“Population ageing is a process without parallel in the history of humanity.”
This a quote from the World population ageing report published by the United Nations. Since 1950, the proportion of older persons over 65 has been rising steadily in the world, passing from 8 per cent in 1950 to 11 per cent in 2009, and is expected to reach 22 per cent in 2050.
The social-economic effects such as rising health care and pension expenses have been widely published in the media and issues related to housing, mobility, health- and social care have been the subject of many academic publications. However, the effects of these ageing issues on the built environment of our cities and vice versa, while very pressing, have hardly been covered. Therefore this graduation thesis part of the master Urbanism at Delft University of Technology focuses on the spatial consequences and solutions for greying cities and their inhabitants in the Netherlands and Spijkenisse is particular. In order to find the solutions for the built environment this book combines findings from GPS trackings, interview and physical activity diary data, urban analysis and literature reviews in an unique way. Next to the urbanism department at Delft University of Technology this thesis is supported by Erasmus Medical Centre in Rotterdam, TNO in Utrecht and SVP architectuur en stedenbouw in Amersfoort.
Colophon
Graduation thesis. Greying cities
January 2013

Charlotte I. Cammelbeeck
studentnumber. 1302566
Charlottecammelbeeck@gmail.com

Mentor team
dr. ir. R.M. Rooij Chair of Spatial Planning & Strategy, TU Delft
ir. M.G.A.D. Harteveld Chair of Urban Design, TU Delft

Supported by
A. Etman, MSc. Chair of Public Health, Erasmus MC
ir. J. Galjaard SVP Architectuur en Stedenbouw

Delft University of Technology
Faculty of Architecture
Master Urbanism
Studio Urban Regeneration. Urban Regeneration in the European Context

Keywords
Ageing population, urban redesign, elderly, frailty, active ageing, public space, Spijkenisse

cover image by F. Muller in 2011
Preface

This is the thesis of my graduation project Greying Cities. This graduation project is part of the master Urbanism at the faculty of Architecture at Delft University of Technology and guided by Remon Rooij, member of the chair of Spatial Planning and Strategy and Maurice Harteveld who is a member of the Urban Design chair. Further support is given by members of the Public Health department at the Erasmus MC in Rotterdam, SVP architecture and urbanism in Amersfoort and Frank Pierik and Reinier Sterkenburg at TNO in Utrecht. I would like to thank them for their time, knowledge and support.

Charlotte Cammelbeeck

figure 1.
Sun city, an elderly city in the state of Arizona, U.S.A.
(Google, 2011)
De vergrijzing van de wereldpopulatie is een ongeloofwaardig proces in de geschiedenis van onze samenleving (Zlotnik, 2009). De komende dertig jaar zal percentage van de mensen boven de 65 in de wereld verdubbelen. Ten gevolge van de babyboom en de toename van de levensverwachting zal in ontwikkelde landen zoals Nederland de vergrijzing betekenen dat meer dan een kwart van de bevolking ouder is dan 65 in 2040 (CBS, 2010). De effecten van de vergrijzing op sociaal economisch terreinen zoals de kosten van de gezondheidszorg en de pensioenen zijn aan de orde van de dag in kranten en academische publicaties. Echter de gevolgen van de vergrijzing voor de bebouwde omgeving van de steden is op vele vlakken onderbelicht gebleven. Daarom gaat deze afstudeerthesis over de ruimtelijke gevolgen van de vergrijzing voor de bebouwde omgeving in Nederland. Ouderen worden vaak gedefinieerd als alle mensen boven de 65. Echter wordt er dan geen recht gedaan aan de diversiteit binnen deze populatiegroep. Deze thesis richt zich dan ook op een specifieke groep ouderen waar de bebouwde omgeving veel voor kan betekenen, de kwetsbare ouderen. Kwetsbaarheid kent vele definities en op basis van verschillende onderzoeken heeft het Sociaal Cultureel Planbureau de volgende definitie opgesteld die ook in deze thesis is gehanteerd: ‘Kwetsbaarheid bij ouderen is een proces van het opeenstapelen van lichamelijke, psychische en/of sociale tekorten in het functioneren dat de kans vergroen op negatieve gezondheidsuitkomsten (functiebeperkingen, opname, overlijden)’ (Campen, 2011, p45).

Om aan de wens van ouderen te voldoen om zo lang mogelijk zelfstandig te blijven wonen in hun eigen omgeving is het van belang om de negatieve gezondheidsuitkomsten te verminderen of zelfs te verhogen. De combinatie van de verschillende analyses hebben te voorkomen of te beperken dat de kans vergroot op negatieve gezondheidsuitkomsten ten gevolge van kwetsbaarheid te voorkomen of te beperken (Lijzinga, Depenbrock en Hendriks, 2009; Iersel en Liedelmeijer, 2010). Omdat kwetsbaarheid een dynamisch proces is welke kan worden verminderd of zelfs teruggebracht is het zeer geschikt voor interventies om zo de zelfstandigheid van ouderen te verbeteren (Etxman et al., 2012; Gobbens et al., 2010b). Om kwetsbaarheid een dynamisch proces is welke kan worden verminderd of zelfs teruggebracht is het zeer geschikt voor interventies om zo de zelfstandigheid van ouderen te verbeteren (Etxman et al., 2012; Gobbens et al., 2010b).

De hoofdvrage van dit afstudeerproject is dan ook: Welke type ruimtelijke interventies in de openbare ruimte van de bestaande Nederlandse buurten zijn noodzakelijk om de zelfstandigheid van kwetsbare ouderen te bevorderen? De vraag is beantwoord met behulp van verschillende onderzoeksmethodes. Als eerste is er literatuuronderzoek gedaan naar welke ontwerpinvententies in de openbare ruimten in buurten van kwetsbare ouderen zouden moeten worden toegepast om actief ouder worden de bevorderen (Michael, Green en Farquhar, 2009). Een totaal van 40 ontwerprincipes is naar voren gekomen die volgens de literatuur belangrijk zijn voor het ontwerp van oudervriendelijke openbare ruimtes. De ontwerprincipes kunnen in zes essentiële thema’s worden onderverdeeld: herkenbaarheid, leesbaarheid, comfort, verscheidenheid, toegankelijkheid en veiligheid.

In een volgend deel van het onderzoek zijn de ontwerprincipes op hun beurt ruimtelijk vertaald en gebundeld in een ontwerprincipecatalogus. De ontwerprincipecatalogus assisteert stedenbouwkundige ontpwellers en andere actoren bij het ontwerpen van oudervriendelijke openbare ruimtes die actief ouder worden moeten bevorderen. Echter toonde het literatuuronderzoek aan dat veel van de ontwerprincipes nog niet zijn vertaald naar de context van een stedenbouwkundig ontwerp. Een volgende stap in het onderzoek is dan ook geweest om de ontwerprincipes toe te passen in een ontwerp voor representatieve openbare ruimtes in de buurten van een Nederlandse stad. De casus voor dit onderzoek is de groeiwijken Spijkenisse. Om de ontwerprincipes op een effectieve manier toe te passen is het van belang te bepalen welke obstakels in de openbare ruimte oudere bewoners van Spijkenisse zelf ervaren wanneer ze hun doelen buitenshuis proberen te bereiken. Het bepalen van de obstakels is gedaan aan de hand van een stedenbouwkundige analyse in combinatie met data uit GPS tracks, interviews en beweegdagboeken in totaal 437 oudere inwoners van Spijkenisse, verzameld door het Erasmus Medisch Centrum en TNO. De combinatie van de verschillende analyses hebben geleid tot een SWOT analyse die als basis heeft gediend voor de ontwerppogave voor drie wijken in Spijkenisse, te weten het centrum, Sterrenkwartier en De Akkers. De ontwerppogave voor de drie wijken houdt in:

- Het verbeteren van de bereikbaarheid voor het langzame verkeer.
- De wijkencentra met elkaar verbinden, gebruikmaken van de centrale gelegen voorzieningen in de wijken.
- De wijkencentra verbinden aan de stedenbouwkundige structuur van de wijk.
- Het verbeteren van het netwerk van wegen en openbare ruimtes door ze te verbinder aan de bestaande hoofdassen van de wijken.
- De sociale veiligheid verbeteren door het vervangen en verwijderen van moeilijk te onderhouden groen en het samenbrengen van verschillende typen weggebruikers.

De ontwerppogave vormt de basis voor het ontwerp van een verbindende route tussen drie wijken in Spijkenisse.
Voor het ontwerp van de route zijn op verschillende representatieve ontwerplocaties de ontwerpprincipes uit de ontwerpprincipecatalogus toegepast. Door het ontwerp ontstaat er een veilige, leesbare en comfortabele route langs verschillende types van openbare ruimtes en gebouwen, zowel in ontwerp als gebruik.

Uit het onderzoek is duidelijk geworden dat met relatief kleine ruimtelijke ingrepen in de openbare ruimte kwetsbare ouderen kunnen worden gemotiveerd om actief ouder te worden en zo langer zelfstandig in hun wijk te blijven wonen. Hierbij zijn een aantal ontwerpprincipes zoals een wandelbare afstand tot voorzieningen en de daaraan ondersteunende principes essentieel. En naast het implementeren van de opgestelde ontwerpprincipes is voor het creëren van oudervriendelijke openbare ruimtes onontbeerlijk dat verschillende actoren zoals gemeenten, ouderen organisaties en stedenbouwkundige samenwerken.
# Contents

**PREFACE**

**DUTCH SUMMARY**

## PART I. INTRODUCTION

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Preface</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Dutch summary</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
<td>Part I. Introduction</td>
<td>11</td>
</tr>
</tbody>
</table>

### CHAPTER 1. MOTIVATION: AGEING POPULATION

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>2.1 Introduction</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>2.2 Frailty</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>2.2.1 Physical frailty</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>2.2.2 Psychological frailty</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>2.2.3 Social frailty</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>2.3 Wish to be and stay independent</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>2.4 Inactive elderly and out-of-home mobility</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>2.5 The importance of neighbourhood design and the public space</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>2.6 Problem statement</td>
<td>19</td>
</tr>
</tbody>
</table>

### CHAPTER 2. PROBLEM FIELD WHEN DESIGNING ELDERLY FRIENDLY CITIES

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>2.1 Introduction</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>2.2 Frailty</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>2.2.1 Physical frailty</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>2.2.2 Psychological frailty</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>2.2.3 Social frailty</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>2.3 Wish to be and stay independent</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>2.4 Inactive elderly and out-of-home mobility</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>2.5 The importance of neighbourhood design and the public space</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>2.6 Problem statement</td>
<td>19</td>
</tr>
</tbody>
</table>

## PART II. THEORETICAL FRAMEWORK: URBAN DESIGN ENCOURAGING ACTIVE AGEING

### CHAPTER 3. PROJECT LOCATION: SPIJKENISSE

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motivation: greying Spijkenisse</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>3.1 Motivation: greying Spijkenisse</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>3.2 The reconstruction period</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>3.3 The New Town period: 1972-1985</td>
<td>27</td>
</tr>
<tr>
<td>5</td>
<td>3.3.1 Down scaling</td>
<td>27</td>
</tr>
<tr>
<td>6</td>
<td>3.3.2 Garden city</td>
<td>27</td>
</tr>
<tr>
<td>7</td>
<td>3.3.3 Democratisation of the planning process</td>
<td>29</td>
</tr>
<tr>
<td>8</td>
<td>3.3.4 Metroline</td>
<td>29</td>
</tr>
<tr>
<td>9</td>
<td>3.3.5 The economic crisis</td>
<td>29</td>
</tr>
<tr>
<td>10</td>
<td>3.4 Design task for a Dutch New Town: 1985-now</td>
<td>31</td>
</tr>
<tr>
<td>11</td>
<td>3.4.1 Insufficient amount of facilities</td>
<td>31</td>
</tr>
<tr>
<td>12</td>
<td>3.4.2 Suburban public space</td>
<td>31</td>
</tr>
<tr>
<td>13</td>
<td>3.4.3 Growing distance to facilities</td>
<td>31</td>
</tr>
<tr>
<td>14</td>
<td>3.4.4 High maintenance green city</td>
<td>31</td>
</tr>
<tr>
<td>15</td>
<td>3.4.5 Greying Spijkenisse</td>
<td>31</td>
</tr>
</tbody>
</table>

### CHAPTER 4 PROJECT AIM

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter 4 Project aim</td>
<td>35</td>
</tr>
</tbody>
</table>

### CHAPTER 5 PROJECT APPROACH

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>37</td>
</tr>
<tr>
<td>2</td>
<td>5.1 Introduction</td>
<td>37</td>
</tr>
<tr>
<td>3</td>
<td>5.1.1 Research questions</td>
<td>37</td>
</tr>
<tr>
<td>4</td>
<td>5.1.2 Project methodology scheme</td>
<td>37</td>
</tr>
<tr>
<td>5</td>
<td>5.2 Theoretical framework: urban design encouraging active ageing</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>Analysis of Spijkenisse</td>
<td>39</td>
</tr>
<tr>
<td>7</td>
<td>Design catalogue</td>
<td>41</td>
</tr>
<tr>
<td>8</td>
<td>Urban design: Spijkenisse’s route to active ageing</td>
<td>45</td>
</tr>
</tbody>
</table>

### CHAPTER 6. RELEVANCE

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scientific</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>Societal</td>
<td>48</td>
</tr>
</tbody>
</table>

### CHAPTER 7. INTRODUCTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter 7 Introduction</td>
<td>50</td>
</tr>
</tbody>
</table>

### CHAPTER 8. FRAIL ELDERLY

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter 8 Frail elderly</td>
<td>53</td>
</tr>
</tbody>
</table>

### CHAPTER 9. OUT-OF-HOME MOBILITY GOALS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter 9 Out-of-home mobility goals</td>
<td>54</td>
</tr>
</tbody>
</table>

### CHAPTER 10. THE INFLUENCE OF NEIGHBOURHOOD DESIGN ON OUTDOOR ACTIVITIES

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter 10 The influence of neighbourhood design on outdoor activities</td>
<td>55</td>
</tr>
</tbody>
</table>

### CHAPTER 11. DESIGN INTERVENTIONS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11.1 Familiarity</td>
<td>56</td>
</tr>
<tr>
<td>2</td>
<td>11.2 Legibility</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>11.3 Distinctiveness</td>
<td>57</td>
</tr>
<tr>
<td>4</td>
<td>11.4 Accessibility</td>
<td>59</td>
</tr>
<tr>
<td>5</td>
<td>11.5 Comfort</td>
<td>59</td>
</tr>
<tr>
<td>6</td>
<td>11.6 Safety</td>
<td>61</td>
</tr>
</tbody>
</table>

### CHAPTER 12. CONCLUSIONS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter 12 Conclusions</td>
<td>63</td>
</tr>
</tbody>
</table>

### CHAPTER 13. IMPLICATIONS FOR THE DESIGN OF ELDERLY FRIENDLY PUBLIC SPACES

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter 13 Implications for the design of elderly friendly public spaces</td>
<td>64</td>
</tr>
</tbody>
</table>

### CHAPTER 14. DESIGN CATALOGUE

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter 14 Design catalogue</td>
<td>65</td>
</tr>
</tbody>
</table>
PART I.
INTRODUCTION

figure 2.
Elderly who were interviewed by the The Netherlands Institute for Social Research for a research about frailty and elderly (Campen, 2011)
part I. introduction

The amount of elderly over 65 years of age is growing harder in the Netherlands (CBS, 2010) than in the world (United Nations, 2010).

figure 3.

The amount of elderly over 65 years of age is growing harder in the Netherlands (CBS, 2010) than in the world (United Nations, 2010).
1. Motivation: ageing population

“Population ageing is a process without parallel in the history of humanity.” (Zlotnik, 2009) This a quote from the World population ageing report published by the United Nations. Since 1950, the proportion of older persons over 65 has been rising steadily in the world, passing from 8 per cent in 1950 to 11 per cent in 2009, and is expected to reach 22 per cent in 2050 (Zlotnik, 2009). However, in the more developed regions the population ageing is far more advanced. One of these greying counties is the Netherlands. Here the elderly population over 65 will increase from 15 percent in 2012 to almost 26 percent in 2040 (see figure 3). This is the result of the baby boom after the Second World War and the rising life expectancy (Jong and Duin, 2009).

The social-economic effects such as rising health care and pension expenses have been widely published in the media and issues related to housing, mobility, health- and social care have been the subject of many academic publications. However, the effects of these ageing issues on the built environment of our cities and vice versa, while very pressing, have hardly been covered. Therefore this graduation project will focuses on the spatial consequences and solutions for greying cities and their inhabitants in the Netherlands.
Part of the population in the Netherlands who are 65 years or older in 2009 (Campen, 2011)

LEGEND
Percentage per municipality (%)
- 15 or less
- 15 - 20
- 20 - 25
- 25 - 30
- more than 30

Part of the population in the Netherlands who are 65 years or older in 2040 (Campen, 2011)

LEGEND
Percentage per municipality (%)
- 15 or more
- 15 - 20
- 20 - 25
- 25 - 30
- Less than 30
2. Problem field when designing elderly friendly cities

2.1 Introduction
The amount of elderly inhabitants in the Netherlands will almost double during the next thirty years (Campen, 2011). This will present many academics and practitioners from fields such as urban planning and design with a population group that must be taken into account. But, who are these elderly? Institutions such as Statistics Netherlands (CBS) simply define elderly as the population of 65 years of age or older. This is directly related to the retirement age in the Netherlands (Garssen, 2011). However, this is a generalizing definition that doesn’t do justice to the diversity within the growing group of elderly. That is why this chapter is dedicated to a more extensive research into elderly people in the Netherlands and the obstacles they are confronted with in their daily lives.

