannen-2018/gebiedsplannen/centrum-west/ (Accessed: 13 August 2019).

Municipality of Amsterdam (2018b) *Walkability in Amsterdam, More space for the mother of all modes of transport*. Amsterdam. Available at: https://www.itf-oecd.org/sites/default/files/docs/walkability-amsterdam.pdf (Accessed: 29 August 2019).

Municipality of Utrecht (2014) *Openbare ruimte Sint Jacobsstraat, Utrecht Voorlopig Ontwerp*. Available at: https://docplayer.nl/33119178-Openbare-ruimte-sint-jacobsstraat-utrecht-voorlopig-ontwerp.html.

Municipality of Utrecht (2015) *Twijnstraat & Nicolaasstraat*. Utrecht. Available at: https://online.ibabs.eu/ibabsapi/publicdownload.aspx?site=utrecht&id=531a9f10-af8c-42ea-afd6-88d7a039bbaa.

Municipality of Utrecht (2016) *Herinrichting Oudkerkhof*. Utrecht. Available at: https://online.ibabs.eu/ibabsapi/publicdownload.aspx?site=utrecht.

Municipality of Utrecht (2017) *Utrecht Fiets en Voetganger op één*. Utrecht. Available at: https://www.crow.nl/downloads/pdf/verkeer-en-vervoer/crow-kpvv/mobiliteit-en-omgeving-2017/mobiliteit-en-omgeving-11-05-2017_alex-tsakmakis.aspx (Accessed: 13 August 2019).

NOS (2018) *Al die toeristen, waar laat je die?*, *CBS Statistics Netherlands*. Available at: https://nos.nl/artikel/2254154-al-die-toeristen-waar-laat-je-die.html (Accessed: 27 August 2019).

NRC (2015) 'De straat is van iedereen (maar niet heus)', *NRC Media*, p. 1. Available at: https://www.nrc.nl/nieuws/2015/03/11/de-straat-is-van-iedereen-maar-niet-heus-1473510-a277255.

NRC (2018) 'Amsterdam zou de drukte nu echt te lijf gaan – en, werkt het?'. Available at: https://www.nrc.nl/nieuws/2018/01/20/amsterdam-zou-de-drukte-nu-echt-te-lijf-gaan-en-werkt-het-a1588852.

Oxford University Press (2018) *Definition: practice*. Available at: https://www.lexico.com/en.

PBL and CBS (2016) *PBL/CBS - Regionale bevolkings- en huishoudensprognose 2016-2040: sterke regionale verschillen*, *Population trends*.

Pikora, T., Giles-Corti, B., Bull, F., Jamrozik, K., & Donovan, R. (2003) 'Developing a framework for assessment of the environmental determinants of walking and cycling.', *Social Science & Medicine*, 56(8), pp. 1693–1703. doi: S0277953602001636 [pii].

Pivo, G. and Fisher, J. (2011) *The Walkability Premium in Commercial Real Estate Investments*, *Real Estate Economics*. doi: 10.1111/j.1540-6229.2010.00296.x.

Powell, K. E., Paluch, A. E. and Blair, S. N. (2011) 'Physical Activity for Health: What Kind? How Much? How Intense? On Top of What?', *Annual Review of Public Health*, 32(1), pp. 349–365. doi: 10.1146/annurev-publhealth-031210-101151.

Pucher, J. and Buehler, R. (2009) 'Integrating Bicycling and Public Transport in North America', *Journal of Public Transportation*, 12(3), pp. 79–104. doi: 10.5038/2375-0901.12.3.5.

Pucher, J. and Dijkstra, L. (2003) 'Promoting Safe Walking and Cycling to Improve Public Health: Lessons From The Netherlands and Germany', *American Journal of Public Health*, 93(9), pp. 1509-16.

Ramanathan, V. and Feng, Y. (2009) 'Air pollution , greenhouse gases and climate change : Global and regional perspectives', *Atmospheric Environment*. Elsevier Ltd, 43(1), pp. 37–50. doi: 10.1016/j.atmosenv.2008.09.063.

Rauterkus, S. Y. and Miller, G. N. (2011) 'Residential Land Values and Walkability', *The Journal of Sustainable Real Estate*, 3(1), pp. 23–43.

Reyer, M., Fina, S., Siedentop, S., & Schlicht, W. (2014) 'Walkability is only part of the story: Walking for transportation in Stuttgart, Germany', *International Journal of Environmental Research and Public Health*, 11(6), pp. 5849–5865. doi: 10.3390/ijerph110605849.

Reinink, A.W. (1976) Oudkerkhof, Utrechts Archief. Available at: https://hetutrechtsarchief.nl/beeldmateriaal/detail/bc77540e-02d0-558e-80a4-e6d7cf6534cb/media/8c9ce673-48bf-7d7f-bb4d-039feeeb3c97.

Ritsema van Eck, J., Van Dam, F., De Groot, C. & De Jong, A. (2013) *Demografische ontwikkelingen 2010-2040. Ruimtelijke effecten en regionale diversiteit.* The Hague: Uitgeverij PBL. doi: 978-94-91506-32-1.

Rogers, S. H., Halstead, J. M., Gardner, K. H., & Carlson, C. H. (2011) 'Examining Walkability and Social Capital as Indicators of Quality of Life at the Municipal and Neighborhood Scales', *Applied Research in Quality of Life*, 6(2), pp. 201–213. doi: 10.1007/s11482-010-9132-4.

Saelens, B. E., Sallis, J. F., Black, J. B., & Chen, D. (2003) 'Neighborhood-Based Differences in Physical Activity: An Environment Scale Evaluation', *American Journal of Public Health*, 93(9), pp. 1552–1558.

Saelens, B. E., Sallis, J. F. and Frank, L. D. (2003) 'Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures', *The Society of Behavioral Medicine*, 25(2), pp. 80–91. doi: 10.1207/S15324796ABM2502_03.

Sallis, J. F. (2009) 'Measuring Physical Activity Environments. A Brief History', *American Journal of Preventive Medicine*. Elsevier Inc., pp. S86–S92. doi: 10.1016/j.amepre.2009.01.002.

Seawright, J. and Gerring, J. (2008) 'Case Selection Techniques in Case Study Research', *Political Research Quarterly*, 61(2), pp. 294–308. doi: 10.1177/1065912907313077.

Shamsuddin, S., Hassan, N. R. A. and Bilyamin, S. F. I. (2012) 'Walkable Environment in Increasing the Liveability of a City', *Social and Behavioral Sciences*, 50(July), pp. 167–178. doi: 10.1016/j.sbspro.2012.08.025.

Silverman, D. (2014) *Interpreting Qualitative Data.* Fifth. Los Angeles, London, New Delhi, Singapore, Washington DC: SAGE Publications.

Southworth, M. (2005) 'Designing the Walkable City', *Journal of Urban Planning and Development*, 131(4), pp. 246–257. doi: 10.1061/(ASCE)0733-9488(2005)131:4(246).

Talen, E. and Koschinsky, J. (2013) 'The Walkable Neighborhood: A Literature Review', *International Journal of Sustainable Land Use and Urban Planning*, 1(1), pp. 42–63. doi: 10.24102/ijslup.v1i1.211.

Talen, E. and Koschinsky, J. (2014) 'Compact, walkable, diverse neighborhoods: Assessing effects on residents', *Housing Policy Debate*. Taylor & Francis, 24(4), pp. 717–750. doi: 10.1080/10511482.2014.900102.

Tolley, R. (2011) *Good for Busine$: The benefits of making streets more walking and cycling friendly* Available at: https://www.heartfoundation.org.au/images/uploads/publications/Good-for-business.pdf.

UNDESA (2012) *World Urbanization Prospects: The 2011 Revision*. doi: 10.2307/2808041.

Walk Score (2014) *Walk Score® ChoiceMaps™*. Available at: https://www.walkscore.com/choice/shopping/WA/Seattle (Accessed: 17 August 2019).

Weber, J. (2014) 'The process of crafting bicycle and pedestrian policy: A discussion of cost–benefit analysis and the multiple streams framework', *Transport Policy*. Elsevier, 32, pp. 132–138. doi: 10.1016/j.tranpol.2014.01.008.

Wee, B. van, Annema, J. A. and Banister, D. (2013) *The transport system and transport policy: an introduction*. Cheltenham: Edward Elgar Publishing Limited.

Weinberger, R. and Sweet, M. N. (2012) 'Integrating Walkability into Planning Practice', *Transportation Research Record: Journal of the Transportation Research Board*, 2322(20–30). doi: 10.3141/2322-03.

WHO Regional Office for Europe (2005) *Health effects of transport-related air pollution*.

WHO Regional Office for Europe and JRC European Commission (2011) *Burden of disease from environmental noise: Quantification of healthy life years lost in Europe*.

Zakaria, J. and Ujang, N. (2015) 'Comfort of Walking in the City Center of Kuala Lumpur', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 170, pp. 642–652. doi: 10.1016/j.sbspro.2015.01.066.

Zuniga-Teran, A. A., Orr, B. J., Gimblett, R. H., Chalfoun, N. V., Going, S. B., Guertin, D. P., & Marsh, S. E. (2016) 'Designing healthy communities: A walkability analysis of LEED-ND', *Frontiers of Architectural Research*. Elsevier, 5(4), pp. 433–452. doi: 10.1016/j.foar.2016.09.004.

Zuniga-Teran, A. A., Orr, B. J., Gimblett, R. H., Chalfoun, N. V., Marsh, S. E., Guertin, D. P., & Going, S. B. (2017) 'Designing healthy communities: Testing the walkability model', *Frontiers of Architectural Research*. Elsevier B.V., 6(1), pp. 63–73. doi: 10.1016/j.foar.2016.11.005.

List of policy documents

Table 19: List of policy documents Amsterdam.

Reference code	Source
(AMS-PD-PEDESTRIAN, 2017)	Gemeente Amsterdam (2017). Notitie stand van zaken voetganger. pp. 1-46. (Established: March 2017) Retrieved from: the municipality of Amsterdam by e-mail. (Latest accessed: 12-04-2019).
(AMS-PD-EMPEROR, 2009)	GroenLinksfractie Gebruikte (2009). De voetganger keizer – meer ruimte voor de Amsterdamse tweevoeter. pp. 1-9. (Established: September 2009) Available at: http://groenlinks.maartenvanbeek.nl/files/groenemobiliteit/De%20voetganger%20Keizer.pdf (Latest accessed: 18-04-2019).
(AMS-PD-MOBILITY, 2013)	Gemeente Amsterdam (2013). Amsterdam Aantrekkelijk en Bereikbaar, Mobiliteitsaanpak Amsterdam 2030. pp. 1-74. (Established: June 2013) Available at: https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/verkeer-vervoer/ (Latest accessed: 12-03-2019).
(AMS-PD-AGENDA, 2015)	Gemeente Amsterdam (2015). Uitvoeringsagenda Mobiliteit. pp. 1-94. (Established: September 2015) Available at: https://issuu.com/gemeenteamsterdam/docs/uitvoeringsagenda_mobiliteit_-_cons (Latest accessed: 14-03-2019).
(AMS-PD-TRAFFIC, 2018)	Gemeente Amsterdam (2018). Beleidskader Verkeersnetten. pp. 1-57. (Established: January 2018) Available at: https://www.amsterdam.nl/publish/pages/749796/beleidskader_verkeersnetten.pdf (Latest accessed: 22-03-2019).
(AMS-PD-GUIDELINE, 2016)	Gemeente Amsterdam (2016). Leidraad Centrale Verkeerscommissie. pp. 1-105. (Established: April 2016) Available at: https://assets.amsterdam.nl/publish/pages/749796/leidraad_centrale_verkeerscommissie_26_april_2016.pdf (Latest accessed: 27-03-2019).
(AMS-PD-CITYSTREETS, 2017)	Gemeente Amsterdam (2017). Onderzoeksrapport Stadsstraten. pp. 1-37. (Established: August 2017) Available at: https://assets.amsterdam.nl/publish/.../onderzoeksrapport_stadsstraten_amsterdam.pdf (Latest accessed: 24-03-2019).
(AMS-PD-CITY, 2011)	Gemeente Amsterdam (2011). Structuurvisie Amsterdam, Economisch sterk en duurzaam. pp. 1-324. (Established: February 2011) Available at: https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/stedelijke/documenten/ (Latest accessed: 16-03-2019).
(AMS-PD-INNERCITY, 2018)	Gemeente Amsterdam (2018). Gebiedsplan 2018 Centrum Oost. pp. 1-34. (Established: January 2018) Available at: https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/gebiedsgericht/gebiedsplannen-2018/gebiedsplannen/centrum-west/ (Latest accessed: 17-03-2019).
(AMS-PD-PUBLIC, 2017)	Gemeente Amsterdam (2017). Visie Openbare Ruimte 2025 De huiskamer van a' lle Amsterdammers Richtlijnen voor ontwikkeling en beheer van de Amsterdamse openbare ruimte. pp. 1-59. (Established: June 2017) Available at: https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/stedelijke/documenten/ (Latest accessed: 04-03-2019).
(AMS-PD-PUCCINI, 2018)	Gemeente Amsterdam (2018). Beleidskader Puccinimethode Standaard voor het Amsterdamse straatbeeld. pp. 1-83. (Established: January 2018) Available at: http://www.bomenstichting amsterdam.nl/beleidskaderpuccinimethode2018inclusiefamendement.pdf (Latest accessed: 04-03-2019).
(AMS-PD-SAFETY, 2016)	Gemeente Amsterdam (2016). Meerjarenplan Verkeersveiligheid 2016-2021. pp. 1-78. (Established: September 2016) Available at: https://www.amsterdam.nl/publish/pages/764350/meerjarenplan_verkeersveiligheid.pdf (Latest accessed: 08-03-2019).
(AMS-PD-MOTION, 2018)	Urhahn (2018). De Beweegvriendelijke stad. pp. 1-191. (Established: October 2017) Available at: https://issuu.com/urhahn/docs/de_20beweegvriendelijke_20stad_20-_ (Latest accessed: 12-04-2019).
(AMS-PD-GREENERY, 2015)	Gemeente Amsterdam (2015). Agenda Groen 2015-2018. pp. 1-59. (Established: September 2015) Available at: https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/groen/ (Latest accessed: 08-04-2019).
(AMS-PD-MAINTENANCE, 2016)	Gemeente Amsterdam (2016). Stedelijk Handhavingsprogramma 2017-2018. pp. 1-88. (Established: December 2016) Available at: https://assets.amsterdam.nl/.../stedelijk_handhavingsprogramma_2017-2018-2.pdf (Latest accessed: 10-04-2019).

Table 20: List of policy documents Utrecht.