2.2 Frailty
What affects the quality of the daily life of elderly the most is their health (Mollenkopf et al., 2004a). The reason why their health is so important for elderly is that, if it deteriorates, it often forms the starting point of a downward spiral. This process starts with health limitations resulting in a lower out-of-home mobility, a crucial prerequisite for autonomy and well being (Mollenkopf et al., 2004a). The lower out-of-home mobility in turn results in a smaller social network causing psychological problems such as loneliness, functional disabilities, admission to an institution and eventually even death (Mollenkopf et al., 2004b)(Campen, 2011). This process has been described in literature as frailty;

‘Frailty in older persons is a process of an accumulation of physical, psychological and/or social deficits in functioning which increase the chance of adverse health outcomes (functional disabilities, admission to an institution, death)’ (Campen, 2011, p. 47).

In order to get a grip on this process the physical, psychological and social deficits that frail elderly face, the definition be will be further developed and deepened in the next three paragraphs.

2.2.1. Physical frailty
Key characteristics of physical frailty are undernourishment, reduced energy levels, reduced strength and slowness. Furthermore, it gives rise to a vicious circle in which undernourishment can lead to disruption of hormonal processes, then to weakening of muscle tissue, reduced strength and reduced mobility, and ultimately to reduced physical activity. Which in turn can further disrupt the hormonal processes (Fried et al., 2001)(Campen, 2011).

Physical frailty comprises a total of eight separate characteristics:

- little or no walking;
- unintentional weight loss;
- difficulty walking;
- difficulty maintaining balance;
- poor hearing;
- poor vision;
- lack of grip strength;
- and physical tiredness.

Individual characteristics which occur relatively commonly are poor balance and physical exhaustion.

The Netherlands Institute for Social Research (SCP) carried out a study on frail older persons in the Netherlands. Their results suggest that avoiding physical frailty is not an unattainable ideal for older persons. The characteristics that are strongly related to mobility offer pointers for a policy aimed at preventing physical frailty or reducing its consequences. Examples are adaptations in the home and facilities in the neighbourhood to increase accessibility for people with impaired mobility (Campen, 2011). However, this is not the only domain of frailty.
part I. introduction

Figure 6. Physical limitations per age group in the Netherlands in 2010, in percentages (Garssen, 2011)

Figure 7. Percentage of people in the Netherlands over 75 years of age in care- and nursing homes 1995-2007 (Iersel and Leidelmeijer, 2010)
affecting the daily lives of elderly in a negative way.

2.2.2 Psychological frailty

Studies on frailty suggest that the psychological domain plays an important role in the concept of frailty (Puts et al., 2005; Levers et al., 2006; Gobbens et al., 2010). Several studies have shown that ageing is often accompanied by an increase in psychological complaints and cognitive disabilities which in turn affects the health of elderly (Campen, 2011). Research done by the SCP establishes four items regarding psychological frailty:

- Problems with memory; virtually all older persons are also confronted with a decline in their cognitive abilities. Their memory becomes less reliable, their speed of thought reduces and their ability to do several things at the same time diminishes.
- Feeling down; many older persons have symptoms of depression and anxiety which greatly impede their daily functioning (Beekman et al., 1997, 1998). In addition, many older persons are lonely (Van Tilburg et al., 2004)
- Feelings of anxiety; see previous bullet point.
- Feeling of helplessness; a feeling that they are losing control of their lives (Jonker et al., 2009).

The psychological factors are important in order to improve the quality of life of frail older persons and prevent or delay adverse health outcomes. After all, while some diseases may not be preventable or curable, a number of psychological characteristics such as depression, anxiety or loneliness can be influenced.

2.2.3 Social frailty

Social frailty refers to deficits in social relationships: the lack of a partner or trusted confidant, lack of support, low participation in social networks such as family, neighbourhood and organisations, potentially resulting in a degree of experienced loneliness. In other words, someone is socially frail if they have too few people they can turn to in difficult times or if they receive too little support from those surrounding them. We know from the literature that there is a relationship between social factors and health (George, 1996). This relationship manifests itself in two ways. First, social integration (marriage, family relationships, friendships, church and civic communities, volunteering) is good for the health of the individuals concerned (Berkman et al., 2000). These social relationships make people feel safe and secure in a familiar setting and assured that they will receive support in times of need. Secondly, social integration prevents health problems, leads to more rapid recovery where health problems do occur, and extends life (George, 1996; Penninx et al., 1999; Berkman et al., 2000). The more social relationships someone has, the fewer health problems they will suffer.

2.3 Wish to be and stay independent

It is sometimes thought the solution for the physical, psychological and social ageing problems only lies in new types of housing and residential care homes where social networks and health care are provided. However, the needs of elderly are changing and many people want to stay autonomous and live independently (see figure 7). This trend of longing to remain independent in their own neighbourhood is of importance for the design of residential neighbourhoods. Elderly remain living independently for a longer period of time. Only if there is no other alternative due to health reasons, a share of the people choose to live in care or nursing homes. And even then, while the majority of the people demanding health care do want these facilities in their immediate surroundings, they still want to provide independently in their basic everyday needs for as long as possible. Preferably in their own neighbourhoods, which becomes increasingly important to them as it helps to maintain a level of autonomy, privacy and stability at a time when they are likely to be coping with difficult changes in their lives (Iersel and Leidelmeijer, 2010; Burton and Mitchell, 2006).

Furthermore, with a quarter of the population over 65 years of age in 2040 (Garssen, 2011), building care and
nursing homes for all these people would present us with an impossible building task. Therefore it is essential to find the solution within the context of the current built environment.

2.4 Inactive elderly and out-of-home mobility
Obviously, frailty and its consequences is something that should be reduced, or prevented from worsening. As said before in paragraph 2.2, deteriorating health is often the starting point of the frailty process. And therefore it comes as no surprise that empirical research has shown that this process of frailty can be postponed by healthy and active ageing (Ruuskanen and Ruoppila, 1995). Active ageing describes the desire and ability of elderly to be and stay physically active. Additionally, active ageing includes social participation and engagement in daily economic activities, such as going to the supermarket (Michael, Green and Farquhar, 2006). However, large portions of the elderly population are not sufficiently active. For example, in the Netherlands from 2001 to 2006 an estimated average of 48 per cent of women and 34 per cent of men aged 65 years or over did not engage in sufficient regular physical exercise as recommended by Dutch guidelines (Statistics Netherlands, 2007). Hereby putting themselves at risk of going further downwards in the spiral of frailty which can lead to admission into an institution or even death (Campen, 2011; Borst et al., 2008). Furthermore, inactivity results in a lower out-of-home mobility. This effects the lives of elderly in a negative way as out-of-home mobility is essential for elderly to maintain their independent living (Mollenkopf et al., 2004). Therefore, to prevent frailty from worsening and to enable elderly to live independently it is of the up most importance to encourage elderly to become and stay active.

2.5 The importance of neighbourhood design and the public space
For elderly the main mode of transportation is walking (Borst et al., 2009; Rooij and Tacken, 1998). As a result, elderly are often limited to their nearby surroundings for their daily activities. Additionally, frail elderly are confronted with multiple deficits in functioning such as declines strength, endurance, balance, walking performance, and low activity. As a consequence, the neighbourhood environment becomes increasingly significant for frail elderly (Mahmood et al., 2012). Research done by van Lenthe, Burg and Mackenbach in 2005 shows that the built environment, in particular neighbourhood design, influences the amount of physical activity undertaken by inhabitants of urban neighbourhoods. And while the activities which are part of active ageing predominantly take place in the public space, very little work has been done to understand the elements of neighbourhood context and urban form that allow successful active ageing (Cannuscio et al., 2003, Jong and Duin, 2009). Furthermore, research has been done one pedestrian friendly design, this has not been focused on a specific population group such as elderly (van Bellen, 2012; Gehl, 2011).

Consideration of the built environment is particularly pertinent for older people: as they age, they are likely to spend more time in their home and community environments, and declining health and functional status can make them more susceptible to barriers in them (see figure 8) (Burton, Mitchell and Stribe, 2011). The fact that the built environment can be the one of the reasons that elderly are inactive has been further underlined by the research done by Greenberg in 1982. Greenberg (1982) found that older car users make around 25 percent more journeys than older people without access to a car. This suggests that older people who do not drive do not stay at home through choice but because of the problems they encounter as pedestrians in the outdoor environment.

The design of the neighbourhood is not only of importance for the physical health of elderly, but also plays an important role in the preventing and reducing of the social aspects of frailty. In the public space the elderly get the chance to meet others and although
the contact in the public space is of a low intensity and mainly passive, it makes people feel like they are not alone (Gehl, 2011).

2.6 Problem statement

The amount of people over 65 years of age will double during the next thirty years (Campen, 2011). And sadly a large amount of these elderly are confronted with many impairments which directly affects their quality of life (see figure 5) (Mollenkopf et al., 2004b). The reason that it effects their quality of life is that health limitations in elderly often result in physical, psychological and/or social deficits. This process is known in literature as frailty. Elderly who are frail are at risk of adverse health outcomes such as functional disabilities, admission to an institution, and even death (Campen, 2011).

Frailty is characterised by several social, physical and social deficits such as reduces strength, slowness, poor vision, feeling down, problem with memory and low participation in social networks such as neighbourhoods (Campen, 2011)

In Western countries such as the Netherlands the solution for physical, social and psychological ageing related problems is thought to lie in new types of housing and residential care homes. However, as is shown in figure 6, this will not meet the needs of elderly and is simply unfeasible for this rapidly growing population.

Empirical research has shown that this process of frailty can be postponed by healthy and active ageing (Ruuskanen and Ruoppila, 1995). However, large portions of the elderly population in the Netherlands is not sufficiently active. Hereby putting themselves at risk of going further in the downward spiral of frailty which can lead to admission into an institution or even death (Campen, 2011; Borst et al., 2008).

A solution to this problem can be found in the built environment and neighbourhood design. Research done by van Lenthe, Burg and Mackenbach in 2005 shows that the built environment, in particular neighbourhood design, influences the amount of physical activity undertaken by inhabitants of urban neighbourhoods. Consideration of the built environment is particularly pertinent for older people: as they age, they are likely to spend more time in their home and community environments, and declining health and functional status can make them more susceptible to barriers in them (Burton, Mitchell and Stribe, 2011). For example, barriers such as narrow sidewalks, great changes in height, uneven pavement and great distances to shops might be surmountable for healthy and active people. However they can be the reason for frail elderly to stay at home and become of remain inactive putting them at risk of adverse health outcomes (Burton and Mitchell, 2006).

Hence, attention needs to be paid to the needs of frail elderly in the field of urban design. However, frail elderly have hardly been the focus of studies into urban design (Cannuscio, Block and Kawachi, 2003; Jong and Duin, 2009). Furthermore, while research has been done on the effects of the physical environment of frail elderly in field such as environmental gerontology, these have not been successfully translated into the current research and application related to neighbourhood design (Michael, Green and Farquhar, 2006).
Badly designed or maintained streets can be a problem for anyone but especially for older people (Burton and Mitchell, 2006).
part I. introduction

Maasvlakte

Den Haag

Europoort

before 1920

1921-1945

1946-1965

1966-1975

1976-1985

1986-1995

1996-2005

after 2006

trees

grass

water

main neighbourhood road

city road

regional road

fig. 9. Map of Spijkenisse showing the building periods and the connections to surrounding cities and villages scale 1:10,000 (by the author)
3. Project location: Spijkenisse

3.1 Motivation: greying Spijkenisse

The focus on elderly in the design of our neighbourhoods and cities and making it possible for them to live in their current neighbourhood is not completely new. The idea of age-friendly communities was developed by the World Health Organisation through their Global Age Friendly Cities Project launched in 33 cities in 2005. There are alternative names for such communities: for example, they tend to be called ‘liveable communities’ in the US and ‘lifetime neighbourhoods’ in the UK. In the Netherlands these type of age-friendly communities are called ‘generation proof neighbourhoods’. When going deeper into the case of the Netherlands it is evident that in recent years the Dutch government has focussed its policy more and more on the growing amount of elderly in its society. Part of this new focus is the action plan ‘More at home in the neighbourhood’, in which the former Ministry of Housing, Spatial Planning and the Environment (VROM) establishes the following goal: ‘making it possible for elderly and people with impairments to remain independent in their neighbourhood, receive support and health care at home and thereby making it possible to participate in society. Elderly and people with impairments should be free to choose how they want to live and how they, if necessary, receive health care.’ (Ministry of Housing, Spatial Planning and the Environment, 2007, p. 4). The goal to built and transform neighbourhoods to become generation proof is part of the ‘More at home in the neighbourhood’ policy. However, the policy doesn’t give any indication on how this goal could spatially be achieved.

Nevertheless, Spijkenisse was one of the first Dutch municipalities that expressed the wish to adopt the policy in their city. This wish is one of the reasons why Spijkenisse has become the project location of this graduation project. In order to be able to assess the possibilities of Spijkenisse becoming a generation proof and elderly friendly city, an urban analysis of Spijkenisse it is essential. This chapter starts with a look into the beliefs and concepts at the origin of the city, divided into four periods;

1. The preliminary phase: The reconstruction period
3. Life after the ‘Groeikern’: 1985 - now

The urban analysis will conclude with a general Dutch New Town related design task in part 3.4 and will be further deepened on elderly related themes in part III of this book.

3.2 The reconstruction period

Spijkenisse is a mid-sized city of around 80,000 inhabitants in the province of Zuid-Holland right under Rotterdam (Rossum, 2005). This young city has undergone two major periods of growth.

The first was in the 1950s and 1960s during the reconstruction period after the Second World War. The expected growth of the population, the increase of wealth and the rise of the new middle class after the Second World War led to a discussion on the urban development of the Netherlands. The government expected an enormous increase in the housing demand and therefore plans were made for the expansion of villages such as Purmerend, Vreeswijk and Spijkenisse (see figure 10) (Reijndorp, Bijlsma and Nio, 2012).

On top of the expected population increase all over the Netherlands Spijkenisse together with Hoogvliet prepared for the expansion of the Rotterdam harbour, even though many people questioned if the expected growth was realistic. With the ambitious ‘Development program 1958’ Spijkenisse, together with Hoogvliet, started building homes for the dockworkers. Forty percent of the homes were built in Spijkenisse. Planning and building processes of that time were strongly rationalised. Up until 1972 the rationalisation and modernisation was expressed by the built of high rise surrounded by long straight stacked low rise buildings. Halfway the 1960s
part I. introduction

figure 10. picture from the sky of Spijkenisse in 1958 (Spijkenisse Online, n.d.)

figure 11. picture from the sky of Spijkenisse in 1982 (Wellenberg, 2010)

figure 11. picture from the Marrewijkflat (by the author)
part I. introduction

figure 12
The garden city scheme by Ebenezer Howard (Provoost and Rottenberg, 2007)

figure 13
The neighbourhood principle scheme by Clarence Perry (American society of planning officials, 1960)
part I. introduction

**Figure 14**
The neighbourhood principle based on the scheme used in the 1950s (based on Provoost and Rottenberg, 2007, p. 50)

**Legend**
- Industry
- Centre of the city, district or neighbourhood

**Figure 15**
Scheme showing the garden city and neighbourhood principle as the structure of Spijkenisse (by the author)
Spijkenisse planned for high rise flats and as a result right next to the planned shopping malls the Marrewijkflat was built (see figure 11). However, before the high rise wave takes over Spijkenisse the Spatial planning councillor threw the plans in the bin and switched to family housing with a garden. An move which is regarded as the start of a new period in the history of Spijkenisse.

3.3 The New Town period: 1972-1985

In 1966 Spijkenisse was assigned to the role of ‘Groeikern’ or New Town by the Dutch government. The urban growth policy or ‘Groeikernenbeleid’ was part of the Second Spatial planning document or ‘Tweede Nota ruimtelijke ordening’. Spijkenissess’ task was to build housing to accommodate 50,000 people in an undefined period of time. The policy was a response to a growing fear of unrestrained growth of the urban areas in the Netherlands, especially in the Randstad. In order to prevent the urbanization of the country side, concentrated deconcentration or ‘gebundelde deconcentratie’ became the concept behind the urban growth areas in the Netherlands such as Spijkenisse (Hajer, 2012). In other words, sub urbanization should be concentrated in some smaller towns within the reach of a larger city, thereby hoping to prevent urban sprawl. The concentrated deconcentration led to tension between urbanity and sub urbanity in the neighbourhoods built during the new town period (Reijndorp, Bijlsma and Nio, 2012). The sober (sub)urban character typical for Dutch New Towns can be traced back to five major influences on planning at that time; the garden city, the democratisation of the building process, downscaling, the economic crisis and the built of the metroline.

3.3.1 Down scaling

From 1972 onwards a radical down scaling took place in the approach to planning. Both morphologically as well as functionally. Instead of the region, the neighbourhood became the focus point. At this time people like Christopher Alexander, Kevin Lynch and Jane Jacobs became of great influence. The planners and urban designers of that time tried to achieve a small scale urbanity in the new neighbourhoods by experimenting with urban neighbourhood centres and quiet cul-de-sacs (Reijndorp, Bijlsma and Nio, 2012). The most important characteristics of these neighbourhoods are: integration of facilities, walkable distances, high density, car-free streets and low building blocks.