(UTR-PD-PEDESTRIAN, 2015)	Gemeente Utrecht (2015). Actieplan Voetganger 2015-2020, Utrecht Aantrekkelijk en bereikbaar. pp. 1-21. (Established: May 2015) Available at: https://www.utrecht.nl/fileadmin/uploads/documenten/bestuur-en-organisatie/beleid/verkeersbeleid/Actieplan_voetgangers_V6.pdf (Latest accessed: 22-04-2019).
(UTR-PD-MOBILITY, 2016)	Gemeente Utrecht (2016). Slimme Routes, Slim Regelen, Slim Bestemmen: Mobiliteitsplan Utrecht 2025. pp. 1-105. (Established: May 2016) Available at: https://www.utrecht.nl/fileadmin/uploads/documenten/bestuur-en-organisatie/beleid/verkeersbeleid/nota-slimme-routes-slim-regelen-slim-bestemmen.pdf (Latest accessed: 23-04-2019).
(UTR-PD-ACCESSIBLE, 2012)	Gemeente Utrecht (2012). Utrecht Aantrekkelijk en Bereikbaar. pp. 1-70. (Established: January 2012) Available at: https://www.utrecht.nl/fileadmin/uploads/.../bestuur.../Ambitiedocument_2012_01.pdf (Latest accessed: 29-04-2019).
(UTR-PD-FOOTPATH, 2014)	Bouw Advies Toegankelijkheid (2014). Voetpaden voor iedereen. pp. 1-41. (Established: August 2014) Available at: https://www.utrecht.nl/...en.../Handboek_voetpaden_openbare_ruimte_Utrecht.pdf (Latest accessed: 02-05-2019).
(UTR-PD-USER, 2016)	Gemeente Utrecht (2016). De Gebruiker Centraal 2016 - 2020 (met concrete invulling voor 2016-2017). pp. 1-59. (Established: 2016) Available at: https://www.ibu.nl/fileadmin/uploads/...en.../2016-Actieplan-de-gebruiker-centraal.pdf (Latest accessed: 04-05-2019).
(UTR-PD-STRATEGY, 2016)	Gemeente Utrecht (2016). Utrecht kiest voor gezonde groei, Ruimtelijke Strategie 2016. pp. 1-64. (Established: 2016) Available at: https://www.utrecht.nl/fileadmin/uploads/documenten/wonen-en-leven/bouwen/bouwprojecten/Rapport-RSU-Utrecht-kiest-voor-gezonde-groei-20160610.pdf (Latest accessed: 22-04-2019).
(UTR-PD-CITY, 2018)	Gemeente Utrecht (2018). MPSO 2018 (Meerjaren Perspectief Stedelijke Ontwikkeling). pp. 1-127. (Established: 2018) Available at: utrecht2018.mpso.nl/assets/docs/total.pdf (Latest accessed: 23-04-2019).
(UTR-PD-INNERCITY, 2015)	Gemeente Utrecht (2015). Utrecht Aantrekkelijk en Bereikbaar Centrum, Gebiedsagenda. pp. 1-28. (Established: April 2015) Available at: https://omgevingsvisie.utrecht.nl/thematisch-beleid/verkeer-en-mobiliteit/gebiedsagendas/#c201860 (Latest accessed: 20-04-2019).
(UTR-PD-SAFETY, 2015)	Gemeente Utrecht (2015). Utrecht Aantrekkelijk en Bereikbaar Actieplan Verkeersveiligheid 2015-2020. pp. 1-48. (Established: 2015) Available at: http://docplayer.nl/10519881-Utrecht-aantrekkelijk-en-bereikbaar-actieplan-verkeersveiligheid.html (Latest accessed: 19-04-2019).
(UTR-PD-PUBLIC, 2016)	Gemeente Utrecht (2016). Kadernota Kwaliteit Openbare Ruimte Een. pp. 1-49. (Established: December 2016) Available at: https://www.utrecht.nl/fileadmin/uploads/documenten/ondernemen/Kadernota-Kwaliteit-Openbare-Ruimte.pdf (Latest accessed: 17-04-2019).
(UTR-PD-GREENERY, 2018)	Gemeente Utrecht (2018). Actualisatie Groenstructuurplan 2017 - 2030 'Voor een gezonde groene toekomst'. pp. 1-41. (Established: March 2018) Available at: https://www.utrecht.nl/fileadmin/uploads/documenten/wonen-en-leven/parken-en-groen/groenbeleid/2017-04-Actualisatie-Groenstructuurplan.pdf (Latest accessed: 20-04-2019).
(UTR-PD-MAINTENANCE, 2019)	Gemeente Utrecht (2019). Handhavingsprogramma Openbare Ruimte en Bebouwde Omgeving 2019. pp. 1-34. (Established: 2019) Available at: https://www.utrecht.nl/fileadmin/uploads/...en.../Handhavingsprogramma-2018.pdf (Latest accessed: 20-04-2019).

List of interviewees

Table 21: List of interviewees.

City	#	Interviewee	Discipline	Reference code
Amsterdam	1.	D. Iede Terpstra	Traffic planner (Municipality of Amsterdam)	(AMS-IN-Terpstra, 2019)
	2.	J. Olsthoorn	Mobility advisor (Municipality of Amsterdam)	(AMS-IN-Olsthoorn, 2019)
	3.	A. Molster	Urban planner (Molster Stedenbouw)	(AMS-IN-Molster, 2019)
	4.	R. van Soest	Psychologist/ city guide (Stadswandelkantoor)	(AMS-IN-Van Soest, 2019)
Utrecht	5.	A. Tsakmakis	Advisor Mobility (Municipality of Utrecht)	(UTR-IN-Tsakmakis & Ditewig, 2019)
	6.	R. Ditewig	Advisor Traffic (Municipality of Utrecht)	(UTR-IN-Tsakmakis & Ditewig, 2019)
	7.	M. in der Maur	Advisor Mobility management (XTNT)	(UTR-IN-In der Maur, 2019)
	8.	J.M. Dalmeijer	Designer/ city guide (Freelancer)	(UTR-IN-Dalmeijer, 2019)

APPENDIX

I: WALKABILITY IN SCIENTIFIC LITERATURE

Table 22: Walkability in scientific literature.

Field: PD: Planning and urban design; T: Transportation; H: Public health; E: Economy; S: Sociology.

LITERATURE	FIELD	INSTRUMENT	MAIN FACTORS	DEFINITION AND FACTORS
Moudon & Lee, 2003; p. 30 and 31	PD	*Evaluation Environmental Audit Instruments*	*1. Roadway characteristics;* *2. Environment along roadway;* *3. Network.* *4. Area.*	*Visibility; street or road segments; vehicle lanes; outside lanes; bicycle lanes; on-street parking; paths (type and width); vehicular access; transit service; bus service (bus stops); curbs; slope; barriers; crossings; median; signalization; pedestrian signalization; sidewalks; surface (path condition, smoothness, material) buildings (architecture, maintenance); lighting; litter; bicycle parking; sidewalks (buffer between cars and pedestrians); street furniture; trees; connectivity; continuity; sidewalk networks; network density; access; O/D accessibility; density/intensity; market area; land use type; land uses linked by travel; proximity; urban form; land use as travel generator.*
Alfonzo, 2005, p. 825	PD	*The hierarchy of walking needs*	*1. Feasibility* *2. Accessibility* *3. Safety* *4. Comfort* *5. Pleasurability*	*1. Mobility; time; responsibilities. Number of adults in household; number of children in household; childcare responsibility; age, health or physical mobility.* *2. The pattern, quantity, quality, variety and proximity of activities present; connectivity between uses; walking-related infrastructure. Presence/completeness of sidewalk network; presence/number of barriers; distance to destinations.* *3. Urban design characteristics related to physical incivilities and fear of crime; types of land uses; people present. Presence of graffiti, litter, abandoned buildings, 1st- floor windows; presence of bars, liquor stores, pawnshops; presence of threatening or loitering individuals.* *4. Urban design characteristics that affect the relationship between pedestrians and motorized traffic; urban design characteristics related to the pedestrian walkway system and street network; urban design amenities. Presence of traffic calming features (e.g., roundabouts, medians, curb bulb-outs); width of the street, length of blocks, width of sidewalk, presence of sidewalk buffers, street trees; street furniture, arcades, canopies, water fountains.* *5. Diversity and complexity; liveliness (activity level; architectural coherence and scale; aesthetic appeal. Presence of a varied streetscape, mixed uses, architectural elements, historic or unique architecture, color; presence of public space; presence of other people, street vendors, outdoor dining.*
Southworth, 2005, p. 248 and 249	PD	*Criteria for design of a successful pedestrian network.*	*1. Connectivity* *2. Linkage with other modes* *3. Fine grained land use patterns* *4. Safety* *5. Quality of path* *6. Path context*	***"Walkability is the extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort, and offering visual interest in journeys throughout the network".*** *Width; paving; landscaping; signing, lighting; street design; visual interest of the built environment, transparency; spatial definition; landscape; overall explorability.*
Ewing et al. 2006,	PD	*Urban Design*	*1. Imageability*	-

p. 236		*Qualities with high score of frequently discussed urban design qualities in literature*	*2. Visual enclosure* *3. Human scale* *4. Transparency* *5. Complexity*	
Mehta, 2008, p. 241	PD	*The hierarchy of walking needs on the neighborhood Main Street*	*1. Feasibility* *2. Accessibility* *3. Usefulness,* *4. Safety* *5. Comfort* *6. Sensory pleasure* *7. Sense of belonging*	*Wide sidewalks; shade-providing trees and canopies; interesting and engaging storefronts, signage and displays; street furniture; articulated building façades; variety and range of businesses; uniqueness of goods and services; occurrence of events organized or supported by businesses; community-gathering places; the presence of people and activities; and real and perceived safety from crime.*
Lo, 2009, p. 163	PD	*Factors appearing in a number of walkability measures*	-	*Presence of continuous and well-maintained sidewalks; universal access characteristics; path directness and street network connectivity; safety of at-grade crossing treatments; absence of heavy and high-speed traffic; pedestrian separation or buffering from traffic; land-use density; building and land-use diversity or mix; street trees and landscaping; visual interest and a sense of place as defined under local conditions; perceived or actual security.*
Ewing and Cervero, 2010, p. 267	PD	*The D Variables as measures of the Built Environment*	*1. Density* *2. Diversity* *3. Design* *4. Destination accessibility* *5. Distance to transit*	*Household density; land use mix; intersection or street density; accessibility by auto; accessibility by transit; distance to downtown; distance to transit; distance to nearest transit stop.*
Talen and Koschinsky, 2013, p. 43	PD	-	*1. Safe* *2. Well serviced* *3. Comfortable* *4. Interesting*	***"A concise definition of "walkable neighborhood" is that it is a safe, well-serviced neighborhood, imbued with qualities that make walking a positive experience". "A "positive" walking experience means that streets, sidewalks and paths (pedestrian routes) are comfortable and interesting"***.
Blečić et al., 2015, p. 1357	PD	*Walkability Explorer (WE)*	*1. Urban Design* *2. Physical features* *3. Land-use pattern*	*Building density; degree of integration; and street type. Land-use pattern; bicycle track; number of car lanes car speed limit (in km/h); one-way street; car parking along the road; footway width (in meters); and degree of maintenance. Commercial activities; services and offices.*
Moura, Cambra and Gonçalves, 2017, p. 282	PD	*The multi-dimensional 7C's layout (adults, children, seniors and impaired mobility pedestrians)*	*1. Connectivity* *2. Convenience* *3. Comfort* *4. Conviviality* *5. Conspicuousness* *6. Coexistence* *7. Commitment*	*Path/sidewalk continuity; path directness; accessible pedestrian network; land use diversity; sidewalk effective width; daily commerce and services; perception by pedestrians; sidewalk quality; meeting places; existence or visibility of anchor places; service hours; existence or visibility of landmarks; street toponymy (street names, signposting, way finding); traffic safety; pedestrian crossing location; existence of design standards and planned public space design interventions.*
Habibian and Hosseinzadeh, 2018, p. 222	PD	*Walkability Index (correlation between design indices and walk share (Job, Educational, Shopping and All trips)*	*1. Design indices* *2. Diversity indices* *3. Density index* *4. Destination accessibility indices*	*Cul-de-sac density; 3-way intersection density; 4-way intersection density; intersection density; percentage of 3-way intersections; percentage of 4-way intersections; density of major; 3-way intersections; density of major 4-way intersections; ratio of cul-de-sac to nodes; ratio of minor streets to major streets; street density; major street density; minor street density; connected node ratio; ratio of links to nodes; average link length; average major link length; gamma index; alpha index; node connectivity; link connectivity; entropy HHI; MXI; job-pop balance; population density; distance to CBD (Aerial); distance to CBD (Network).*
Zuniga-Teran et al., 2016, p. 435	PD	*LEED-ND and Walkability Framework*	*1. Connectivity* *2. Land use* *3. Density* *4. Traffic safety*	*Multiple, direct, and short routes; facilities; residential and retail density; safe and comfortable bus stops; frequent and reliable bus service; place of parking; streetscape proportions; aesthetics; way finding*

			5. Surveillance *6. Parking* *7. Experience* *8. Green space* *9. Community*	*considerations; thermal comfort level; slope; presence of fumes; and presence of dogs/wildlife; variety of green space and vegetation in size and proximity; easy access; space for social interaction.*
Henson, 2000, p. 30	T	*Level of services for pedestrians (LOS)*	*1. Comfort* *2. Convenience* *3. Safety* *4. Security* *5. Economy* *6. Inconvenience*	*Weather protection, climate control, arcades, transit shelters and other pedestrian amenities. Walking distances, pathway directness, grades, sidewalk ramps, directional signing, directory maps and other features making pedestrian travel easy and uncomplicated. Separation of pedestrians from vehicular traffic, horizontally in malls and other vehicle-free areas, vertically using overpasses and underpasses; and traffic control devices. Lighting, open lines of sight, and the degree and type of street activity. Aspects relate to the user costs associated with travel delays. The rental value and retail development as influenced by pedestrian environment.*
Jaskiewicz, 2000, p. 11	T	*Jaskiewicz's qualitative pedestrian level of service (LOS) factors:*	-	*Enclosure or definition; Path network complexity; building articulation; complexity of spaces; overhangs and rooflines; buffer; shade trees; transparency; sidewalk condition; vehicular speed; lighting.*
Frank et al. 2009, p.8	T	*Walkability index (WAI)*	-	*Net residential density; retail floor area ratio; intersection density; and land use mix.*
Kelly et al., 2011, p. 1503	T	*Factors which influence levels of walking and pedestrian route choice*	-	*Sidewalk; cleanliness; street lighting; traffic volume; traffic speed; detours; sidewalk width; cyclists; road crossings; uneven sidewalks; and utility (score).*
Abley, 2011, p. 3	T	-	-	***"The extent to which the built environment is walking friendly".***
Hall and Ram, 2018, p. 2	T	-	-	***"Walkability can be broadly defined as the extent to which an environment, usually the built environment, enables walking (Kelly et al., 2011) and is pedestrian friendly (Gebel et al., 2009; Moura et al., 2017)".***
Cao, Handy and Mokhtarian, 2006, p. 9	T	-	-	*Within the neighbourhood: safety; shade; houses; scenery; traffic; people. Local commercial areas: stores; walk advantage; walk comfort (Handy et al. 1998).*
Litman, 2018	T	-	-	***"The quality of walking conditions, including safety, comfort and convenience".*** *Economic impacts of walkability: accessibility; consumer cost savings; public cost savings (reduced external costs); efficient land use; liveability; public fitness and health; economic development; equity.*
Saelens et al., 2003, p. 1554	H	*Neighborhood Environment Walkability Scale (NEWS)*		*- Residential density, land use mix–diversity, land use mix-access, street connectivity, walking/cycling facilities, aesthetics, pedestrian/traffic safety and crime safety.*
Brennan Ramirez et al. 2006, p. 515	H	*Indicators of activity-friendly communities*	-	*Land use environment, access to exercise facilities, transportation environment, aesthetics, travel patterns, social environment, land use economics, transportation economics, institutional and organizational policies, and promotion.*
King *et al.*, 2002, p. 22	H	*The Charter of the New Urbanism*	-	*Region scale: multiple centres, identifiable urban edges, encourage infill development within the heart of the city and supporting alternative transportation modes. Neighbourhood scale: walking distance, mix of land uses and easily reach a variety of public amenities and civic spaces. Block scale: buildings fronting streets, low traffic speeds, street connectivity, narrow streets, on-street parking, sidewalks, small block size, and street trees.*
Pikora *et al.*, 2003, p. 1698	H	*Physical environmental*	*1. Functional* *2. Safety*	*Walking surface (path type, surface type, maintenance and continuity); streets (width); traffic (volume, speed,*