3.3.2 Garden city

The suburban character of Spijkenisse can be traced back to the roots of the Urban Growth Policy which can be found in the Garden city movement of Ebenezer Howard (Reijndorp, Bijlsma and Nio, 2012). At the end of the 19th century Howard proposed a radical alternative for the endless industrial and suburban sprawl of the Victorian cities in the United Kingdom. He wanted to combine the advantages of the village (peace and quiet) with the cultural and social-economic advantages of the city which resulted in the garden city scheme. The garden city scheme as shown in figure 12 consisted of smaller units of several hundreds of houses each with their own facilities which, in turn, were part of a neighbourhood. The neighbourhoods consisted of several thousands of houses with their own possibilities for employment. Multiple neighbourhoods formed a garden city of no more than 30,000 inhabitants. Finally a garden city was part of a scheme of multiple cities housing around 250,000 people, all located in a green landscape providing peace and quiet (Provoost and Rottenberg, 2007).

Several additions on the Garden City scheme have been made which were of great influence. One of the most important additions has been made by the American Clarence Perry in the 1920s. Perry elaborated on Howards’ social and spatial principles by coming up with the neighbourhood principle, in which several hundreds of houses were centred around a social centre, with a school as the most important element (see figure 13 and 14)(Provoost and Rottenberg, 2007).
Part I. Introduction

Flyer made to recruit people to come live in Spijkenisse and design their living environment (Reijndorp, Bijlsma and Nio, 2012)

Picture of the public participation meeting about the master plan for Spijkenisse in 1973 (Reijndorp, Bijlsma and Nio, 2012)

Time schedule for the participation meetings on the several sub-plans (Reijndorp, Bijlsma and Nio, 2012)
The six basic principles of the neighbourhood principle were:

1. “Major arterials and traffic routes should not pass through residential neighbourhoods. Instead, these streets should provide the boundaries of the neighbourhood.” (American society of planning officials, 1960, p.2)

2. “Interior street patterns should be designed and constructed through use of cul-de-sacs, curved layout and light duty surfacing so as to encourage a quiet, safe, low volume traffic movement and preservation of the residential atmosphere.” (American society of planning officials, 1960, p. 2)

3. “The population of the neighbourhood should be that which is necessary to support its elementary school. (When Perry formulated his theory, this population was estimated at about 5,000 persons; current elementary school size standards probably would lower the figure to 3,000–4,000 persons.)” (American society of planning officials, 1960, p. 2)

4. “The neighbourhoods focal point should be the elementary school centrally located on a common or green, along with other institutions that have service areas coincident with the neighbourhood boundaries.” (American society of planning officials, 1960, p. 2)

5. “The radius of the neighbourhood should be a maximum of one quarter mile, thus precluding a walk of more than that distance for any elementary school child.” (American society of planning officials, 1960, p. 3)

6. “Shopping districts should be sited at the edge of the neighbourhood, preferably at major street intersections.” (American society of planning officials, 1960, p. 3)

The garden city scheme and the neighbourhood principle had a large following and have been used as the basis for the built of new cities worldwide. Therefore many New Towns such as Spijkenisse have the same layout, as shown in figure 15:

- A hierarchical system of roads.
- Between those roads ten till twelve neighbourhoods with each 5000 inhabitants and a facility centre.
- A city centre located on the spot of the former village.
- A total of around 60,000 habitants,
- and surrounded by green.

3.3.3 Democratisation of the planning process

Freedom of choice, emancipation and self-fulfillment were important visions and ideals of the 1960s and 70s, The ideals were reflected in the building process of Spijkenisse by the participation of residents which resulted in the end of the monopoly of professionals in the building of cities (see figures 16,17 and 18). The growing significance of future inhabitants and their desire for family housing led to a break with the prior period of high rise and blue print planning. To make it possible for inhabitants to have a say in the design of their homes and neighbourhoods, a new plan type was introduced: the zoning plan. Making it possible to make decisions on the scale of about 300 homes. Furthermore, the approach of planning at the time was from small to big, first the built of the neighbourhoods and their centres and eventually the city centre as the breech of the New Town. As a result Spijkenisse built 7,000 homes designed as a sum of several small sub-plans between 1978 and 1983 (see figure 18).

3.3.4 The metro line

When, in 1976, Spijkenisse was assigned to become a New Town the city accepted the task on the condition that it would be connected to the metro line of Rotterdam. The national government agrees, provided that the municipality would built 14,300 in twelve years time around the three new stations. The additional task put pressure on the plans and the municipality felt forced to built with a higher density than envisioned. Together with the fact that it was designed as a big concrete over ground construction the metro line has put a big stamp on the urban fabric (Reijndorp, Bijlsma and Nio, 2012).
part I. introduction

Figure 19. Demographic pyramid showing the high amount of future elderly in Spijkenisse on January 1st 2008 (GGD Rotterdam-Rijnmond, 2010)

Figure 20. Percentage of inhabitants of Spijkenisse who are 65 years or older of age per neighbourhood (Statistics Netherlands, 2009)
3.3.5 The economic crisis
The oil crisis of 1979 influenced the urban development of Spijkenisse greatly. Homes built for the sale market became unmarketable and therefore were turned into homes to let made possible by subsidies from the government. However, the crisis led to a limit of the money available for subsidies which consequently led to cuts on the building budget of the municipality of Spijkenisse. As a result, the neighbourhoods had a higher density and homes became a product of mass production. Characteristics of the architecture and urban planning of that time were a lack of variation in floor plans and sections and uniformity in facade design.

3.4 Design task for a Dutch New Town: 1985 - now
Around 1985 the ‘Groeikern’ task came to an end and life as a ‘regular’ mid sized city began. However, for many began a time of reflection on the past decades. Although opinions differed some general urban (design) tasks can be identified for Spijkenisse comparable to other Dutch New Towns:

3.4.1 Insufficient amount of facilities
Different from other governments such as the British and the French, the Dutch government had no clear vision for the New Towns such as Spijkenisse. While in the Ville Nouvelle in France and New Towns in the United Kingdom ideological terms such as a balanced population, ‘self-containment’ and urbanity took centre stage, these terms were never part of the Dutch discussion on New Towns. Consequently, many inhabitants complain about the lack of facilities, although the municipality has tried to catch up by renewing the city centre (Reijndorp, Bijlsma and Nio, 2012).

3.4.2 Ill maintained green city
The motto chosen for Spijkenisse at the time of it’s start as a New Town was the green city. In hindsight this motto hasn’t been well selected, because of the high maintenance costs (Reijndorp, Bijlsma and Nio, 2012). Since the start of the financial and debt crisis in 2006 the budgets of the municipality has been cut, similar to the time during the oil crisis of the 1980s. Consequently, many of the public greens have become ill maintained.

3.4.3 Growing distance to facilities
The renewal of the city centre of many Dutch New Towns during the last years has been part of the believe in the compact city concept since the 1990’s. As a result of these new believes the focus of the municipalities shifted from ‘building for the neighbourhood’ to the urban renewal of industrial sites and city centres (Reijndorp, Bijlsma and Nio, 2012. Together with the shift in focus many facilities moved from the neighbourhoods to the city centres. Furthermore, due to the spatial separation and the establishment of commercial enterprises beyond residential areas, a high level of out-of-home mobility is a prerequisite for independent living in these suburban areas. And it is exactly this out-of-home mobility which is lower in elderly than in many other frail members of the population in cities such as Spijkenisse (Mollenkopf et al., 2004).

3.5.2 Suburban public space
As has been discussed in the previous sections, Spijkenisse consists of a considerable amount of suburban neighbourhoods (Reijndorp, Bijlsma and Nio, 2012). In these areas desirable conditions have been created in the form of gardens for private outdoor activities; at the same time communal outdoor activities have been reduced to a bare minimum because of street design, automobile traffic, and especially the wide dispersal of people and events. In the neighbourhoods that have been created all over world at the same time as the neighbourhoods in Spijkenisse it is a common complaint that the streets are quiet and that the life between buildings has been phased out (see figure 21) (Gehl, 2011).
Figure 21. Quiet green suburban streets in Spijkenisse (by the author).
3.4.2 Greying Spijkenisse

The original inhabitants of the new town neighbourhoods are becoming the elderly of tomorrow (see figure 19). As figure 20 shows, the neighbourhoods which are affected the most by the ageing population are in the North, around the centre and in the West of Spijkenisse (CBS Statline, 2009). Furthermore the ageing population lives in the greying neighbourhoods of the 60s and the 70s where the housing no longer meets the demands of today partly due to the cheap way of building. Mainly due to the high pressure and financial crisis it was built in, as has been discussed in the previous sections.
part I. introduction

Figure 22. Neighbourhood designs for elderly are just as beneficial for parents with buggies, people who are physically impaired, and so on (Burton and Mitchell, 2006).
4. Project aim

This graduation project establishes spatial interventions for the public space in the current context of Dutch cities encouraging the vastly growing population of frail elderly to age actively. Thereby reducing of or preventing frailty from worsening and enhancing their independence. The findings should add to the general body of knowledge about elderly friendly public spaces and be suitable for the daily practice of urban planners and designers.

To make the research results, which are mainly from the academic field such as gerontology, suitable for urban designers and planner they are spatially visualized. Therefore an additional booklet has been made, based on findings from literature and practise, containing design principles which practitioners can use.

The design for Spijkenisse is used as a case to show how the interventions could be implemented in the context of a Dutch city. The design is an answer to the spatial problems which Spijkenisse is faced with and therefore meets the needs of different population groups and frail elderly inhabitants in particular by making use of literature based elderly specific interventions.

For example while the interventions are used to create easy accessible public spaces for elderly, they are just as beneficial for parents with buggies, people who are physically impaired and so on (see figure 22).

The design interventions keep existing neighbourhood intact and respond to the whishes of elderly to age in their existing neighbourhoods and as a result create generation proof neighbourhoods (see figure 23).

Finally, due to the current economical crisis the interventions are for strategic locations and try to achieve a big affect with a smaller budget.
part I. introduction

<table>
<thead>
<tr>
<th>question</th>
<th>answer</th>
<th>method</th>
</tr>
</thead>
</table>

figure 23.
Amount of people over 55 in the Netherlands who indicate that they are interested in living together with other people over 55. n = potential target group (Lijzinga, Depenbrock and Hendriks, 2009)

<table>
<thead>
<tr>
<th>n</th>
<th>amount</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All people over 55</td>
<td>2,152</td>
<td>2,794,500</td>
</tr>
<tr>
<td>Together with people over 55</td>
<td>311</td>
<td>394,500</td>
</tr>
<tr>
<td>Together with people over 55 in a building</td>
<td>194</td>
<td>247,000</td>
</tr>
<tr>
<td>Together with people over 55 in a street</td>
<td>100</td>
<td>133,500</td>
</tr>
<tr>
<td>Together with people over 55 in a neighbourhood</td>
<td>43</td>
<td>62,000</td>
</tr>
<tr>
<td>Together with people over 55 in a village</td>
<td>20</td>
<td>27,000</td>
</tr>
<tr>
<td>Together with people over 55 in a city</td>
<td>19</td>
<td>24,000</td>
</tr>
</tbody>
</table>

figure 24.
Diagrammatic representation of the necessary conditions for academic research (Biggs and Buchler, 2008)
5. Project approach

5.1 Introduction
In order to achieve the aims and objective set in the previous chapter, an extensive amount of academic research and design work has been done. Biggs and Buchler (2008) express the link between the necessary conditions for academic research in diagrammatic form, shown in figure 24. Every research begins with a clear question. Biggs and Buchler show that there initially is an overlap between question and answer, because a well-formulated question implies its answer within an audience-led context: a philosophical question begs a philosophical answer, an urban design question demands an urban design answer, and so on.

‘Different disciplines have discipline-specific interests for which discipline-specific answers are required. There is a linkage that is represented by the overlap between question and answer, and method provides a further connection, i.e. if one is interested in this particular question, then a particular route would be appropriate in order to find out something or develop the interpretation of this issue and precipitate a meaningful outcome. This way of describing the connection between the necessary conditions for academic research renders a practical and pragmatic structure by which to evaluate the appropriateness of method,’ (Biggs and Buchler, 2008, p 10)

It is essential for academic work that is it criticizable and therefore exposing the way the research has been and will be done. That is why this chapter is dedicated to the research questions, the corresponding methodology and the answers/products has led to.

5.1.1. Research questions
The main research question of this graduation project is: What kind of spatial interventions in the public space are required to enhance the independence of frail elderly within the current context of Dutch neighbourhoods?

5.1.2 Project methodology scheme
Figure 25 on page 38 shows the research methodology of this project in the form of a scheme. Here you can see the different activities that have been undertaken during this project; literature research, empirical research, development of design principles and urban design. All these activities are linked to each other, together resulting in an answer to the main research question. As figure 25 shows, the process has not been linear. This is exemplary of the process common in urban design and other creative processes where every activity receives input from the other activities. For instance the findings from the literature influences where the empirical research is focus on. And while designing some unforeseen problems have come to the surface and asked for some more literature research and so on. While some activities are indirectly linked, others give direct input to certain activities have proven necessary to continue the research in that field. This is made visible in the scheme on page 38 with small grey arrows.

Every activity contains the three conditions of academic research as discussed earlier, a question, a method and a product (or answer). The answers and products of these activities form the answer to the main research question. The next paragraphs will elaborate on the different activities and their conditions.

5.2 Theoretical framework: urban design encouraging active ageing
Sub question
Which neighbourhood design interventions in the public space encourage frail elderly to age actively?

Methodology
The method used in this part of the process is a literature research. The research focuses on the study of and critical reflection on theories in a abroad array of health,
What kind of spatial interventions in the public space are required to enhance the independence of fragile elderly within the current context of Dutch neighbourhoods?

LITERATURE RESEARCH
Which neighbourhood design interventions in the public space encourage frail elderly to age actively?

This research draws primarily on recent peer-reviewed literature in a broad array of urbanism and gerontology fields.

Which hindrances do frail elderly inhabitants of Spijkenisse experience in the public space of their neighbourhood that prevent them from fulfilling their out-door-mobility goals?

EMPIRICAL RESEARCH
Which urban design principles or patterns need to be embedded into the current context of Dutch cities in order to create easy accessible public spaces for elderly?

Testing urban design principles in representative types of public spaces in the case of Spijkenisse, resulting in designs for the public space of exemplary locations.

DESIGN PRINCIPLES
Which urban design principles or patterns are essential for practitioners to create elderly friendly public spaces that stimulate active ageing?

Using the pattern language format of Alexander to translate research findings into spatial urban design principles.

Collection of design principles o design principle catalogue filled with design principles for elderly friendly public spaces

URBAN DESIGN
Which urban design principles or patterns need to be embedded into the current context of Dutch cities in order to create easy accessible public spaces for elderly?

Testing urban design principles in representative types of public spaces in the case of Spijkenisse, resulting in designs for the public space of exemplary locations.

Collection of design principles o design principle catalogue filled with design principles for elderly friendly public spaces

Collection of design principles o design principle catalogue filled with design principles for elderly friendly public spaces

Spatial analysis of the location: o Spatial analysis maps o GPS maps o interview statistics o activity diary statistics

figure 25. methodology scheme illustrating the research activities with the related questions, methods and products (by the author)
planning and environmental fields. In order to answer the sub question, the definition of frailty is further established as well the out-door mobility goals of frail elderly. Furthermore, the role of neighbourhood design as a tool to encourage elderly to be and stay active is examined. The findings are primarily based on recent peer-reviewed literature. Hereby developing a theoretical underpinning for the graduation project.

Products
The product is a theoretical underpinning of the graduation project described in part two of the thesis. Furthermore, a review paper has been written as a part of the course Theory of Urbanism given at the TU Delft, faculty of Architecture. This paper is added to the thesis plan in the appendix (Cammelbeeck, 2012)

5.3 Analysis of Spijkenisse
Sub question
In order to design public spaces in Spijkenisse that encourage its elderly inhabitants to stay active it is essential to determine which hindrances they themselves are experiencing in the public space. That is why the following question needed to be answered:
Which hindrances do frail elderly inhabitants of Spijkenisse experience in the public space that prevent them from fulfilling their out-door-mobility goals?

Methodology
This research consists of two main parts. The first is the urban analysis of the built environment and public space of Spijkenisse linked to the in literature found important evaluation parameters for elderly. Because of the fact that walking is the main mode of transportation for elderly, the built environment on the neighbourhood scale is the most relevant. Therefore the urban analysis on Spijkenisse is done to be able to select three neighbourhoods which are exemplary for different cities in the Netherlands due to their building and urban plan typology and therefore making it usefull for urban designers and planners who are dealing with other design contexts.

The second part of the research is in collaboration with the Erasmus University Medical Centre (Erasmus MC) in Rotterdam. The Erasmus MC has started in 2011, as part of the The National Care for the Elderly Programme (NPO), with the research on the role of the physical environment on the independence of frail elderly. This research is being done in Spijkenisse, connecting perfectly to this graduation project and its main research question. Because the research and design of this thesis has been done from an urban design and strategic planning perspective it adds to the research done by the Erasmus MC and TNO. Furthermore, it presents this graduation project with an opportunity to underpin the urban analysis, urban design and design principles with extensive academic empirical research findings.

The research team from the Erasmus MC is formed by Dr. F.J. van Lenthe, A. Etman Msc and Dr. C.B.M. Kamphuis. Additionally researchers Dr F. Pierik and H. Vos Msc from TNO are part of the team.

The two main goals of their research are:
• Obtain insight into the role of the physical (built) environment on the physical activity, function preservation and -recovery, participation, independence and quality of life of frail elderly.
• Formulating recommendations for adjustments, renovation of existing and building of new neighbourhoods making it possible for frail elderly to achieve physical activity, function preservation and -recovery, participation, independence and quality of life.