		factors that may influence walking for recreation in the local neighbourhood	*3. Aesthetic* *4. Destination*	*traffic, control and devices); permeability (street design, intersection design, intersection distance and other access points). Personal (lighting and surveillance); traffic (crossings, crossing aids and verge width). Streetscape (trees, garden maintenance, street maintenance, cleanliness, pollution and parks); views (sights and architecture). Facilities (parks and shops).*
Saelens, Sallis & Frank, 2003, p. 80	H	*The walkability scale*	-	*Density, land use mix and diversity, access to a mix of uses, street connectivity, walking and bicycling facilities, street aesthetics, level of traffic and street crime.*
Leslie, Butterworth and Edwards, 2006, p. 4	H	*The Walkability Index*	-	***"The walkability of a community may be conceptualised as the extent to which characteristics of the built environment and land use may or may not be conducive to residents in the area walking for either leisure, exercise or recreation, to access services, or to travel to work".*** *Dwelling density, street connectivity, land use mix, and net retail area.*
Hoedl, Titze and Oja, 2010, p. 457	H	*The Bikeability and Walkability Evaluation Table (BiWET)*	-	*Traffic safety (combination of speed limitations and traffic lanes); attractiveness of the surroundings (billboards or walls, green strip [green space with width 10 m], trees, green space, public green space [sports playing field or park], open space [non-green]); land use (residential or business area, lower or higher than three stories, special [attractive/historic/cultural] buildings); and walking and cycling infrastructure (cycle lanes, sidewalks).*
Duncan, Aldstadt & Whalen, 2011, p. 4161	H	*Validation walkscore*	-	***"Collectively, these features that promote various forms of physical activity (such as walking) can be referred to as 'neighborhood walkability' and often include access to walking destinations such as retail stores and parks, and community design features such as street connectivity and sidewalk access" (Lo, 2009).***
Hajna et al., 2015, p. 2	H	*The variables that best capture design, diversity and density*	*1. Street connectivity* *2. Land use mix* *3. Residential density*	***"The variables that best capture design, diversity and density are street connectivity, land use mix and residential density (collectively referred to as neighbourhood walkability)".***
Pivo and Fisher, 2011, p. 1	E	-	-	***"Walkability is the degree to which an area within walking distance of a property encourages walking for recreational or functional purposes"***
Cerin et al., 2006, p. 215	S	*NEWS-A*	-	*Residential density; land-use mix; access to services; street connectivity; infrastructure and safety for walking; aesthetics; traffic load; crime; parking difficulties; hilly streets; physical barriers to walking; not many cul-de-sacs.*

II: CODING SCHEMES

Table 23: Code scheme interests.

CODE FAMILY / CODE	OTHER ENGLISH SEARCH TERMS	DUTCH SEARCH TERMS
INTERESTS		
Less automobile use	car use; motorized traffic; traffic congestion	autogebruik|; autoverkeer; automobiliteit
Less air and noise pollution	air quality;	luchtvervuiling; luchtkwaliteit; geluid; lucht; uitstoot
Less energy consumption	fossil fuel	energie; energiegebruik; fosiele brandstoffen
Space efficient	less space; space efficiency	minder ruimte; ruimtegebruik
Physical and mental health	-	gezondheid; gezond
Quality of life	-	leefbaarheid; leefbare; leefkwaliteit
Traffic safety	accidents	verkeersveiligheid; ongevallen; veiligheid
Cost savings	cost	maatschappelijke baten/kosten
Real estate values	real estate performances; value; investment	huren; vastgoedwaarde
Social capital	social connection; cohesion	sociale samenhang; cohesie
Social equity	equity; inequity; access; taking part	iedereen; gelijkheid
Safety from crime	crime; threat of crime; crime rates;	sociale veiligheid

Table 24: Code scheme pedestrians.

CODE FAMILY / CODE	OTHER ENGLISH SEARCH TERMS	DUTCH SEARCH TERMS
PEDESTRIANS		
Age	-	leeftijd; jong tot oud; levensloopbestendig
Children	-	kinderen; kind; jong
Adults	-	volwassen
Elderly	old	ouderen
Gender	sex	geslacht
Female	-	vrouw; meisje
Male	-	man; jongen
Disability	disabled; mobility impaired; constraints	minder validen; beperking; gehandicapt; handicap
Physical disability	-	fysieke beperking; fysieke handicap; rollator; ter been
Wheelchair	-	rolstoel
Visual	-	visuele; visueel gehandicapten
Purpose	trip purpose; walking purposes; purposeful	doel
Transportation	Transport	transport; van A naar B
Recreation	-	recreatie; recreatief; recreatieve; recreant

Table 25: Code scheme place.

CODE FAMILY / CODE	OTHER ENGLISH SEARCH TERMS	DUTCH SEARCH TERMS
PLACE		
Topography	-	topografie
Slope	hillier; hills; flat	helling
Elevation	-	verhoging; hoogte
Views	scenic views	stadsgezicht; uitzicht; kijklijn
Climate	climate change; weather	klimaat; klimaatverandering; klimaatbestendig; weer
Cold	-	koud
Heat	warm	warm
Sun	sunny	zoning; zon
Precipitation	rain	neerslag; regenval
Wind	windy	wind
Area type	-	gebieds type
Residential area	neighbourhood	buurt; woonomgeving
Shopping area	commercial area	winkelgebied
Bus / tram stop	-	bushalte; tramhalte

Table 26: Code scheme walking needs.

CODE FAMILY / CODE	OTHER ENGLISH SEARCH TERMS	DUTCH SEARCH TERMS
WALKING NEEDS		
Accessibility	access; accessible	toegankelijk; toegankelijkheid
Safety	safe	veiligheid; veilig
Comfort	comfortable	comfort; comfortable; gemak
Pleasurability	attractiveness; pleasure	plezierigheid; aantrekkelijkheid
Connectivity	connection; connected	connectiviteit; verbinding
Proximity	closeness; distance	nabijheid; afstand
Visibility	visible	overzicht; zicht
Maintenance	maintain	handhaving; handhaven
Distance to other traffic	proximity to other traffic	nabijheid/ afsand van ander verkeer
Low traffic speed	speed; pace	snelheid
Low traffic volume	volume	verkeersvolume; hoeveelheid verkeer
Path quality	sidewalk quality	kwaliteit van het pad
Thermal comfort	weather protection; weather conditions	bescherming
Shade and shelter	shade; shelter	schaduw; beschutting
Coolness	cool	verkoeling
Experience	-	ervaring
Aesthetics	aesthetic	vormgeving; aesthetisch
Complexity	diversity	complex
Liveliness	-	levendigheid

Table 27: Code scheme planning & design.

CODE FAMILY / CODE	OTHER ENGLISH SEARCH TERMS	DUTCH SEARCH TERMS
PLANNING AND DESIGN		
Presence of path	presence of sidewalk	aanwezigheid van het trottoir
Free of obstacles	-	obstakels; obstakel vrij
Free of physical barriers	barriers	barrier; fijnmazig netwerk
Land use diversity	land use mix; diversity of land uses	functiemenging; divers aanbod; diverse functies
Land use density	density; compact	dichtheid; verdichting; compact; intensivering
Urban form	structure	oriëntatie; stedelijke vorm; stedelijke structuur
Windows	surveillance through windows	ramen; sociaal toezicht
Street lighting	lights	straatverlichting; verlichting
Land use type	type of land use	voorzieningen
Litter	waste	afval
Graffiti	-	graffiti
Vandalism	-	vandalisme
Greenery	green	groenvoorzieningen; groen; vegetatie
Buffer zone	strip; zone	buffer; strook
Solid objects	-	objecten
Narrow lane widths	-	wegbreedte; smal wegprofiel
Enclosure of buildings	-	Omgeven door gebouwen
Number of lanes	-	aantal rijbanen
Path width	sidewalk width	breedte trottoir
Surface	-	ondergrond; materiaal
Street furniture	-	straatmeubiliair
Roof overhangs	awnings; canopies	afdakjes; beschutting
Street trees	trees	bomen
Water bodies	ponds	waterlichamen; vijvers; sloten; rivieren; stroompjes
Greenery	green	groenvoorzieningen; groen; vegetatie
Architecture	-	architectuur
Street design	urban design; design; lay-out	design; inrichting
Street trees	trees	bomen
Outdoor activities	-	festiviteiten; festivals; evenementen

III: INTERVIEW PROTOCOL FOR MUNICIPALITY OF AMSTERDAM

I will first give a brief introduction. This interview is being held as part of my thesis for the Spatial Planning Master's degree program at the University of Wageningen. My master's thesis is about the definition and use of 'walkability' in large Dutch cities. In this study I compare the international trends of 'walkability' in the scientific literature with the pedestrian policy of large Dutch cities. This interview will focus on certain choices made in pedestrian policy and how the policy is expressed in practice. The interview will last a maximum of 45 minutes.

First I have a number of practical questions:
1. Do you mind if this interview is recorded so that I can transcribe it afterwards?
2. Can I mention your name in my Master's thesis or do you prefer that I only mention your title and municipality?
3. What is your professional title?
4. What is your role within the municipality?

Okay, then I start recording now. Recently I have analysed many policy documents of your municipality with regard to pedestrian policy.
5. Which policy documents are besides “Mobiliteitsaanpak 2030”; “Uitvoeringsagenda Mobiliteit 2015” en “de Beweegvriendelijke stad” of Urhahn important for the pedestrian policy and why?
6. Why does the municipality of Amsterdam not have a separate policy document for pedestrians such as that of the municipality of Utrecht?

In my research I approach the definition and use of 'walkability' from five domains: interests; pedestrian characteristics; place characteristics; walking needs (not tangible qualities such as safety); and planning and design (tangible or visible qualities such as street furniture). I will ask you a few questions about these domains.
7. What has been the main reason to focus more on the pedestrian in your municipality?
8. What is the difference between the position of the pedestrian and the cyclist in your municipality?
9. Are there factors that impede the application of pedestrian policy and, if so, which ones?
10. To what extent are they aware of the benefits and attention for pedestrian policy at the municipality of Amsterdam?

According to a number of scientists, the definition of pedestrian characteristics influences the definition of walkability.
11. Has a definition of the pedestrian been laid down in the municipal policy? If so, where can it be found? If not, why not?
12. To what extent has pedestrian policy been approached from different types of pedestrians? (e.g. wheelchair users)
13. To what extent has pedestrian policy been approached from different walking goals? (e.g. ongoing meeting and tourism)

According to a number of scientists, environmental characteristics (place characteristics) such as climate and topography also influence walking behavior.
14. How is attention paid to climate comfort for pedestrians? (shelter)
15. What makes the pedestrian policy of Amsterdam different from that of Utrecht do you think?

A scientist named Alfonzo (2005) developed 'the hierarchy of walking needs' in which she divided pedestrians' needs into' 'accessibility' '; 'Safety' (safety); “comfort”; and “ pleasurability '(pleasure). The following questions are about these 'walking needs' and the “ planning and design “ characteristics.

According to the literature, the feeling of road safety in pedestrians is influenced by vision; distance to other traffic; speed of other traffic and the volume of traffic.
16. To what extent are these qualities in the area of traffic safety included in the pedestrian policy of your municipality?
17. A buffer and solid objects (trees) between the pedestrian and fast traffic seems to be lacking in the policy or hardly occur, is there an explanation for this?

According to the literature, the feeling of comfort among pedestrians is influenced, among other things, by the space that a pedestrian receives.
18. To what extent is it possible to give the pedestrian more space with the new priority system whereby the municipality of Amsterdam makes choices between the different modalities?
19. In what situations is shared space applied and does it work in practice?
20. Are there still things that could be interesting for me to share?

Okay, then I'll stop the recording. Thank you very much for your time. As I said, I will send the interview transcript to you as soon as it has been processed. If you have any questions or comments afterwards, please let me know.

IV: INTERVIEW PROTOCOL FOR EXPERTS

I will first give a brief introduction. This interview is being conducted as part of my thesis for the Master of Spatial Planning at the University of Wageningen. My master thesis is about the definition and use of "walkability" in large Dutch cities. In this research I compare the international trends of "walkability" in the scientific literature with the pedestrian policy of large Dutch cities. In this I compare two cases and those are Amsterdam and Utrecht. This interview will focus on your vision on "walkability" and what you think of the pedestrian policy in Utrecht. The interview will take approximately 45 minutes. First I have some practical questions:
1. Can I state your name in my master's thesis or would you prefer that I only state your title and municipality?
2. Do you think it is good if this interview is recorded?
Afterwards I will transcribe and send the transcript for verification. Okay, then I start recording now.
3. What is your professional title and what do you do in your work?

In my research, I approach the definition and use of "walkability" from five domains: interests (interests and benefits); pedestrian characteristics (definition of the pedestrian); place characteristics; walking needs (not tangible qualities such as safety); and planning and design (tangible or visible qualities such as street furniture). I am going to ask you a few questions about these domains.

Starting with the importance (interest) of walking and pedestrian policy.
4. To what extent are you familiar with the pedestrian policy of the municipality of Amsterdam/Utrecht?
The municipality of Utrecht has a separate pedestrian policy document, while Amsterdam has laid down pedestrian policy in several policy documents because many other policy areas influence pedestrian quality.
5. How do you think the pedestrian policy of a municipality can best be recorded and why?
6. To what extent are you aware of the benefits of pedestrian policy, and how do you think this awareness can be improved?
7. Do you think that enough attention is paid to the pedestrian in the municipality of Amsterdam/Utrecht looking at the policy and the projects implemented for the pedestrian? Why?

According to a number of scientists, the definition of pedestrian has an influence on the definition of walkability.
8. Do you think that the pedestrian policy is adequately approached from different types of pedestrians (wheelchair users)? How could this be improved?
9. Do you think that the pedestrian policy is sufficiently approached from different walking goals (ongoing meetings or running)? How could this be improved?

According to a number of scientists, environmental characteristics (place characteristics) such as climate and topography also influence walking behaviour.
10. To what extent do you think climate comfort is important for pedestrians and do you think that enough attention is paid to it?
11. What makes the pedestrian policy that is needed for Amsterdam different from what you think for Utrecht? What effect does the difference have on morphology and topographical features such as water on the pedestrian policy of both cities?

The municipality of Amsterdam/Utrecht sets the following requirements for pedestrian quality (show requirements).
12. What do you think of these requirements drawn up by the municipality of Amsterdam/Utrecht?

A scientist named Alfonzo (2005) has developed "the hierarchy of walking needs", subdividing the needs of pedestrians into "accessibility"; "safety"; “comfort”; and "pleasurability". The following questions are about these "walking needs" and the "planning and design" characteristics. Starting with accessibility for pedestrians.
13. What do you think of the accessibility for pedestrians in Amsterdam/Utrecht and how could that be improved?

The degree of social and road safety also influences our choice to walk or not.
14. What do you think about safety from crime in Amsterdam/Utrecht and how could that be improved?
15. What do you think of road safety in Amsterdam/Utrecht and how could it be improved?

The comfort of the pedestrian is, among other things, determined by the amount of space and climate comfort.
16. What do you think of the pedestrian comfort in Amsterdam/Utrecht and how could that be improved?
17. What do you think of the amount of space available for walking in the city centre?

The attractiveness of public space such as the presence of art objects also influences the choice to walk or not.
18. What do you think about the attractiveness of Amsterdam/Utrecht for the pedestrian and how could that be improved?
19. What can be improved on the pedestrian policy of Amsterdam/Utrecht?
20. Are there still things that could be interesting for me to share?

Okay, then I'll stop the recording. Thank you for your time. As mentioned, I will send the interview transcript to you for verification as soon as it is processed. If you have any questions or comments afterwards, please let me know.

V: INTERVIEW PROTOCOL FOR CITY GUIDES

I will first give a brief introduction. This interview is being held as part of my thesis for the Spatial Planning Master's degree program at the University of Wageningen. My master's thesis is about the definition and use of 'walkability' (pedestrian climate) in large Dutch cities. This interview will focus on the question of what you think of the inner city as a pedestrian. The interview will last about 45 minutes.

First I have a number of practical questions:

1. Do you agree if this interview is recorded so that I can transcribe it afterwards? Afterwards I will send the interview transcript for review. Okay, then I start the recording right now.
2. Can I mention your name in my Master's thesis or do you prefer that I only mention your professional title?
3. What is your professional title?
4. What do you do in your work?