The empirical research done by the Erasmus MC consists of 437 interviews and 130 physical activity diaries of elderly inhabitants of Spijkenisse. 130 participants of the research have used an GPS- and movement tracking device. For this thesis the interviews are the main source of information, further underpinned by the GPS tracking and the physical activity diaries.

The participants were selected in two different ways. Firstly by using the municipal personal records (GBA) of
part I. introduction

figure 26. The cover of the three books that form the core of the pattern language, written by Christopher Alexander (Alexander et al., 1975; Alexander et al., 1977; Alexander, 1979)

figure 27. A language for a garden. "In this network, the links between the patterns are almost as much a part of the language as the patterns themselves" (Alexander, 1979)
Spijkenisse and selecting everyone older than 65 years of age and in the order of their zip code. Secondly by using data from a research done by Health care for Elderly (ZVO) where elderly who were just released from the hospital were studied. Hereby a broad array of elderly who have no, light, moderate or severe impairments were selected. After this selection a letter was send to their homes informing them of the research. Following this letter they were called by people following a set of instructions and an checklist asking them if they wanted to participate and to judge if they were suitable for the research. The elderly were asked if they wanted to participate with an interview, wear a movement- and GPS tracking device and fill in a physical activity diary over a period of seven days. However, they had the option to just do the interview. When an inhabitant agreed to one or more of the methods, an interviewer came by for a visit and asked him or her 160 questions and statements related to their living environment, mobility, health and more.

If the participant agreed to use they GPS device and fill in the physical activity diary, it was explained to them how it works and how it should be filled in. In the case of the physical activity diary the participant was asked to write down every morning, noon and night at what time they were home, when they came back from a trip, what they did and which mode of transport they had chosen. Although the data have been collected for a research strongly related to this research, some questions that were asked are of no interest for the field of urbanism. That is why the data have been filtered. This was achievable because of the fact that the data from the diaries and interviews have been transferred to SPSS statistics (Statistical Package for the Social Sciences) and TNO has translated the GPS data into workable maps. For this research the data has been used to come to the conclusion which hindrances elderly are experiencing. Combined with the findings from the spatial analysis this has resulted in a SWOT (strength, weakness, opportunities and threats) analysis of the project location. The SWOT analysis forms the basis of the design task definition.

**Sub question**

Which design principles or patterns are essential for practitioners to create elderly friendly public spaces that stimulate active age?

**Methodology**

In order to make the findings from literature, empirical and design research suitable for practitioners in the urbanism field it is essential to translate them into comprehensible spatial interventions. The method used is a design method, in this thesis it has been used as a method to organise and give an overview of design principles which can be used in a flexible manner. This paragraph will go deeper into the theory of Alexander and how it could be applied by practitioners.

“The Timeless Way of Building”, “A Pattern Language” and “The Oregon Experiment” written in respectively 1979 , 1977 and 1975, form the trilogy at the core of the pattern language (see figure 26). Volume 1, The Timeless Way of Building, lays the foundation of the series. It provides the theory and the instructions for a movement in architecture, building and planning, the pattern language (Alexander, 1979). Volume 2, A Pattern Language, describes the detailed patterns for towns and neighbourhoods, houses and gardens and rooms. Alexander’s goal was to provide an archetypal language which allows any lay person or
Each pattern has an introductory paragraph, which sets the context for the pattern, by explaining how it helps to complete certain larger patterns.

A headline of the problem statement

The body of the problem, the longest section. It gives the empirical background of the pattern. The evidence for its validity, the range of different ways the pattern can be manifested, and so on.

Then, the solution - the heart of the pattern - which describes the field of physical and social relationships which are required to solve the stated problem, in the stated context. This solution is explained in the form of an instruction.

A diagram, which shows the solution in the form of a diagram, with labels to indicate its main components.

This part ties that particular pattern to all those smaller patterns which are needed to complete, embellish or fill it out. As has been made visible in the first part of the pattern language, the pattern fields map.

Other beneficiary population groups

The degree to which the pattern is frail elderly specific. On a scale of one to five.

Figure 28.
the format of the design principle booklet, based on the pattern language of Christopher Alexander (by the author)
group of people to design a part of the environment for themselves (Alexander et al., 1977).

Volume 3, The Oregon Experiment, is the first of series that followed that describes in full detail how this theory may be implemented (Alexander et al., 1975). Alexander describes patterns as certain entities where every town and building is made of. He underlines that everything can be decomposed to become a set of patterns, they are ‘a set of atoms of our man-made universe’ (Alexander, 1979, p. 99). Every pattern causes a different reaction; some patterns can help us to resolve our conflicts and others prevent us. However, while these patterns can be distilled from its source and do have their own character, that doesn’t mean they are autonomous and monotonous. In fact, patterns are a part of a system, and this system makes them work in a unique way. This system takes shape in the form of a language, the pattern language.

A pattern language gives a person who uses it, the power to create an infinite variety of new and unique buildings, neighbourhoods or towns. Just as his ordinary language gives him the power to create an infinite variety of sentences appropriate for different circumstances, at will (Alexander, 1979, p. 167).

The structure of a pattern language is created by the fact that individual patterns are not isolated. Each pattern sits at the centre of a network of connections which connect it to certain other patterns that help to complete it. And it is the network of these connections that creates the language. It is the structure of the network and the sequence of patterns which makes sense of individual patterns, because it anchors them, and helps make them complete. And in this structure the principal components need to be defined and that is what completes the language (Alexander et al., 1977).

As stated before, the language is a network of connections (see figure 20). To make a pattern language and its patterns explicit, we have to make the inner structure clear. This makes it judge able, which is essential in a public and academic practice like urbanism. This has been done by exposing the structure of the language and its patterns. That is why each pattern has the same format and they are all collected in a booklet. This format is derived from ‘A Pattern Language’, written in 1979 by Christopher Alexander and is shown in a figure on the previous page and will be further explained in the next paragraph.

The format of the design principles or patterns

Firstly, the book begins with an illustration showing the pattern language by making use of a so called a pattern field map. This map illustrates all connections between the patterns in this pattern field. The field is ordered between two axes with different parameters. What is most important about this field, is that each pattern is connected to certain larger patterns which come above in the field; and to certain smaller patterns which come below it in the language. The patterns help to complete those larger patterns which are above it, and are themselves in turn supported by those smaller patterns which are below it.

Secondly, the patterns in the pattern language needs to be made explicit. For convenience and clarity, each pattern has the same format (see figure 28). First there is a picture, which shows an archetypical example of the pattern.

Second, after the picture, each pattern has an introductory paragraph, which sets the context for the pattern, by explaining how it helps to complete certain larger patterns.

Then the second paragraph starts, with the headline of the problem statement which gives the essence of the problem in one or two sentences. And then follows the body of the problem, the longest section. It gives the empirical background of the pattern. The evidence for its validity, the range of different ways the pattern can be manifested, and so on.

Then, the solution - the heart of the pattern- which describes the field of physical and social relationships which are required to solve the stated problem, in the
part I. introduction

figure 29. Methodology scheme research by design (Dorst, 2012)

figure 30. Scheme giving insight into the design process (by the author)
stated context. This solution is explained in the form of an instruction. After the solution, there is a diagram, which shows the solution in the form of a diagram, with labels to indicate its main components. After all, as Alexander himself explains it, ‘if you can’t draw a diagram of it, it isn’t a pattern’ (Alexander, 1979, p. 267).

This ends the main body of the pattern. However, it is important to show the ties the pattern has to other pattern. That is why the sixth paragraph ties that particular pattern to all those smaller patterns which are needed to complete, embellish or fill it out (Alexander et al., 1977). As has been made visible in the first part of the pattern language, the pattern fields map.

Because of the fact that the patterns are design principles for the public space which will benefit other users and the fact that elderly want to stay in contact with other population groups another paragraph has been added. Here the relation of that pattern to other beneficiary population groups is stated. Making it possible for urban designers to get an idea of who benefits and possibly look up design suggestion for that particular population group.

Furthermore, while all of the patterns are of importance when designing elderly friendly public spaces, there is a degree to which they are frail elderly specific. For instance, because of the fact that the main mode of transportation of elderly is walking, some of the patterns will be beneficial for pedestrians in general. Therefore the last paragraph includes a scale from one till five on how elderly specific the pattern is, based on the literature where the principle is based on.

Implementation

Essential for the pattern language to work is that the problem it tends to solve is real and that the configuration solves the problem. This underlines the fact that the research to find the problem is crucial, but the implementation to is just as essential. After all, ‘It is reality itself that makes the difference.’ (Alexander et al., 1977, p.299).

That is why, as you can see in figure 25, the pattern language is directly linked to design. Here the patterns are implemented in an existing neighbourhood is extensively analysed.

The method of the pattern language helps to translate the findings from literature, empirical and design research into comprehensible spatial interventions made visible by using pictures of examples. This is essential for this project to make it suitable for practitioners in the field of urbanism who are very visually oriented and to make it understandable for people outside the academic practise.

Discussion

This method, as Alexander describes it, can be interpreted as highly generalizing and compulsory. Especially because he describes designing as a process that needs to unfold step by step. However, urban design is more than just a checklist, not in the least because it has to do with people and different and ever changing social and spatial local conditions. That is why in this project the design principles are implemented as an answer to the current design task of Spijkenisse.

Times and contexts change and therefore the catalogue should be regarded as a growing reference guide with in the future different editions that planners, designers and other practitioners can use.

Products

The main product will be a pattern catalogue filled with design principles for elderly friendly public spaces which can be used by and added to by practitioners from the field of urbanism.

5.5 Urban design: Spijkenisse’s route towards active ageing

Sub question

Which urban design principles or patterns need to be implemented into the current context of Spijkenisse in order to create easy accessible public spaces for elderly?
Part I. Introduction

Methodology

One of the most important activities of the field of urbanism is design, therefore it is one of the central activities of this graduation project. Design is a creative process and never fully objective (Dorst, 2003; Lawson, 2003). In order to make this process judgable and more likely to be successful it is essential to make the design methodology insightful. Figure 30 illustrates the design process of this thesis in a scheme.

The problem field and design task definition is based on the urban analysis on themes found in literature and supported by research done by the Erasmus MC and TNO which has been discussed in the section 5.4 as they are part of the empirical research activities. The urban analysis will result in the problem field and design task definition and can be seen as necessary input at the start of the design process (Dorst, 2003). When the design task is set several design alternatives have been made eventually resulting in the design for the public space of exemplary and strategic location. And during this process the design principles have been used and tested in the context of Spijkenisse.

It is important to keep in mind that frail elderly have a small action space within their neighbourhood and that therefore the small scale is the most relevant. Furthermore, as has been stated in the aim of this thesis, the interventions keep mixed age group neighbourhoods intact. And that is why the designs are for certain zones and routes instead of the whole neighbourhood.

Products

The products will be designs for public spaces on strategic places in Spijkenisse. This are designs for exemplary, problematic and important routes and zones for elderly and squares where facilities for elderly are located. These design will be visualised with artist impressions, drawings, maps and pictures.
6. Relevance

6.2 Scientific

Frail elderly have hardly been the focus of studies into urban design (Cannuscio, Block and Kawachi, 2003; Jong and Duin, 2009). And while research has been done on aspects of the built environment that influence the behaviour of frail elderly by academics in the fields of health and gerontology, these have not been successfully translated into the current research and application related to neighbourhood design (Michael, Green and Farquhar, 2006). That is why this thesis combines findings from a broad array of health, planning and environmental fields, putting forward neighbourhood design interventions that encourage active ageing among frail elderly. By working together with two academic institutions from different fields, the Erasmus MC and TU Delft and by working together with the people in the practise of urban design at SVP architecture an urbanism, the combination of findings from different fields are further strengthened in this thesis. Furthermore, the research done by Erasmus MC has given this graduation project the opportunity to lay down an extensive academic base for the urban design. The basis for the urban design is further strengthened by the method of Christopher Alexander which helps to translate the findings from literature, empirical and design research into comprehensible spatial interventions which can be used by urban design and spatial planning practitioners.

6.1 Societal

The world population is ageing. This unprecedented demographic change, which started in the developed world in the nineteenth century and more recently in developing countries, is already transforming many societies (United Nations, 2009).

The United Nations has warned the Governments of developing countries in their World Ageing Report 2009. “The ageing process is expected to accelerate in the near future, particularly in developing countries. Because they have a shorter time to adapt to the changes associated with population ageing, it is urgent that the Governments of developing countries begin taking steps to face the challenges and make the best of the opportunities that population ageing brings.” (United Nations, 2009: p 15)

While developing countries such as the Netherlands are adapting their policy more towards an ageing society, the focus has mainly been on economic related issues such as the affordability of health care and pensions. However, the effects of these ageing issues on the built environment of our cities and vice versa, while very pressing, have hardly been covered.

This is a mist opportunity as academic research has shown that the built environment is one of the aspects which influences the amount of activity undertaken by inhabitants of urban neighbourhoods (van Lenthe, Burg and Mackenbach, 2005). And it is exactly this activity, also known as active ageing, that can reduce, or prevent social, physical and psychological frailty. Which in turn can lead to the preventing and reducing of adverse health outcomes such as admission into an institution or even death which governments and the society as a whole would like to avert.

However, there are some underlying ethical issues which should be pointed out. Firstly, it is import for this research to not generalize the elderly population group and ignore the diversity within the group. Therefore an extensive research has been done to specify which elderly are the target group, because ‘the elderly’ do not exist. Furthermore, because many elderly would like to stay in contact with other demographic groups and the fact that public space is in principle accessible to everyone, it is important to keep in mind the other users of the public space.

And secondly, while the increasingly smaller action space is seen in different academic fields as problematic for the physical and psychological health of elderly, often frail elderly don’t feel the need to leave their neighbourhood.
part I. introduction

The complicated relationship between supply and demand in relation to this project has been kept in mind.
PART II.
THEORETICAL FRAMEWORK:
URBAN DESIGN
ENCOURAGING
ACTIVE AGEING
part II. theoretical framework: urban design encouraging active ageing

7. Introduction

With greater life expectancy and an increasing proportion of elderly people of the age of 65 or older, population ageing has become a process without parallel in the history of humanity (Borst et al., 2008; Zlotnik, 2009). Sadly, older persons often become a part of a process of an accumulation of physical, psychological and/or social deficits in functioning. This process is known as the process of frailty and increases the chance of adverse health outcomes such as functional disabilities, admission to an institution, and even death (Campen, 2011).

With the growing amount of elderly becoming part of this process of frailty it has become an increasingly important public health issue that needs to be addressed (Etman et al., 2012; Borst et al., 2008; Borst et al., 2009).

Empirical research has shown that the process of frailty can be postponed by healthy and active ageing (Ruuskanen and Ruoppila, 1995; Mahmood et al., 2012). Active ageing describes the desire and ability of elderly to be and stay physically active. Additionally, active ageing includes social participation and engagement in daily economic activities, such as going to the supermarket (Michael, Green and Farquhar, 2006). However, large portions of the elderly population are not sufficiently active.

For example, in the Netherlands from 2001 to 2006 an estimated average of 48 per cent of women and 34 per cent of men aged 65 years or older did not engage in sufficient regular physical exercise as recommended by Dutch guidelines (Statistics Netherlands, 2007). Hereby putting themselves at risk of going further downwards in the spiral of frailty possibly leading to admission into an institution or even death (Campen, 2011; Borst et al., 2008).

In order for elderly to become and stay active and thereby reducing of preventing frailty from worsening, research needs to be done on the aspects that influence physical activity in elderly. One of the aspects is the built environment, in particular neighbourhood design, which has been found to influence the amount of physical activity undertaken by inhabitants of urban neighbourhoods (van Lenthe, Burg and Mackenbach, 2005). However, frail elderly have hardly been the focus of studies into urban design (Cannuscio, Block and Kawachi, 2003; Jong and Duin, 2009). Furthermore, while research has been done on the effects of the physical environment of frail elderly in field such as environmental gerontology, these have not been successfully translated into the current research and application related to neighbourhood design (Michael, Green and Farquhar, 2006).

The aim of this research activity is to put forward neighbourhood design interventions that encourage active ageing among frail elderly, combining the findings of researches in abroad array of health, planning and environmental fields.

In order to achieve this aim a reliable and valid definition and measurement of the concept of frailty will be established in chapter 10 to help identify this high risk population (Gobbens et al., 2010a). When trying to encourage active ageing it is required to establish the outdoor mobility goals of elderly that they want to full fill. The goals will be specified in chapter 11 followed by research into the role of urban design in achieving these goals. The research will draw primarily on recent peer reviewed literature and will result in design recommendations for the public space of neighbourhoods that that elderly are or will be living in to encourage them to age actively and thereby reducing, or preventing frailty from worsening.

These recommendations can be found in chapter 13 which forms the core of this research activity. This part of the thesis results in a summary of neighbourhood design interventions which encourage frail elderly to age actively followed by recommendations for further research. The conclusions and recommendation have proven to be highly useful to make design recommendations to assist in elderly friendly developments and neighbourhood improvements.
in the public space. However, from a built environment perspective, the most significant shortcoming in research to date is that it is often difficult to translate the findings into practice. Therefore the findings are further visualised is the design principle catalogue and tested in the case of the design for Spijkenisse in the next parts of this thesis.
part II. theoretical framework: urban design encouraging active ageing

figure 31.
Cycle of frailty hypothesized as consistent with demonstrated pair wise associations and clinical signs and symptoms of frailty (Fried et al., 2001)
8. Frail elderly

In practice there have been considerable differences between the various definitions of frailty (Gobbens et al., 2010a). In this thesis the definition developed by Campen in 2011 is used. He defines frailty as a process of an accumulation of physical, psychological and/or social deficits in functioning which increases the chance of adverse health outcomes such as functional disabilities, admission to an institution, and even death (Campen, 2011).

There is growing consensus that markers of frailty include age-associated declines in lean body mass, strength, endurance, balance, walking performance, and low activity. And that multiple components must be present clinically to constitute frailty. Many of these factors are related and can be unified, theoretically, into a cycle of frailty (see figure 31) (Fried et al., 2001).

Until recently, studies mainly focused on frailty as a non-dynamic entity. However, frailty can be understood as a continuum with intermediate states that can be modified. Frailty is a process which it attractive for interventions, for instance in the built environment, because it can be slowed down or even reversed (Etman et al., 2012; Gobbens et al., 2010b).
9. Out-of-home mobility

9.1 Mobility goals
Out-of-home mobility is a crucial prerequisite for autonomy and well-being. Mobility is of the up most importance for frail elderly as it promotes active and healthy ageing which can reduce or prevent frailty from worsening (Mollenkopf et al., 2004). In order to increase the out-door mobility of elderly their goals need to be defined.

Shopping has been found in many researched as the most common destination for trips (Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Burton and Mitchell, 2006). Other important destinations are the general practitioner (GP), church, a park and visiting family and friends. However, the majority of older people regularly also go out for its own sake, without having a particular purpose in mind (Michael, Green and Farquhar, 2006).

9.2 Walking as main mode of transportation
When trying to reach their out-door mobility goals, walking is the most common form of transportation and exercise for elderly (Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Mollenkopf et al., 2004). With walking as their main mode of transport, elderly are often limited to their nearby surroundings for their daily activities. Additionally, frail elderly are confronted with multiple deficits in functioning such as declines strength, endurance, balance, walking performance, and low activity which further decreases their action space. Action space can be defined as the spatial unit of physical activity places, which a person of a group of persons has visited in a certain period of time (Dijst, 1995; Rooij and Tacken, 1998) As a consequence, the neighbourhood environment becomes increasingly significant for frail elderly (Mahmood et al., 2012).
10. The influence of neighbourhood design on outdoor activities

Outdoor activities are influenced by a number of conditions. The physical environment is one factor that influences the activities to a varying degree and in many different ways (Gehl, 2011). Findings from several studies indicate that physical aspects of neighbourhoods may influence physical activity levels and walking behaviour among residents (Mahmood et al., 2012; Michael, Green and Farquhar, 2006; van Lenthe, Burg and Mackenbach, 2005; Borst et al., 2009) and that urban design can be a powerful tool for improving the overall health of residents (Jackson, 2003). The design of the built environment is particularly pertinent for older people: as they age, they are likely to spend more time in their home and community environments, and declining health and functional status can make them more susceptible to barriers in them (Burton, Mitchell and Stride, 2011).

In the next chapter the barriers that frail elderly are faced with in the public space will be discussed, directly followed by suggested neighbourhood design interventions that have been found to encourage active ageing among frail elderly.
part II. theoretical framework: urban design encouraging active ageing

figure 32. New developments should be small and incremental and buildings and features should reflect the local style (Hoek, 2010)

figure 33. In order to achieve a legible neighbourhood for frail elderly, an irregular grid pattern is preferred (Burton and Mitchell, 2006)
11. Design interventions

Burton and Mitchell found six key themes that are essential when designing elderly friendly neighbourhoods; familiarity, legibility, distinctiveness, accessibility, safety and comfort. In the literature that was reviewed for this paper these themes, while not always being used explicitly, could be applied. Therefore these themes and the scale on which the interventions act will be used to structure the found neighbourhood design interventions that encourage active ageing among frail elderly. The themes and their related interventions are visualised at the end of this chapter in table 1.

11.1 Familiarity
Familiarity refers to the extent to which streets are recognisable to older people and easily understood by them. Many frail elderly find unfamiliar environments and features increasingly stressful to cope with and they tend to restrict their activities to familiar local places as they grow older (Mollenkopf et al., 2004).

Therefore, in order to design familiar streets for elderly, changes should be small and incremental and buildings and features should reflect the local style (see figure 32) (Burton and Mitchell, 2006).

11.2 Legibility
Legibility refers to the extent to which streets help older people to understand where they are and to identify which way they need to go.

The comfort of knowing where they are, where they can find the services and facilities they require and how local features work helps them to enjoy trips out of the home and to maintain their independence and self-esteem (Michael, Green and Farquhar, 2006; Burton and Mitchell, 2006).

When designing a legible neighbourhood, cul-de-sacs and grid patterns should be avoided as dead ends result in longer and indirect walking routes. Furthermore, a regular grid pattern often consists of similar streets and cross roads which are cause for confusion for frail elderly (Burton and Mitchell, 2006). An irregular grid as shown in figure 33 however is desirable as it provides an easy to understand network of routes and junctions and gently winding streets which are legible for frail elderly.

The legible street pattern should be supported on street level by clear signs and symbols and buildings reflecting their use with visible and obvious entrances (Burton and Mitchell, 2006).
part II. theoretical framework: urban design encouraging active ageing

figure 34. Distinctive structures catch the eye and help people to identify which way they need to go (Burton and Mitchell, 2006)

figure 35. Primary services and facilities should be within 500m of older people’s housing and secondary services should be within 800m (drawing based on Burton and Mitchell, 2006)
11.3 Distinctiveness

A theme related to the previous theme of legibility is distinctiveness. Distinctiveness relates to the extent to which streets give a clear image of where they are, what their uses are and where they lead. Distinctive streets reflect the local character of the area and they have a variety of uses, built form, features, colour and materials that give the streets and buildings their own identity within the overall character of the neighbourhood (Burton and Mitchell, 2006).

Design aspects that add to a neighbourhood’s visual interest include the presence of a variety of architectural styles within one block, historical markers and curved streets (see figure 34)(Michael, Green and Farquhar, 2006; Burton and Mitchell, 2006).

11.4 Accessibility

Accessibility refers to the extent to which streets enable elderly to reach, enter, use and walk around places they need or wish to visit, regardless of any physical, sensory or mental impairment (Burton and Mitchell, 2006). Local shopping and services provide frail elderly with places to walk, to meet others, and to stay active hereby encouraging active ageing (Michael, Green and Farquhar, 2006). Pearce (1982) found that older people are more likely to use local facilities within walking distance of home, shop more often and make regular visits to medical facilities. Therefore, when designing accessible neighbourhoods the presence of shops and services on a walkable distance is essential (Borst et al., 2009). The importance of accessible services and facilities is underlined by the fact that participants in the Senior Walking Environment Assessment Tool (SWEAT) study even said that their ability to walk to needed services played a role in their decision to live in a particular neighbourhood. Furthermore, an area that lacked accessible services was linked to decreased incentive to walk to local amenities and increased isolation (Michael, Green and Farquhar, 2006; Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Burton and Mitchell, 2006).

The definition of a walkable distance differs depending on the consulted source of information. Several studies show that elderly should ideally live no further than 500 m from essential services and facilities. If secondary services and facilities, including a park or other form of open space, library, dentist, optician, places of worship, and community and leisure facilities, cannot also be within 500 m they should be no further than 800 m (Borst et al., 2009; Burton and Mitchell, 2006; Carstens, 1985). These findings have been visualised in figure 35. In the case that the out-door mobility goals are or cannot be located within a walkable distance, the proximity of a public transport stop near the home and the destinations are key (Mahmood et al., 2012). Adequate public transportation is essential to remain active in the larger community and independent in one’s neighbourhood. Elderly even report that walking a long distance to reach a public transport stop makes traveling out of their neighbourhood less safe and in some cases unfeasible (Michael, Green and Farquhar, 2006).

In summary, accessible neighbourhoods should have local services and facilities and public transport on a walkable distance (Burton and Mitchell, 2006; Borst et al., 2008; Borst et al., 2009).
Urban design encouraging active ageing

Figure 36. Benches provide places for resting and are facilitators of physical activity. In order to facilitate physical activity, seating should be every 100 m to 125 m (Burton and Mitchell, 2006).

Figure 37. Older people feel safer using signal-controlled pedestrian crossings with audible cues and visual signals on both sides of the road than other types of crossing (Burton and Mitchell, 2006).
11.5 Comfort
Comfort refers to the extent to which streets enable people to visit places of their choice without physical or mental discomposure and to enjoy being out of the house. Comfortable streets are calm, welcoming and pedestrian-friendly with the services and facilities required by older people and people experiencing temporary or permanent incapacity (Burton and Mitchell, 2006). Intervention that help elderly feel more comfortable are widening sidewalks, creating buffer zones between sidewalk and streets and adding benches that provide places to rest as shown in figure 36 (Michael, Green and Farquhar, 2006; Mahmood et al., 2012).

11.6 Safety
Safety refers to the extent to which streets enable people to use, enjoy and move around the outside environment without fear of tripping or falling, being run-over or being attacked.
Safety even emerged in several different studies as the biggest concern of elderly which limits their walking for everyday activities as well as exercise (Mahmood et al., 2012; Michael, Green and Farquhar, 2006; Burton and Mitchell, 2006; Borst et al., 2009). The theme of safety includes both physical environmental features of the streetscape related to physical safety, as well as the social perception of feeling secure. Primary safety concerns are busy trafficked streets, unsafe street crossings, damaged sidewalk pavement and crime (Michael, Green and Farquhar, 2006; Burton and Mitchell, 2006; Bjornsdottir, Amadottir and Halldorsdottir, 2011; Mahmood et al., 2012; Borst et al., 2009). Traffic signals with pedestrian controls are found essential to feel safe at street crossings (see figure 37). However, many crossings are found to not provide enough time to cross the street.
Safe public spaces have buildings facing onto them, separate bicycle lanes and wide, well-lit, plain and smooth footways (Burton and Mitchell, 2006; Jackson, 2003).
table 1. The in literature found neighbourhood design interventions which encourage frail elderly to age actively. Further structure by the six key themes found by Burton and Mitchell and the scale on which the interventions take place (by the author)
12. Conclusions

With greater life expectancy and an increasing amount of elderly people over the age of 65, the growing amount of frail elderly is becoming an important public health issue (Zlotnik, 2009; Borst et al., 2008; Etman et al., 2012). Research has shown that the process of frailty can be reduced or prevented from worsening by active ageing (Ruuskanen and Ruoppila, 1995). An important factor influencing the physical activity undertaken by elderly is the built environment (van Lenthe, Burg and Mackenbach, 2005). Therefore urban design can be a powerful tool to encourage active ageing (Jackson, 2003).

Because of the physical, psychological and/or social deficits that are associated with frailty, walking is the main mode of transportation and physical activity for elderly (Rooij and Tacken, 1998; Mollenkopf et al., 2004). Consequently, the action space of frail elderly is mostly limited to their neighbourhood (Fried et al., 2001; Gobbens et al., 2010b; Rooij and Tacken, 1998) and therefore urban design interventions that are meant to encourage active ageing should primarily be focused on the neighbourhood scale.

Literature from different fields such as health, planning and gerontology put forward around 39 different neighbourhood design interventions that encourage active ageing. In turn the design interventions can be divided into six interrelated themes; familiarity, legibility, distinctiveness, accessibility, comfort and safety (see table 1). Particularly design interventions related to the themes of accessibility and safety are put forward in literature as important prerequisites for active ageing in the built environment of the neighbourhood (Burton and Mitchell, 2006; Burton, Mitchell and Stride, 2011; Mahmood et al., 2012; Borst et al., 2008; Borst et al., 2009).

The close proximity of amenities and facilities to frail elderlies’ homes appears to be a determining accessibility related factor in encouraging individuals to go out and walk to the particular destination (Mahmood et al., 2012; Borst et al., 2009).

On the other hand, primary concerns are safety related such as busy trafficked streets, unsafe street crossings, damaged sidewalk pavement and crime (Michael, Green and Farquhar, 2006; Burton and Mitchell, 2006; Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Mahmood et al., 2012; Borst et al., 2009). Therefore, equally important design interventions are; separate bicycle lanes and wide, well-lit, plain and smooth footways and controlled pedestrian crossings (Burton and Mitchell, 2006; Jackson, 2003).
13. Implications for the design of elderly friendly public spaces

Many studies define elderly or frail elderly in a different manner. Because of the high diversity in the elderly population group it is highly important for further research activities related to frail elderly to be clear who the intended population group is. Therefore in chapter 18 an operational definition for frailty is defined.

In terms of designing elderly friendly public spaces the literature research has found familiarity, comfort, legibility, accessibility, distinctiveness and safety to be the important themes. These themes are incorporated into the analysis to determine the design task. As there are 40 principles which are a part of the six themes, a clear design task is helpful and even essential before designing elderly friendly public spaces. When a clear design task is set an urban designer can establish which interventions should be applicable for the design.

Important to note however is that many of the recommended design interventions which were found in literature haven’t been tested in the form of a design for the public space. The importance of putting the interventions into the context of a neighbourhood design is underlined by findings of the SWEAT study. The researchers observed that safety concerns and the need for accessible services could conflict with each other because services are often located at busy arterials (Michael, Green and Farquhar, 2006).

Therefore the conclusion and recommendations at the end of the thesis again discuss the implications of the findings in literature on the design of elderly friendly public spaces.
14. Design catalogue

An important project aim set in chapter 4 was to make the findings from literature, empirical and design research suitable for practitioners in the urbanism field. Therefore it is essential to translate the findings from literature into comprehensible spatial interventions. While the previous chapters do give an indication with text and illustrations on the spatial implications of the themes, the specific principles have not been sufficiently explained and visualised. Therefore, as has been addressed in the project approach, a design catalogue has been made visualising and describing all the found design principles based on peer reviewed literature (Cammelbeeck, 2013). This is a separate book, however the principles will form the input for the design for Spijkenisse and therefore are being discussed in the design part of this thesis.
part II. theoretical framework: urban design encouraging active ageing
PART III.
ANALYSIS OF SPIJKENISSE
part III. analysis of Spijkenisse

Parameters found in literature

Urban analysis Spijkenisse

Urban analysis neighbourhoods

Strength Weakness
++ +
++
+ -
-
-

Threats Opportunities

Problem & task definition

Design alternatives + development phases

Research by design

Designs for the public space of exemplary and strategic locations:
- routes
- zones

Data analysis interviews

Data analysis GPS tracks

Physical activity diaries

figure 38. Scheme giving insight into the design process (by the author)
15. Introduction

Spijkenisse is the case for this graduation project. In order to design public spaces in Spijkenisse that encourage its frail elderly inhabitants to become and stay active it is essential to determine which hindrances they themselves are experiencing in the public space. That is why the following question needs to be answered:

Which hindrances do frail elderly inhabitants of Spijkenisse experience in the public space that prevent them from fulfilling their outdoor-mobility goals?

The answer to this question results in a design task definition for Spijkenisse which forms the starting point for the design in part IIII.

As has been explained in chapter 5 of this book the research done to be able to define a design task consists of two main parts, the urban analysis of Spijkenisse and the research done in collaboration with the Erasmus MC and TNO. The combination of several methods used in different academic fields is the strength of this graduation project and therefore urban analysis and the interviews have been combined as well as the analysis of the GPS tracks and the physical activity diaries to put forward a design task definition (see figure 33).

The use and combination of the several methods will be explained in detail in the next sections.

15.1 Urban analysis + interviews

To make sure that the urban design made for this graduation project will be as effective as can be expected the design task needs to be thoroughly underpinned. For this research the unpinning is partly done by the means of an urban analysis of Spijkenisse and the interviews done by the Erasmus MC. Yet, not every scale of the city or every question asked during the interviews is of importance.

Because literature research has shown the importance of the neighbourhood in the daily lives of elderly (Mahmood et al., 2012) the analysis of the data and urban conditions should be done on the neighbourhood scale. In the time frame of this graduation project an analysis and design for a location site consisting of a maximum of three neighbourhoods is achievable. However, before these neighbourhoods can be chosen, an analysis of Spijkenisse needed to be done on which the neighbourhood would be chosen (see chapter 17). The selection of a certain neighbourhoods and the themes on which the analysis has been done is based upon several goals set for this graduation project in chapter 4.

One of the goals is to create a design for the public space that keeps mixed age group neighbourhoods intact. Therefore the urban analysis is done on more general urban analysis themes, however throughout the urban analysis a link will be made to the elderly related themes found in literature (see table 1, p. 64). The subjects of the urban analysis therefore are:

- Infrastructure and public transport | Accessibility
- Morphology | Legibility, distinctiveness, familiarity
- Public + green spaces | comfort
- Safety

A second goal expressed in chapter 4 is adding to the general body of knowledge on elderly friendly public spaces and making it suitable for the daily practice of urban planners and designers. Therefore the three neighbourhoods selected are be exemplary for different cities in the Netherlands due to their building and urban plan typology and because they differ from each other on the themes selected for the urban analysis.

When analysing the neighbourhoods the findings from the interviews done by the Erasmus MC are used to further substantiate the analyses. As has been stated before, not all questions asked during the interviews are of importance for this research. Therefore a selection of questions has been made.

**Infrastructure and public transport | Accessibility**

Regarding the theme of accessibility several questions were asked during the interview. In relation to this
part III. analysis of Spijkenisse

graduation project the ones addressing the accessibility of facilities and services such as shops and public transport stops within a walkable distance of frail elderly homes are the most relevant (Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Burton and Mitchell, 2006). According to literature a walkable distance is considered to be a maximum of 800 meters, or 10-15 minutes (Borst et al., 2009; Burton and Mitchell, 2006; Carstens, 1985). The question that is relevant for the analysis of the accessibility of Spijkenisse regarding this project is the following: “Are these services within a 10 minute walking distance from your home?” A total of twenty services were listed. The participants could respond to the statement with yes, no, don’t know, irrelevant or don’t give an answer.