A scientist named Alfonzo (2005) developed 'the hierarchy of walking needs' in which she divided pedestrians needs into “accessibility”; “Safety”; “comfort”; and “pleasurability”. The questions are about these factors and the related planning and design characteristics.

Starting with accessibility for pedestrians.

5. How do you experience the walkability in the city center? Do you suffer from obstacles? If yes which one?
6. How do you experience the distances to facilities in the city center? Do you explain this on foot or by other means of transport?
7. Do you think that enough provisions are being made for the pedestrian group of tourists? Why?

The degree of safety from crime and road safety also influences our choice to walk or not.

8. How do you experience social security (crime) in the city center? Why do you think it is socially safe or not?
9. What do you think of the maintenance of the streets in the city center? To what extent are you bothered by litter, graffiti and vandalism?
10. How do you experience road safety in the city center? Why do you find it safe or not in traffic?

The comfort of the pedestrian is determined, among other things, by the amount of space and climate comfort.

11. What do you think of the amount of space available to walk in the city center? Are there enough places to stand still?
12. What do you think of the protection offered against the weather in the city center? Are there enough shady and sunny spots? How do you experience the amount of wind in the city center?

The attractiveness of the public space also influences the choice to start running or not.

13. What makes Amsterdam / Utrecht an attractive city to walk through?
14. What makes you less attractive to the city center? Where do you disturb yourself as a pedestrian?
15. How could the inner city be improved for the pedestrian?
16. Are there still things that could be interesting for me to share?

Okay, then I'll stop the recording. Thank you very much for your time. As I said, I will send the interview transcript to you as soon as it has been processed. If you have any questions or comments afterwards, please let me know.

VI: WALKABILITY TRENDS IN SCIENTIFIC LITERATURE

Table 28: Description of trends frequently mentioned in various disciplines.

WALKABILITY TRENDS IN SCIENTIFIC LITERATURE	
TRENDS	**DESCRIPTION**
INTERESTS	
Less automobile use	*"From a transportation research and urban planning perspective, walkability is relevant in order to reduce traffic congestion"* (Reyer *et al.*, 2014, p. 5850).
Less air and noise pollution	*"Walking and cycling also help alleviate traffic congestion, save energy, reduce air and noise pollution, conserve land, and produce various other environmental benefits"* (Pucher and Dijsktra, 2003, p. 1514).
Less energy consumption	*"Non-motorized modes can achieve transport planning objectives including reduced traffic and parking congestion, energy consumption and pollution emissions"* (Litman, 2018, p. 2).
Physical and mental health	*"The public health benefits of promoting walking extend beyond its direct benefits, that is, benefits that derive from physiologic effects (e.g., improved blood pressure, glucose control, lipid profile, etc.) in individuals who are more physically active"* (Lee and Buchner, 2008, p. 517).
Quality of life	*"The drop in walking rates has also troubled social scientists, architects, and planners, as many believe that this decrease may affect quality of life and sense of community"* (Alfonzo, 2005, p. 809).
Traffic safety	*"A wide range of measures are available to improve the safety of walking and cycling in American cities, both to reduce fatalities and injuries and to encourage walking and cycling"* (Pucher and Dijsktra, 2003, p. 1509).
Cost savings	*"Improving walkability provides many consumer- and public cost savings including lower transportation costs; lower health care costs; lower infrastructure costs and lower environmental impact costs of Co2 emissions"* (Litman, 2018).
Real estate values	*"Walkability was associated with higher value for office, retail and apartment properties"* (Pivo and Fisher, 2011, p. 212).
Social capital	*"Social capital is defined as the social networks and interactions that inspire trust and reciprocity among citizens"* (Putnam, 2000 in Leyden, 2003, p. 1546).
Social equity	*"Walkability can help achieve various equity objectives including a fair distribution of public resources to non-drivers, financial savings and improved opportunity for people who are physically and economically disadvantaged, and basic mobility"* (Litman, 2018, p. 17).
Safety from crime	*"Walkable neighborhoods translate into more "eyes on the street," which lead to less crime"* (Gilderbloom, Riggs and Meares, 2015, p. 23).
PEDESTRIANS	
Age	*"Perhaps older people walk less because of physical mobility limitations or other health problems making walking less feasible". "A person's age, then, may affect the saliency of certain needs, such as feasibility, in the decision to walk* (Alfonzo, 2005, p. 823).
Gender	*"However, there are differences in the perceptions of safety according to gender: for all female the feeling of insecurity constitutes a barrier to walking, and only for some male it is a deterrent"* (Ferrer and Ruiz, 2018, p. 118).
Disability	*"On the basis of social equity, the definition of pedestrians could be further expanded to include those using wheelchairs or other aids"* (Lo, 2009, p. 146).
Purpose	*"What is most walkable differs by walking purposes: whether people are walking to get somewhere, engage in exercise, socialize, or enjoy the outdoors, or if walking is part of some other activity such as looking after children or engaging in paid work"* (Forsyth, 2015, p. 288).
PLACE	
Climate	*"For example, residents of coastal regions or temperate climates may already be more motivated to walk as compared to residents of non-coastal regions or frigid climates"* (Alfonzo, 2005, p. 823).
Topography	*"The topography (e.g. slope, elevation and views) of a place is one of the determinants whether people choose to walk or choose for another mode of transport"* (Pivo and Fisher, 2011, p. 188).
WALKING NEEDS	
Accessibility	*"Accessibility encompasses the pattern, quantity, quality, variety and proximity of activities present, as well as the connectivity between the uses"* (Handy, 1996 cited in Alfonzo, 2005, p. 826).
Connectivity	*"Connectivity of the path network is determined by the presence of sidewalks and other pedestrian paths and by the degree of path continuity and absence of significant barriers"* (Southworth, 2005, p. 249).
Proximity	*"The straight-line distance between different land uses such as residential, office, retail, and commercial activities"* (Saelens, Sallis and Frank, 2003, p. 81).
Safety	*"Several different dimensions are key to places being safe for walking – perceived and actual crime and perceived and actual traffic safety"*(Forsyth, 2015, p. 276).
Visibility	*"Safety also can be increased by providing visible and transparent environment"* (Zakaria and Ujang, 2015, p. 645).
Maintenance	*"Results show that traffic and sidewalk cleanliness and maintenance are the most important factors to rate negatively a street"* (Moura, Cambra and Gonçalves, 2017, p. 294).