Safety

Regarding the theme of safety elderly participants were asked to express what they thought of the following statements:

• I am afraid of crime and being bothered when I walk through my neighbourhood in the dark.
• I am concerned with traffic safety when I walk through my neighbourhood.
• At night the neighbourhood streets are not sufficiently lit.
• In my neighbourhood the footways are badly accessible.
• My neighbourhood is badly maintained.

The participants could respond to the statement with the following answers: Agree, don’t agree, irrelevant or other.

Finally three not theme specific questions were asked although very useful to determine the action space of elderly relevant for the design:

• “How would you define your neighbourhood? In other words, what do you mean when you talk about your neighbourhood?” The answer could be one of the following: The street where I live; The street where I live and several surrounding streets; The district where I live; Other.
• “How much time do you on average spend outside your neighbourhood during a week day?” This question is in line with the previous one, and helps to define if indeed, as has been found in literature, the neighbourhood is the most important outdoor environment for frail elderly.
• Finally, the participants were given the opportunity to add their own comments at the end of the interview, which are relevant to a variety of themes.

15.2 GPS tracking + movement diaries

The GPS tracking maps show the routes the neighbourhoods inhabitants choose when trying to reach their out-door mobility goals and therefore are of interest for the design interventions. While the interviews do give some insight into the perceived accessibility and safety of the built environment, the GPS trackings make it possible to interlink this with the network of streets and facilities of the neighbourhoods. Because the GPS tracks are being used for more neighbourhood and street specific analyses the GPS trackings will only be used for the analysis of the three neighbourhoods which are part of the project location.

While the GPS tracks are processed by Reinier Sterkenburg (researcher at TNO) to show the streets used by inhabitants , the locations where people have stopped and the type of transport used (motorised or active transport) the linking of the GPS tracks with the movement diaries has proven to be of importance. The reason for this linkage is that the movement diaries tell the exact reason for travel (or why they did not travel) and which exact mode of transport they used. Providing a more detailed image of the mobility goals of frail elderly and the chosen type of transportation, both of interest for this research. Therefore chapter 21 will be dedicated to analysing the routes, outdoor mobility goals and types of transportation of the elderly inhabitants of Spijkenisse.

At the end of this chapter a comparison is made between the findings from the urban analysis and the interviews, all resulting in a design task in chapter 22.
One of the conclusions of the literature research was that many studies define elderly or frail elderly in a different manner. Because of the high diversity in the elderly population group it is highly important for further research activities to be clear who the intended population group is. Therefore in chapter 18 an operational definition for frailty is defined.
part III. analysis of Spijkenisse

figure 39. map showing the homes of the 437 participants of the Erasmus MC interviews (by the author)

figure 40. map showing the homes of the 131 participants of the first round of Erasmus MC interviews that are frail according to the ISAR method (by the author)
18. ISAR measuring frailty

Because of the high diversity within the elderly population group it is highly important for further research activities to be clear who the intended population group is. In the case of this graduation thesis the population group of interest are frail elderly. When analysing the findings from the interviews it of importance that an operational definition is defined to make sure that the right population group is analysed.

In literature a high amount of operational definitions has been used. For the purpose of this graduation research the Identification of Seniors At Risk (ISAR) tool is used to define which of the interview participants can be defined as frail. The ISAR tool has been found to evaluate the presence or absence of risk factors for adverse health outcomes (Salvi et al. 2012). In the 161 questions asked during the interview, four questions were included that are part of the ISAR tool. The questions were:

- Do you regularly need assistance of someone else? (Around the house, with the preparation of meals, and so on)
- Are you at this moment making use of walking aids? (such as walking sticks, crutches or walkers?)
- Do you at this moment need assistance during travels?
- Did you receive any education after the age of 14?

The elderly participants over 65 years of age were asked to answer these questions with yes or no. When two or more of these questions were answered with yes, they are considered frail. According to this method 147 of the 437 elderly participants are considered to be frail (see figure 39 and 40) The answers given by these participants in comparison with the none frail elderly participants will be used for the underpinning of the urban analysis of Spijkenisse.
part III. analysis of Spijkenisse

The street where I live

The district where I live

The street where I live and several surrounding streets.

LEGEND

- 0 hours
- 1-2 hours
- 3-5 hours
- 6-10 hours
- more than hours

**Figure 41.**
Map showing the 131 participants of the first round of Erasmus MC interviews that are frail according to the ISAR method (by the author)

**Figure 42.**
The percentage of frail interviewees that gave certain answers to the question: how would you define your neighbourhood? (by the author)
17. Defining the project locations in Spijkenisse

17.1 Determine the action space for design

To be able to define the size of the design locations it is important to establish that the main action space of frail elderly is their neighbourhood, as has been put forward in the literature research done in part II. Action space can be defined as the spatial unit of physical activity places, which a person of a group of persons has visited in a certain period of time (Dijst, 1995; Rooij and Tacken, 1998). The interviews helped to define the action space of elderly in Spijkenisse by analysing the answers to the question: “How much time do you on average spend outside your neighbourhood during a week day?” Elderly were not bound to a certain choice of answers. However, the answers can be categorised into five time frames which are shown in figure 41. An enormous amount of 50 per cent of the frail elderly participants spend no more than 2 hours outside their neighbourhood during a week day. However, the fact that 37 per cent of frail elderly inhabitants of Spijkenisse spend no time at all outside their neighbourhood during a workday confirms even more that the neighbourhood is their main action space. The answers of this question are in line with literature research which has proven the importance of the neighbourhood for the daily lives of frail elderly (Mahmood et al., 2012). However, what frail elderly spatially consider to be their neighbourhood can differ. During the interview 131 frail elderly answered the question: “How would you define your neighbourhood? In other words, what do you mean when you talk about your neighbourhood?”. The answer to this question varied. The majority, 46.7 per cent defined their neighbourhood as the district where they lived. However, a large proportion of participants considered the streets where they live or the streets where they live and several surroundings streets as their neighbourhood (see figure 42). Due to the variety of answers, the neighbourhood locations shouldn’t be considered as an closed entities. Moreover, three adjacent neighbourhoods are chosen in order to be able to cover the daily action space of frail elderly in Spijkenisse.
Comparison between all elderly and frail elderly interviewees that gave certain answers to the question: Are these services within a ten minute walking distance from your home? (by the author)

**LEGEND**

- yes
- no
- I don’t know
- irrelevant
- no answer

Table 4.
17.2 Infrastructure + public transport + facilities | Accessibility
Accessibility refers to the extent to which street enable elderly to reach, enter, use and walk around places they need or wish to visit, regardless of any physical, sensory or mental impairment (Burton and Mitchell, 2006). Accessible cities provide public transport stops, facilities and green spaces on a walk able distance. Therefore Spijkenisse will be analysed on the amount of services and facilities, infrastructure and public transport.

Amount of services and facilities
The main out-door mobility goal for elderly is shopping, followed by the GP, church and family and friends (Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Burton and Mitchell, 2006). Figure 43 till 45 map these services and facilities in Spijkenisse. For the sake or readability the facilities are divided into three groups, public facilities, civil amenities and elderly specific facilities. Remarkable is the centrality of a multitude of facilities in the centres of several neighbourhoods while in many cities services are located in a more linear pattern alongside main streets. The centrality of the facilities can be explained by the urban design concepts of the garden city and neighbourhood principle, as has been explained in chapter 3. The map shows an exceptionally high concentration of the services in the centre, which was to be expected. However, taking in to consideration that all types of services and facilities should ideally be with an 500 meter radius from the home (Burton and Mitchel, 2006), the neighbourhoods in the south could prove be problematic in terms of accessibility for elderly. In the next section the perception of the accessibility of services and facilities of frail elderly in Spijkenisse is analysed.

Interviews
During the interviews the following question regarding accessibility was asked; “Are these services within a 10 minute walking distance from your home?” A total of twenty services were listed. The participants could respond to the statement with yes, no, don’t know, irrelevant or don’t give an answer. Table 4 shows the answers frail elderly gave to the statements compared to the general elderly group.

When comparing the average and frail elderly to each other a slight difference can be seen, where frail elderly on average find facilities to be less accessible. This difference can be explained by the fact that they need help with completing their everyday tasks and therefore feel that the facilities are harder to reach. Or they might live in different surroundings than their non frail peers. Although I believe in the first line of reasoning more research needs to be done.

When comparing the accessibility of different facilities it is not surprising that a train station was found to be the least accessible, as there isn’t a train station in Spijkenisse. Furthermore, with the closing down of many post offices in the Netherlands it is hardly astonishing that they are found to be out of reach. It is however important to take into consideration that some elderly might not know where they should go when they for instance want to post a package.

There are some answers that are of importance for the development of the problem field of this graduation project. Firstly, more than 40 per cent of all participants said that the neighbourhood association building was outside a 10 minute walking distance or they did not know where it was located. As figure 40 shows, the neighbourhood associations are to be found in almost every neighbourhood and therefore are likely to be within a ten minute walking distance. Because the associations provide many activities for elderly, the routes toward and the public space around the buildings are subjects of interest.

Secondly, more than 40 percent stated that the parks are not within a ten minutes reach. However, Spijkenisse promotes itself as a green city and is surrounded by green spaces (Gemeente Spijkenisse, 2010). The contrast between the perception of the elderly and the
part III. analysis of Spijkenisse

LEGEND
- - - 800 m radius
----- 500 m radius
supermarket
butcher
bakery
letterbox
theatre
cafe/restaurant
hairdresser
atm/bank
postoffice
cemetery
community

figure 43.
Location of the public facilities in Spijkenisse, concentrated in several centralities covering a walkable distance up till 800 meters (by the author)

LEGEND
- - - 800 m radius
----- 500 m radius
library
community
building
religious
institution
elderly-community

figure 44.
Location of the civil amenities in Spijkenisse, concentrated in several centralities covering a walkable distance up till 800 meters (by the author)
LEGEND
- - - 800 m radius
- - - - 500 m radius
- - sports-community
- - gym
- - physical therapist
- - apothecary
- - GP
- - hospital

figure 45.
Location of the elderly specific facilities in Spijkenisse, concentrated in several centralities covering a walkable distance up till 800 meters (by the author)

figure 46.
Spijkenisse divided into 15 neighbourhood recognised by the Statistic Netherland (by the author)
figure 47.
Network of main city and neighbourhood roads separated from amenities and facilities (by the author)
part III. analysis of Spijkenisse

figure 48. Network of public transport with stops located nearby the concentration of facilities and amenities (by the author)
Part III. Analysis of Spijkenisse

Before 1920

1921-1945

1946-1965

1966-1975

1976-1985

1986-1995

1996-2005

After 2006

Trees

Grass

Water

Main neighbourhood road

City road

Regional road

Elevated metroline

Figure 49.
Map of Spijkenisse showing the building periods and the connections to surrounding cities and villages scale 1:10,000 (by the author)
ambition and design of the city could be of interest for this graduation project and will be further discussed at in the next section on public and green spaces.

On the other hand, public transport services such as bus- tram- or tube stations are found to be within a 10 minute walking distance from the home which is a very good sign.

Public transport
For many people public transport is an important service as for some it is the only possibility to reach certain city wide or regional services. This might be especially of importance for the frail elderly of Spijkenisse because services such as the hospital are only located near the centre, which is often outside their 10 minute walking radius.

Spijkenisse is located at the edge of the Randstad in the Netherlands. As has been discussed in chapter 3 the city has always been aimed toward Rotterdam (Gemeente Spijkenisse, 2010). The role as satellite city at the edge of the Randstad is underlined by the layout and types of the public transport modes found in Spijkenisse. Firstly, Spijkenisse is not connected with the Netherlands by rail but only to the region by the metroline built in the 1980s which in turn only leads toward Rotterdam where inhabitants can transfer to other transport modes connecting them to the rest of the Netherlands. On the city and neighbourhood scale the bus lines connect the inhabitants to the metro stops and small surrounding cities and villages in the east, west and south, however not towards Rotterdam (see figure 48).

Figure 48 shows that the public transport stops are well spread throughout the city and located where there is a higher concentration of facilities. However, in order to be able to judge whether the stops are indeed accessible for frail elderly, the neighbourhood and street scale are of importance and should be further analysed as part of the location analysis. As the metro and the bus are likely to be the main mode of transport for elderly when trying to reach services that are not within a walkable distance, metro and bus stops should be part of the neighbourhood design locations.

17.2 Morphology | Legibility, distinctiveness, familiarity
On city scale legibility, distinctiveness and familiarity are both highly related to the neighbourhoods morphology. Therefore these themes will be combined in these analyses.

Distinctiveness relates to the extent to which streets give a clear image of where they are, what their uses are and where they lead. Distinctive streets reflect the local character of the area and they have a variety of uses, built form, features, colour and materials that give the streets and buildings their own identity within the overall character of the neighbourhood (Burton and Mitchell, 2006). Legibility refers to the extent to which streets help older people to understand where they are and to identify which way they need to go. Legible streets have an easy to understand network of routes and junctions with simple, explicit signs and visible, unambiguous features (Burton and Mitchell, 2006).

The literature on these themes is quite detailed on streets level. For the analysis of Spijkenisse it is important to look at the street layout and different typologies built throughout the years. Figure 49 shows the construction periods of the neighbourhoods in Spijkenisse. The map shows two major periods of growth as discussed in chapter 3, the reconstruction period after World War Two and the period after the 1970s when Spijkenisse became a ‘groeikern’. A clear difference can be detected between the neighbourhoods from the 1970s and the 1980s. On the one hand the neighbourhoods built after the 1970s show a clear stamp pattern with straight streets, well known from other neighbourhood built during this period. These neighbourhoods are built up with a high amount of similar building blocks negatively influencing the distinctiveness of the neighbourhood. And on the other hand the neighbourhoods from the 1980s consists a high amount of cul-de-sacs, well known from other neighbourhoods in the Netherlands,
High amount of green in and around Spijkenisse which is fragmented and difficult to maintain, scale 10,000 (by the author)
called ‘Bloemkoolwijken’ (Ubbink, 2011). These cul-de-sacs have a negative effect on the legibility of the neighbourhood because of their lack of hierarchical streets and high amount of dead end streets (Gemeente Spijkenisse, 2009).

Conversely, the city centre forms a contrast with the surrounding neighbourhoods because of the higher building blocks and the several indoor shopping malls. The centre is the only neighbourhood which shows a very high diversity of buildings built during different time periods (see figure 49). This process of change is still going on in 2012, as the centre is being refurbished and new buildings are being added (Gemeente Spijkenisse 2012). These changes are nowhere near incremental and therefore could negatively affects the familiarity with the neighbourhood for the frail elderly inhabitants and therefore are of interest for this graduation project. Furthermore, the diversity might be beneficial for the distinctiveness of the neighbourhoods, it might result in illegibility and therefore further analysis on a lower scale is essential.

As stated in the aim of this graduation thesis, the designs should be representative for other locations. Therefore, the neighbourhood design locations should preferably be within neighbourhoods with different street patterns and building typologies. Consequently the centre, a neighbourhood from the reconstruction period and a neighbourhood built during the new town period are suitable as design locations.

17.3 Public + green space | Comfort

The analysis of public and green spaces is related to in literature found theme of comfort. Comfort refers to the extent to which streets enable people to visit places of their choice without physical or mental discomposure and to enjoy being out of the house. Comfortable cities provide informal green spaces and squares and quiet routes and zones (Burton and Mitchell, 2006). Spijkenisse is located at the edge of the Randstad and lies right between the urban city of Rotterdam and the green landscape of the polders on the south (Gemeente Spijkenisse, 2010). The municipality of Spijkenisse published that per home their is 165 square meter of green within a 500 meters reach. However, the municipality also acknowledges that many inhabitants don’t experience the green they are surrounded by (Gemeente, 2010). The acknowledgement is confirmed by the findings of the interviews, where 40 percent of all frail elderly participants state that parks are outside a 10 minute walking radius from their homes.

On city scale figure 50 illustrated what might be the reason for the inhabitants’ perception of inaccessibility of the green (parks) in Spijkenisse, namely the neighbourhood greens are highly fragmented. And because of this lack of structure, the links to the bigger parks are not being made visible. Furthermore, the fragmented greens are often ill maintained as has been discussed in chapter 3, and therefore don’t add to the quality and comfort of the public space.

The fragmentation of the green is of interest for this project as green along walking routes is perceived by elderly (an others) as attractive (Michael, Green and Farquhar, 2006). Consequently new green structure combined with walking routes could provide elderly with routes towards their destination and encourage them to be active.

17.4 Safety

Safety refers to the extent to which streets enable people to use, enjoy and move around the outside environment without fear of tripping or falling, being run-over or being attacked. Safe streets have buildings facing onto them, separate bicycle lanes and wide, well-lit, plain, smooth footways (Burton and Mitchell, 2006). These characteristics are mainly of interest for the urban analysis on neighbourhood scale. For the analysis on city scale the ‘leefbaarheidsonderzoek Spijkenisse’ (livability study Spijkenisse) done by the municipality of Spijkenisse will form the basis of this analysis together with the findings from the interviews.
part III. analysis of Spijkenisse

Figure 51. General sense of safety per neighbourhood (Last, 2010)

Figure 52. Safety related statements and respective answers made by frail elderly participants of the Erasmus MC interview (by the author)
part III. analysis of Spijkenisse

Figure 53. Word cloud showing the keywords of the remarks the inhabitants made during the interviews (by the author)
part III. analysis of Spijkenisse

figure 54. The three selected neighbourhoods for the project location (by the author)

figure 55. The location of the project location in relation to the public facilities. Each neighbourhood with a centralities covering a walkable distance up till 800 meters (by the author)
Livability study

Part of the livability report is the research into how the inhabitants of Spijkenisse experience the safety in their neighbourhoods. Although this research includes inhabitants of all different age groups, this does give a good impression of which neighbourhoods could be problematic or not. Figure 54 shows in dark grey the neighbourhoods that have been classified by its inhabitants as relatively unsafe. Because of the various aspects of safety, it is not possible to draw conclusions from this general kind of analysis. However, it does show neighbourhoods that could be of interest for design intervention on the theme of safety.