Distance to other traffic	*"The presence of a "buffer zone" between pedestrians and moving vehicles greatly enhances pedestrian safety and comfort"* (Jaskiewicz, 2000, p. 6).
Low traffic speed	*"Vehicular speed greatly affects the actual and perceived safety of pedestrians"* (Jaskiewicz, 2000, p. 7).
Low traffic volume	*"The work reported here based on the three methods highlighted the importance to pedestrians of traffic volume and the dominance of traffic"* (Kelly *et al.*, 2011, p. 1507).
Comfort	"*The extent to which walking is accommodated to capabilities and skills of all types of pedestrians with attributes and amenities that ease the walking experience"* (Moura, Cambra and Gonçalves, 2017, p. 291).
Shade and shelter	*"The presence of shade trees improves the comfort level of pedestrians on hot summer days"* (Jaskiewicz, 2000, p. 6).
Coolness	*"Based on the results of the analysis and observations during each site visit, a pattern is evident: low scoring streets lack shading and cooling elements such as trees, shrubs and awnings"* (Hooi and Pojani, 2019, p. 18).
Pleasurability	*"Pleasurability refers to the level of appeal that a setting provides with respect to a person's walking experience". "Pleasurability is also related to how enjoyable and interesting an area is for walking"* (Alfonzo, 2005, p. 829).
Experience	*"Pleasure derived through a sensory experience of the street depends on various stimuli perceived from the environment – from the lights, sounds, smells, touches, colors, shapes, patterns, textures, and so on, of the fixed, semi-fixed, and movable elements that make up the street" (Lang 1987, Bell et al. 1990, Rapoport 1990, Porteous 1996, cited from* Mehta, 2008, p. 222).
Aesthetics	*"Concerned with beauty or the appreciation of beauty"* (HarperCollins Publishers, 2018).
Complexity	*"Complexity refers to the visual richness of a place". "The complexity of a place depends on the variety of the physical environment, specifically the numbers and kinds of buildings, architectural diversity and ornamentation, landscape elements, street furniture, signage, and human activity"* (Ewing *et al.*, 2006, p. 226).
Liveliness	*"In these definitions, when someone says they are improving walkability, or that a place is very walkable, they are referring to a general sense of liveliness, vitality, sociability, or vibrancy"* (Forsyth, 2015, p. 283).
PLANNING & DESIGN	
Presence of path	*"Accessibility factors may include the presence of sidewalks, paths, trails, or features that provide perceived paths on which to walk"* (Alfonzo, 2005, p. 826).
Free of obstacle	*"Sidewalk comfort has also been linked to higher walking rates. In a study of the perceived environmental attributes associated with physical activity, older adults who reported that the sidewalks in their neighborhoods presented fewer obstacles to a safe and comfortable walk were more likely to be more active than were those who reported that the sidewalks presented more obstacles" (Bauman, et al. 1999, cited in* Alfonzo, 2005, p. 829).
Free of physical barriers	*"Accessibility may also involve actual or perceived barriers to walking, including physical barriers such as an impenetrable land use (a gated community through which one cannot pass), natural feature (a ravine), or a psychological barrier to access (such as a particularly wide road)"* (Alfonzo, 2005, p. 826).
Land use diversity	*"The level of integration within a given area of different types of uses for physical space, including residential, office, retail/commercial, and public space"* (Saelens, Sallis & Frank, 2003, p. 81).
Land use density	*"The number of residential dwelling units per unit of land area (e.g., acre)"* (Saelens, Sallis & Frank, 2003, p. 81).
Land use type	*"Bars, liquor stores, pawnshops, or other types of land uses may affect the level of safety felt by some pedestrians"* (Alfonzo, 2005, p. 827).
Street lighting	*"The level of lighting along the street also has considerable implications for pedestrian safety—in terms of both criminal activity and protection from vehicles"* (Jaskiewicz, 2000, p. 9).
Urban form	*"Also, blocked views have been found to increase fear of crime (Kuo et al., 1998), and view distances were associated with residents' sense of safety" (Fischer & Nasar, 1992; Michael& Hull, 1994 cited in* Alfonzo, 2005, p. 828).
Windows	*"The presence of first-floor windows that are visible from the street"* (Alfonzo, 2005, p. 827).
Buffer zone	*"Buffer improves actual safety through the placement of solid objects between moving vehicles and people, reducing the likelihood that a collision involving a pedestrian will occur"* (Jaskiewicz, 2000, p. 6).
Number of lanes	*"In general, two-lane roadways are more pedestrian- friendly than six-lane roadways, though careful attention to design can largely offset this inherent disadvantage of high-volume thoroughfares"* (Jaskiewicz, 2000, p. 8).
Path width	*'It should be at least wide enough for 2–3 people to pass one another or to walk together in groups, and much wider in very urban situations"* (Southworth, 2005, p. 251).
Surface	*"It should be continuous, without gaps, and should have a relatively smooth surface without pits, bumps, or other irregularities that could make walking and wheelchair access difficult or hazardous"* (Southworth, 2005, p. 251).
Street furniture	*"Features that provide amenities throughout a setting (e.g., street benches, drinking fountains, and other street furniture)"* (Alfonzo, 2005, p. 829).
Street trees	*"The presence of shade trees improves the comfort level of pedestrians on hot summer days". "Shade trees are effective at keeping pedestrians cool as well as blocking the sun from their eyes". "Additionally, shade trees add a nice aesthetic element to the street and contribute to definition and buffer* (Jaskiewicz, 2000, p. 6).
Architecture	*"Diversity, complexity, liveliness, architectural coherence and scale, and aesthetic appeal may all affect a person's level of satisfaction with pleasur- ability"* (Alfonzo, 2005, p. 829).
Urban design	*"The street design creates the visual interest of the built environment"* (Zakaria and Ujang, 2015, p. 644).
Outdoor activities	*"Presence of people and activities particularly added to the sensory pleasure on the street"* (Mehta, 2008, p. 238).

VII: FLOW CHART WALKABILITY IN PLANNING POLICY AND PRACTICE

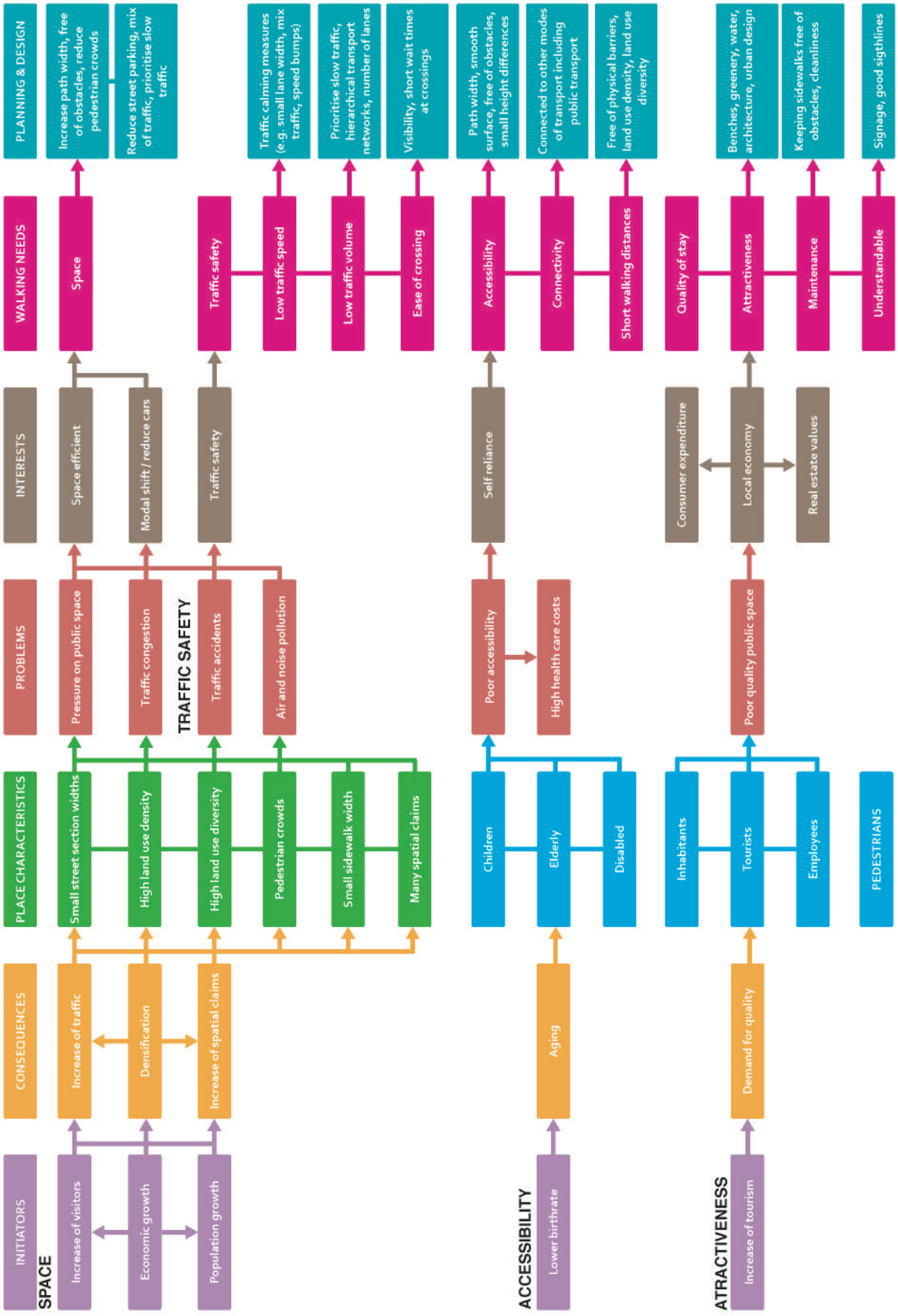

Figure 40: Flow chart Walkability in planning policy and practice.