Interviews

During the interviews several question were asked that are related to safety. Figure 52 shows the statements and respective answers. An alarming finding is that almost half of the frail elderly said that they are afraid of crime and being bothered when walking through their neighbourhood in the dark. While this does not have to be related to the design of the built environment, aspects such as buildings facing the street and minimizing the amount of blind walls in a street can help the overall feeling of safety (Burton and Mitchell, 2006). Two aspects that are however very related to the built environment are maintenance and the accessibility of footways. Both of which were considered to be bad by more than a quarter of the frail elderly participants.

The problems with maintenance and footways have been further underlined by the remarks participants gave at the end of the interview. Figure 53 shows the world cloud that was based on the remarks which clearly shows the high amount of remarks made about the sidewalks, parking and maintenance. A common complaint was the inaccessibility of footways because they were badly maintained, too narrow or because there were cars parked on them. Additionally the greens were said to be badly maintained.

Because these remarks can be highly dependable on which part of the city an inhabitant lives in, further research on the remarks made per neighbourhood needs to be done. Furthermore, many complaints also refer to the job the municipality is doing and cannot be solved by neighbourhood design alone.

17.5 Three design locations

Based on the findings of the urban analysis and interview data on Spijkenisse three neighbourhoods have been chosen as the design locations for this graduation project. There were a number of basic principles which neighbourhoods should meet.

Firstly, the neighbourhoods had to include elderly inhabitants in order to be sure that the interventions will be relevant. Furthermore, the results from the GPS tracks, interviews and movement diaries are more reliable when a substantial amount of neighbourhood inhabitant participated. This has been done by mapping the frail participants as shown in figure 40 locations have been chosen with a relatively high amount of frail elderly interview participants.

Secondly the analysis of the interviews found that the definition of the neighbourhood differed within the group of frail elderly. Therefore three adjacent neighbourhoods were chosen with a relatively high amount of elderly inhabitants and interview participants; the Centre, Sterrenkwartier and the centre of de Akkers. In this section an explanation will be given per neighbourhood why these neighbourhoods are relevant for the graduation project based on the urban analysis presented in the beginning of this chapter. From chapter 18 onwards further analysis will be done on the neighbourhood resulting in a design task definition.

Centre

The centre has been chosen as a design location because of different reasons. First of all, due to the high amount of services and facilities it is a very important
part III. analysis of Spijkenisse

LEGEND
- - - 800 m radius
- - 500 m radius
sports-community
community
apothecary
GP
hospital
built environment
of Spijkenisse
the three chosen
neighbourhoods

figure 56.
Location of design location in relation
to the elderly specific facilities in
Spijkenisse, in theory covering all the
three neighbourhoods (by the author)

90
part III. Analysis of Spijkenisse

**Figure 58.** Network of main city roads separated from amenities and facilities in the three neighbourhoods (by the author)

**Figure 59.** Network of public transport with stops located nearby the concentration of facilities and amenities in the three chosen neighbourhoods (by the author)
part III. analysis of Spijkenisse

Figure 60. Map of Spijkenisse showing the different building periods of the Centre, Sterrenkwartier and de Akkers, scale 1:80,000 (by the author)
location for elderly and other inhabitants of Spijkenisse. Furthermore, the neighbourhood includes several public transport stops of which the surrounding public space and the routes from and towards the centre are of interest for design interventions. Thirdly, due to the high diversity of building typologies and the ongoing the transformations the centre is in danger of or already is becoming illegible and unfamiliar for elderly. Furthermore, inhabitants Spijkenisse qualify the centre as being unsafe which hindrances frail elderly in fulfilling their out-door mobility goals such as shopping.

Sterrenkwartier
Sterrenkwartier is a suburban neighbourhood in the middle of Spijkenisse built in the first growth period after the Second World War. The neighbourhood hardly has any facilities and is surrounded by green and therefore quite typical for a suburban neighbourhood and therefore of interest as an exemplary design location. Furthermore, the neighbourhood has been built based upon the neighbourhood principle where the neighbourhood is supposed to have a substantial neighbourhood centre providing in the needs of its inhabitants (Perry, 1960). Forty year later the neighbourhood, similar to other neighbourhoods of that time period, lacks facilities (see figure 55-57) and depends on services of other neighbourhoods such as the city centre. Unfortunately the inhabitants have to cross the main roads and green spaces which are designed to surround the neighbourhood which could negatively affect the feeling of traffic safety and accessibility. The typical similar building typologies lead to a neighbourhood that lacks distinctiveness and which can negatively affect the legibility of the public space.

de Akkers
The neighbourhood the Akkers was built during another period than the Sterrenkwartier, the second large building period of Spijkenisse, the 1980s. The neighbourhood section that is of interest for this graduation project is the centre. The centre of the Akkers is characterized by the elevated metro line and station and the surrounding parking lots combined with the typical dead end streets of that time. Furthermore, inhabitants qualify the neighbourhood as being unsafe during the interviews. On the positive side, the centre of the Akkers has a high amount of facilities and different types of building typologies which add to the accessibility and the distinctiveness of the area and on which the inhabitants of Sterrenkwartier and other neighbourhood might depend.
part III.

Analysis of Spijkenisse

Figure 61.
Map of the city centre showing the facilities and the structure of roads (by the author)

Figure 62.
Comparison between the elderly of Spijkenisse and elderly inhabitants of the city centre that gave certain answers to the question: Are these services within a ten minute walking distance from your home? (by the author)
18. Centre

18.1 Infrastructure + public transport + facilities | Accessibility

Infrastructure
The centre of Spijkenisse is surrounded by infrastructure, with an outer ring formed by the regional roads and an inner ring of city roads around the inner centre (see figure 61). Around the city roads many parking facilities can be found, making the city centre very well accessible for cars. There is however a small amount of roads leading to the neighbourhoods around the city centre, which can be problematic for people on foot or by bicycle who also have to cross the regional roads on the few places they can be crossed.

Facilities
Figure 61 points out all the facilities which can be found in the centre of Spijkenisse, out of which emerges a core of facilities in the inner city centre. Visible is the high amount of facilities which appear to be more than sufficient for the inhabitants of this neighbourhood. This observation is supported by the results from the interviews, showing that on average more elderly agreed than disagreed with the question if a certain facility is within a ten minute walking distance. The ranking of the accessible and less accessibly facilities in the centre is just about the same as the answers given by for the whole of Spijkenisse (see figure 62). However, two answers are remarkable. Firstly 25 percent found parks to be outside a ten minute walking reach although there is a city park within the centre. A reason for this perception might be the big Marrwijkflat which forms a border on the West of the park and the lack direct routes connecting the housing blocks at the far North and the far East of the park.

Public transport
There are several bus stops spread throughout the centre connecting its inhabitants to the other neighbourhoods.
part III. analysis of Spijkenisse

LEGEND
- before 1920
- 1921-1945
- 1946-1965
- 1966-1975
- 1976-1985
- 1986-1995
- 1996-2005
- after 2006
- trees
- grass
- water
- covered passageway

figure 63. Map of the centre showing the different building periods, scale 1:10,000 (by the author)

figure 64. Drawing showing the inwards orientation and lack of connecting roads and axis of the inner centre, which contains many facilities (by the author)
part III. analysis of Spijkenisse

and villages. Connecting the city centre to Rotterdam and further is the metroline. When in the 1980s the metro line from Rotterdam and Hoogvliet was extended towards Spijkenisse a reasonable part of the centre all ready existed (see figure 63) and therefore the metro station was placed on the south of the centre resulting in the fact that there is a limited amount of roads leading towards the station (see figure 61). Furthermore, as shown by figure 66, these roads are quite difficult to reach because of the large bus station over the full length of the metro station which needs to be crossed in order to get to these roads.

18.2 Morphology | Legibility, distinctiveness, familiarity
As has been explained in chapter 3 the approach to the built of Spijkenisse has been focussed on the residential areas for a long period of time and the centre became of importance after the Groeikern policy had ended in 1985 (Reijndorp, Bijlsma and Nio, 2012). This shift is clearly visible in the map showing the construction periods, as most of the buildings in the inner centre are built after 1985. Remarkable is the contrast between the scale of the shopping malls built in the 1980s and 1990s and the remainder of the buildings. Additionally these shopping malls effect the accessibility of the centre because the covered walkways (see figure 66) generally close after five pm and form large blocks which block direct walking routes, most importantly from the metro station towards the inner centre (see figure 64). Furthermore the contrast in scales and building typologies makes the centre quite fragmented (see figure 63).

A second remarkable feature of the centre is the line of small houses marking the top of the inner centre. As you can see on the figure on the top of page 98, these buildings are in general significantly older than the rest of the centre. The reason for this structure is that these houses form the remainder of the village Spijkenisse ones was. The buildings were built alongside a dike, which is typical for many other Dutch villages because of the high water levels (Gemeente Spijkenisse, 2012).

While this structure can be regarded as an asset with its historical houses and monuments and adds to the distinctiveness of the centre, it is not used to its full potential. Firstly because the main axes of the centre lead past the back of the houses which aren’t attractive and because of the higher level present themselves as a border. And secondly, while there are some connections leading towards and over the dike, they are narrow, quite steep and in some cases like the Spuistraat covered with a synthetic and steel construction which partly blocks the view towards the dike (see figure 65). All negatively affecting the legibility and accessibility of the city centre.

18.3 Public + green space | Comfort
The fragmentation observed in the previous section can also be detected in the design of the public spaces and the connections between them. Or better yet, the lack of connections between them. As has been established in section 18.1 the park located in the centre was not found to be sufficiently accessible according to the elderly inhabitants. And it is exactly this park which forms a great opportunity for the municipality to promote the wanted image of a green city, as it forms the entry to the centre from the metro station. Unfortunately the entry towards the city centre through the park is not clearly marked by the design of the area and therefore cause for confusion. This lack of a distinct entry is underlined by the fact that the municipality felt the need to hang up a banner at the entry of the park. When walking towards the inner centre visitors and inhabitants are confronted with the shopping mall called the stadhuispassage which during the day forms great contrast with the surrounding public space due to its semi indoor design. And after 5 p.m. forming an even larger border when it closes, making it difficult for especially frail elderly to entre the public space of the inner centre where all the facilities are located.

Another aspect which prevents the centre from having a well working and comfortable network of public space is the Marrewijkflat and its surroundings.

As has been noted in the section on accessibility the
part III. analysis of Spijkenisse

figure 64. Drawing showing the potential of strengthening the axe running through the centre combined with facilities (by the author)

figure 65. sections of the Marrewijklaan, Voorstraat, Stadhuispassage, Winkelcentrum Kopspijker and Spuistraat scale 1:500 and Schepenpad 1:1000 (by the author)
figure 66. sections of the Marrewijklaan, Voorstraat, Stadhuispassage, Winkelcentrum Kopspijker and Spuistraat scale 1:500 and Schepenpad 1:1000 (by the author)
I am afraid of crime and being bothered when I walk through my neighbourhood in the dark.

In my neighbourhood the footways are badly accessible

My neighbourhood is badly maintained

I am concerned with traffic safety when I walk through my neighbourhood

At night the neighbourhood streets are not sufficiently lid

LEGEND

Yes
No
I don't know
Irrelevant
No answer

figure 67 + 68. Safety related statements and respective answers made by frail elderly participants of the Erasmus MC interview, comparing the Centre to Spijkenisse as a whole (by the author)
Marrewijk flat forms a distinct border and blocks any connection towards the West of the park. Furthermore, public space on the East of the flat is filled with parking spots which strengthens the border and makes it feel like a leftover space, even though it forms the decor for the weekly market of the city centre.

18.4 Safety
When performing an urban analysis on safety it is important to establish which spatial aspects add to the feeling of safety. According to the literature study safe public spaces have buildings facing onto them, separate bicycle lanes and wide, well-lit, plain and smooth footways (Burton and Mitchell, 2006; Jackson, 2003). Although in general the centre scores quite well on the theme of safety there are some concerns rising from the urban analysis and the interview data.

As discussed an important neighbourhood road leads past the back of the dike houses, and therefore has a lack of buildings facing onto it. Furthermore, the Marrewijk flat does face onto the road that passes it on the side of the parking spaces, however the bottom level of the building is filled with storage spaces and therefore social control is not provided. This feeling of unsafety might be further strengthened by the fact that the public space around it is mainly used as a parking lot.

While there is a lot of traffic running through the centre, especially around the metro station, according to the interviews traffic safety is not a major concern (see figure 67 and 68). The maintenance and accessibility of the footways of the neighbourhood however is, even compared with the city average.

18.5 Conclusions
Although the city centre is fortunate to have a high amount of facilities and public transport connections, the urban layout does not make use of its strong suits to its full potential. The main problem is that the centre, due to its morphology and layout of its public space, is fragmented and lacks legible connections.

The comfort, accessibility and legibility of the city centre could be improved by strengthening the axes running through the centre as has been illustrated in figure 64. These axes connect the many facilities of the centre, strengthening the accessibility. Furthermore, by improving the footways and making use of the park the connections add to the comfort and safety of the neighbourhood. And last but not least, it makes use of the distinctive qualities of the centre such as the historical dike structure.
**part III. analysis of Spijkenisse**

**Map of Sterrenkwartier showing the facilities and the roads structure (by the author)**

<table>
<thead>
<tr>
<th>Spijkenisse</th>
<th>Sterrenkwartier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train station</td>
<td>✔</td>
</tr>
<tr>
<td>Hiking or biking trail</td>
<td>✔</td>
</tr>
<tr>
<td>Swimming pool</td>
<td>✔</td>
</tr>
<tr>
<td>Laundry service</td>
<td>✔</td>
</tr>
<tr>
<td>Library</td>
<td>✔</td>
</tr>
<tr>
<td>Gym</td>
<td>✔</td>
</tr>
<tr>
<td>Post office</td>
<td>✔</td>
</tr>
<tr>
<td>Fitness centre</td>
<td>✔</td>
</tr>
<tr>
<td>Place of worship</td>
<td>✔</td>
</tr>
<tr>
<td>Neighbourhood association building</td>
<td>✔</td>
</tr>
<tr>
<td>Bar/restaurant</td>
<td>✔</td>
</tr>
<tr>
<td>Public park</td>
<td>✔</td>
</tr>
<tr>
<td>Apothecary</td>
<td>✔</td>
</tr>
<tr>
<td>ATM</td>
<td>✔</td>
</tr>
<tr>
<td>Hairdresser</td>
<td>✔</td>
</tr>
<tr>
<td>Local convenience store</td>
<td>✔</td>
</tr>
<tr>
<td>Butcher</td>
<td>✔</td>
</tr>
<tr>
<td>Bakery</td>
<td>✔</td>
</tr>
<tr>
<td>Vegetable shop</td>
<td>✔</td>
</tr>
<tr>
<td>Supermarket</td>
<td>✔</td>
</tr>
<tr>
<td>Bus-, tram- or tube stop</td>
<td>✔</td>
</tr>
</tbody>
</table>

**Legend**
- ✔: Yes
- ✗: No
- ❓: I don't know
- ☑: Relevant
- ☐: Irrelevant
- ❌: No answer

**Legend**
- Trees
- Grass
- Water
- Bus stop
- Metro stop
- GP
- Supermarket
- Walking route
- Neighbourhood road
- Main neighbourhood road
- City road
- Elevated metroline
19. Sterrenkwartier

19.1 Infrastructure + public transport + facilities

Accessibility

*Infrastructure*

As has been put forward in the urban analysis on the city scale, the main roads lead around the residential neighbourhoods. Similar to the centre there are a limited amount of roads connecting the residential neighbourhood with its surroundings. There is however a more straightforward structure of hierarchical roads due to its morphology, which is a strength for the design of elderly friendly neighbourhoods (see the book on Design principles for greying cities by the author).

*Facilities*

The majority of the facilities in Sterrenkwartier are located towards the North in the middle of the neighbourhood (see figure 69). Because of the central location these facilities should be within a ten minute walking distance. When comparing this observation with the results from the interview the prognosis is confirmed (see figure 70). There are however some facilities which score significantly lower than average. Some results are however not that surprising as for instance dry cleaners and post offices areas mainly located in more urban environments such as city centres and could be considered as not daily facilities. However, similar to the centre, the accessibility of a park scores remarkably low while it is located in the middle and North of the neighbourhood. Another low scoring facility is the neighbourhood centre, while it on paper is within a ten minute walking distance of all inhabitants. This might be because of its location surrounded by residential buildings and the fact that it faces its back towards the main roads.

Something which isn’t reflected in the outcome of the interviews is the growing move of facilities out of the residential neighbourhood resulting in a growing vacancy rate, visible when walking through the neighbourhood.
part III. analysis of Spijkenisse
part III. analysis of Spijkenisse

(see figures 71 till 74). The growing vacancy might be the result of the growing amount of facilities in the centre and the upscaling of facilities in general which leads to the disappearance of neighbourhood services. Furthermore, the facilities turn their backs towards the main roads (see the figures the left page) and therefore don’t make full use of their location.

The introvert layout of the centre is something which can be changed, the upscaling of facilities is however a hard phenomenon to influence by for instance by the use of urban design.

The move of facilities is a problem which is particularly difficult for neighbourhoods as Sterrenkwartier of which the neighbourhood principle was the starting point and connections to other neighbourhoods were not a priority. Especially in terms of facilities because one of the main goals of people like Perry was to make neighbourhood self sufficient in terms of facilities (American society of planning officials, 1960).

The growing amount of vacant buildings however does underline the importance of connecting residential neighbourhoods such as Sterrenkwartier to neighbourhoods with a higher amount of facilities such as the city centre, especially for less mobile groups such as frail elderly.

**Public transport**

Similar to the city centre the metro line was added after the neighbourhood was built and therefore the metro station is located at the edge of Sterrenkwartier. Even more so than the centre, it is barely connected to its surroundings, apart from the main city roads.

The buses however are conveniently spread over the neighbourhood and located near services.
part III. analysis of Spijkenisse

figure 75
Layers of the urban plan of Sterrenkwartier (by the author)
19.2 Morphology | Legibility, distinctiveness, familiarity
Sterrenkwartier was predominantly built during the 1970s (see figure 77). As explained in chapter 3 planning and building processes of that time were strongly rationalised. The rationalisation and modernisation was expressed by the built of high rise surrounded by long straight stacked low rise buildings (Reijndorp, Bijlsma and Nio, 2012). In the case of Spijkenisse a clear zoning is visible with five storey high buildings in the North, low rise housing blocks in a stamp like composition throughout the rest of the neighbourhood and a park in the middle which ends in the neighbourhood centre in the North. This clear structure is helpful for the legibility of the neighbourhood. And although some changes have been made during the last decades they have been rather incremental and therefore are likely to have not affected the familiarity of the neighbourhood for the frail elderly inhabitants. The distinctiveness however could be improved on street level due to the similarity in building typologies of the low rise housing blocks.

As has been observed in section 19.1 the Sterrenkwartier could benefit from good connections to other neighbourhoods. Unfortunately Sterrenkwartier has a lack of connections towards other neighbourhoods. The main reason is the concept which was behind the built of this neighbourhood as has been discussed in chapter 3, the neighbourhood principle. Surrounding the neighbourhood with main roads which are difficult to cross (see figure 69) Additionally modernist planners and architects of that time believed in a ‘tabula rasa’ approach, considering the context to be none existent. The wish for a blank canvas was fulfilled in Sterrenkwartier and its neighbour Groenewoud by literary covering the context of the polder with sand and removing it from the then already existing part of the centre (see figure 75). The leftover space between the all ready existing buildings and roads was filled with green space.

19.3 Public + green space | Comfort
Although Sterrenkwartier is a green neighbourhood it does not make use of the public space to its full potential. Firstly, the neighbourhood is surrounded by green but it is treated like left over space, mainly due to the lack of roads and paths leading from the neighbourhood through these greens.

Secondly, while green can be attractive alongside roads, the greens along the Heemraadlaan and Hekelingseweg are badly maintained and hereby blocking the view to other road users (see figure 78).

And finally the park in the middle of the neighbourhood is connected to the neighbourhood, however the facilities located in and around the park are surrounded by gates and the neighbourhood centre turns its back to the park.
figure 76
Drawing showing the potential of the central axis running through the Sterrenkwartier connecting facilities to green and the neighbourhood to its surroundings (by the author)
### part III. Analysis of Spijkenisse

#### Map showing the building periods of the Sterrenkwartier in combination with the road structure (by the author)

**Figure 77**

#### Sections of the Heemraadlaan and Hekelingseweg scale 1:1000 (by the author)

**Figure 78**
part III. analysis of Spijkenisse

**Spijkenisse**

- **I am afraid of crime and being bothered when I walk through my neighbourhood in the dark.**
- **In my neighbourhood the footways are badly accessible.**
- **My neighbourhood is badly maintained.**
- **I am concerned with traffic safety when I walk through my neighbourhood.**
- **At night the neighbourhood streets are not sufficiently lid.**

**Sterrenkwartier**

- **I am afraid of crime and being bothered when I walk through my neighbourhood in the dark.**
- **In my neighbourhood the footways are badly accessible.**
- **My neighbourhood is badly maintained.**
- **I am concerned with traffic safety when I walk through my neighbourhood.**
- **At night the neighbourhood streets are not sufficiently lid.**

**LEGEND**
- Yes
- No
- I don’t know
- Irrelevant
- No answer

*figure 79+80. Safety related statements and respective answers made by frail elderly participants of the Erasmus MC interview, comparing the Sterrenkwartier to Spijkenisse as a whole (by the author)*
19.4 Safety
In terms of safety the interviews show that a large amount of elderly in Spijkenisse are afraid of being bothered when they walk through their neighbourhood in the dark. The reason for this feeling can’t be found in the lighting of the public space, as more than 90 percent find their neighbourhood to be sufficiently lit. An important aspect however could be the lack of social control on the main roads around the neighbourhood. Due to the ill maintained greens and the backs of the buildings turned towards the pedestrian routes (see figure 78).

19.5 Conclusions
Sterrenkwartier is a neighbourhood which has many opportunities due to its legible and familiar structure and the presence of a park in and around the neighbourhood. All combined with daily facilities needed for its inhabitants. The neighbourhood however does not make use of these opportunities due to the lack of connections and the introvert character of the buildings in which the facilities are located. Additionally, Sterrenkwartier is under threat of losing its facilities partly due to the adding and upscaling of facilities in nearby neighbourhoods such as the centre.
### Spijkenisse
- Train station
- Hiking or biking trail
- Swimming pool
- Laundry service
- Library
- Gym
- Post office
- Fitness centre
- Place of worship
- Neighbourhood association building
- Bar/restaurant
- Public park
- Apothecary
- ATM
- Hairdresser
- Local convenience store
- Butcher
- Bakery
- Vegetable shop
- Supermarket
- Bus-, tram- or tube stop

### De Akkers
- Health centre
- Apothecary
- GP
- Parking
- Cafe/restaurant
- Gym
- Physical therapist
- Hairdresser
- ATM/bank
- Post office
- Bus stop
- Metro stop
- Supermarket
- Bakery
- Letterbox
- Community building

**Figure 81**
Map illustrating the location of facilities in de Akkers, scale 1:10,000 (by the author)

**Figure 82**
Graphics showing the answers given to the question: Are these services within a ten minute walking distance from your home? Comparing de Akkers to Spijkenisse (by the author)
20. de Akkers

20.1 Infrastructure + public transport + facilities | Accessibility

Infrastructure

The Akkers has an infrastructure network characteristic for neighbourhoods built in the 1980s, a main neighbourhood road with branches of neighbourhood roads resulting in dead ends (Ubink and van der Steeg, 2011)(see figure 84). There is however a slow traffic network connecting these dead ends. Furthermore, it is framed by a city road on the North and a main neighbourhood road on the East with large parking plots connected to it. All adding to the accessibility of the neighbourhood by car. However, similar to the Centre and Sterrenkwartier the main roads limit the accessibility of other neighbourhoods.

Public transport

Different from the other neighbourhoods the metro station is located in the middle of de Akkers due to the fact the neighbourhood was built after the arrival of the metro station (Reijndorp, Bijlsma and Nio, 2012). The bus stations are located alongside the main city roads and are well spread throughout the neighbourhood (see figure 81).

Facilities

The advantage of the built of the neighbourhood after the metro station is that the facilities were located around this station as well, forming the centre of the neighbourhood (see figure 81). The neighbourhood contains quite a large amount of facilities which is reflected in the answers given by inhabitants of de Akkers. Remarkable however is that de Akkers scores better on accessibility than the centre during the interviews. It is likely that this is because the neighbourhood is somewhat smaller than the centre. Although a library and a swimming pool can be considered as city wide facilities, it might be of interest to locate these facilities in de Akkers as they are quite far away from the centre and could provide in the needs of the inhabitants of the larger surrounding neighbourhoods (see figure 43, p.80).

20.2 Morphology | Legibility, distinctiveness, familiarity

The high amount of dead end streets has a negative effect on the legibility of de Akkers. As mentioned earlier there is a better connected slow traffic network (see figure 85). However, the network misses hierarchy and clear lines necessary for a legibility neighbourhood (Burton and Mitchell, 2010). There is however the remainder of a dike which runs through the middle of the neighbourhood which could work as the main axis (see figure 86). Unfortunately the problem of overgrown greens due to ill maintenance seen in other neighbourhoods is a problem on the dike as well, as they form a border instead of a connection to facilities such as the park on the North of the neighbourhood. Furthermore, de Akkers has similar to the centre some shopping centres. Although they here don’t block direct routes, they are the cause of several blind walls.

20.3 Public + green space | Comfort

De Akkers is surrounded by parks and other types of green public space. The connections towards the parks could be improved mainly by making use of the axis running through the neighbourhood over the dike. Other types of public spaces such as squares are mainly used as parking lots and unfortunately many streets have one or more blind walls facing them.
part III. analysis of Spijkenisse

figure 83
Map showing the building periods of de Akkers, scale 1:10,000 (by the author)

figure 84
Map showing the high amount of dead en streets in de Akkers, scale 1:10,000 (by the author)

LEGEND
- 1976-1985
- 1986-1995
- 1996-2005
- after 2006
- trees
- grass
- water
- covered passageway
- walking route
- neighbourhood road
- main neighbourhood road
- city road
- elevated metroline

figure 85
Map showing the high amount of dead en streets in de Akkers, scale 1:10,000 (by the author)
figure 86
Drawing showing the potential of the central axis structuring de Akkers and hereby connecting the facilities and the park at the border of the neighbourhood to the neighbourhood and its surroundings (by the author)

figure 87
Section of the current Nieuwe Westdijk, scale 1:500 (by the author)
part III. analysis of Spijkenisse

Spijkenisse

I am afraid of crime and being bothered when I walk through my neighbourhood in the dark.

In my neighbourhood the footways are badly accessible.

My neighbourhood is badly maintained.

I am concerned with traffic safety when I walk through my neighbourhood.

At night the neighbourhood streets are not sufficiently lid.

LEGEND

Yes

No

I don’t know

Irrelevant

No answer

de Akkers

I am afraid of crime and being bothered when I walk through my neighbourhood in the dark.

In my neighbourhood the footways are badly accessible.

My neighbourhood is badly maintained.

I am concerned with traffic safety when I walk through my neighbourhood.

At night the neighbourhood streets are not sufficiently lid.

Safety related statements and respective answers made by frail elderly participants of the Erasmus MC interview, comparing de akkers to Spijkenisse as a whole (by the author)
20.4 Safety
Similar to the findings from the ‘leefbaarheidsonderzoek Spijkenisse’ (livability study Spijkenisse) done by the municipality of Spijkenisse, de Akkers has a low score in terms of safety. In particular when it comes to the fear of being bothered, the accessibility of footways and the maintenance there is big room for improvement.
While the fear of being bothered is likely to be the result of more social economic issues, the lack of social control on the roads can be an important factor leading to this fear. Consequently the fear might be reduced when more buildings would face the main walking routes throughout the neighbourhood.

20.5 Conclusions
Due to its central location De Akkers benefits from the accessibility of the metro station and the facilities surrounding it. However, the neighbourhood lacks a clear and hierarchical structure connecting the centre and the rest of the neighbourhood to its surroundings. Therefore a great opportunity lies in the improvement and strengthening of the dike which could from the backbone of the neighbourhood. Furthermore the public space should be improved by letting buildings face the streets, improving the footways and an overall improvement of the maintenance.
part III. analysis of Spijkenisse

Main outdoor mobility goals of 28 frail and non frail elderly participants who filled in the movement diaries during a week (by the author)

Figure 89.

Main outdoor mobility goals of 14 frail and 14 non frail elderly participants who filled in the movement diaries during a week, divided into categories used in the urban analysis (by the author)

Figure 90.

Legend
- frail
- none frail
21. GPS tracking + physical activity diaries

21.1 Main outdoor mobility goals
During the time span of a week 28 elderly inhabitants of the Centre, Sterrenkwartier and De Akkers filled in the movement diaries. During these seven days participants filled in what the goals of their trips were. Obviously participants often had multiple goals during the average of 11 trips per week. As it was not always clear what the main goal was, every outdoor mobility goal was noted (see appendix A). Figure 89 shows which types of facilities were the main outdoor mobility goals of the 28 participants. Similar to several literature studies discussed in part two, daily shopping is the main outdoor mobility goal. Underlining the importance of for instance a supermarket within a walkable distance from the home. The fact that the reason for making a trip in 18 percent of the cases had no direct goal and was more recreational shows that the design of routes themselves are of importance and not only that they connect different facilities. Furthermore, the importance of family and friends underlines the aim of this research to keep mixed age neighbourhoods and cities intact, consequently making it possible for elderly to visit them and not necessarily having to leave the city to do so.

For the purpose of comparing the urban analysis with the findings from the movement diaries the outdoor mobility goals have been divided into the same categories, adding friends+family and no goal (see figure 90). Additionally a distinction has been made between frail and non frail participants. In general the frail and non frail elderly make the same amount of trips, the goals however differ. As shown in the figure on the previous page, the amount of trips with the goal to visit friends and family doubles, which is especially important for elderly to prevent social frailty from surfacing or worsening. Furthermore, frail elderly who have trouble with full filling their daily task due to for instance physical limitations visit more elderly specific facilities such as the doctor.

21.2 Main mode of transportation
When trying to reach the outdoor mobility goals the good news is that none frail as well as frail elderly choose in about 60 percent of the times an active from of transportation, mainly by foot (see figure 91). Another finding is that the elderly prefer the car over public transport when using a motorised type of transportation. It might be because the routes towards the public transport stops are not attractive or the transport itself might be considered to be unsafe. This can be improved, however the great difference between the car and public transport suggests that the car will remain of importance.
figure 91. Maps showing the GPS trackings illustrating the routes used by 28 frail and non-frail participants when using motorised transportation when trying to reach their outdoor mobility goals, scale 1:10,000 (by the author).
part III.

a analysis of Spijkenisse GPS track equaling one journey by car or public transport

figure 92.
Maps showing the GPS trackings illustrating the routes used by 28 frail and non frail participants when using walking or cycling as mode of transportation when trying to reach their outdoor mobility goals (by the author)

LEGEND

- frail
- none frail

figure 91.
Types of transport used by frail and none frail elderly when trying to reach their outdoor mobility goals (by the author)

LEGEND

- location of outdoor mobility goals
- GPS track equaling one journey by bike or on foot

figure 92.
Maps showing the GPS trackings illustrating the routes used by 28 frail and non frail participants when using walking or cycling as mode of transportation when trying to reach their outdoor mobility goals, scale 1:10,000 (by the author)
figure 93. Maps showing the GPS trackings illustrating the routes used by 14 frail participants when using walking or cycling as mode of transportation, scale 1:10,000 (by the author)
LEGEND

- GPS track equaling one journey by bike or on foot

Figure 94. Maps showing the GPS trackings illustrating the routes used by 14 none frail participants when using walking or cycling as mode of transportation, scale 1:10,000 (by the author).
part III. analysis of Spijkenisse

figure 95. Maps showing the tangling of GPS trackings illustrating the several routes used by 28 frail and non frail participants when using walking or cycling as mode of transportation between neighbourhood, scale 1:10,000 (by the author)
21.3 Main routes
Figures 91 till 94 show the processed GPS trackings on the map of Spijkenisse. Unfortunately no GPS tracking were available from participants in de Akkers in the time span of this graduation project. The GPS trackings however give a good indication on which neighbourhood and city roads are being used between and in the neighbourhood of the design location.

Figure 91 illustrated the roads used by car. Not surprisingly predominantly the main city roads around the neighbourhoods and the main neighbourhood roads are being used to get there. While many of the goals lay within the city borders the car and metro line are for a large part of the times being used to go to friend and family in other cities in the Netherlands.

When comparing the motorised transportation routes to the active transport routes it is clearly visible the pedestrians and cyclists prefer other routes and seem to avoid the main city roads. This is in some ways remarkable as studies done by Borst and other in 2008 and 2009 shows that elderly prever the main city roads to walk along in the case of Schiedam. On the other hand, Spijkenisses urban layout is strongly different from that of Schiedam. Furthermore, the urban analysis pointed out that the main city roads are dominated by cars and the metroline and there is a lack of facilities and social control on the pedestrian routes which can explain the choice or routes.

While the main activity is within the city some elderly do choose active transport to go outside the city border, for instance to make a bike ride through the surrounding landscape.

When zooming into the neighbourhood locations it becomes clear that the elderly do use the neighbourhood road extensively, although some main lines can be detected. For the purpose of the formulation of a design task the tangeling of lines between the neighbourhoods is of interest. This suggests that the urban layout on these location does not provide a clear route (see figure 95). In figure 93 and 94 the GPS trackings from the active transportation have been seperated into those of the 14 frail and 14 none frail participants. Although no strong conclusions can be made based on these tracking due to the low amount of people it does show a pattern which suggests that frail elderly are mainly active within the direct surroundings of their neighbourhood while none frail elderly make more use of routes throughout the city.

21.4 Comparing the urban analysis with the GPS trackings
The urban analysis has shown some weaknesses and threats in the design of the main city roads and the connections between the neighbourhood for pedestrians an cyclist and this has been underpinned by the findings from the GPS tracks.

While the findings from literature suggest a high dependence on the facilities in the neighbourhoods and the focus of the urban analysis has focussed on the environments more isolated as well, the GPS findings point out the importance of the connection to facilities in other neighbourhoods.

Furthermore the axis which have been highlighted in the urban analysis as opportunities for design come forward in the GPS trackings as well. Suggesting these axis might be interesting locations to improve the structure inside and between the neighbourhoods.

And finally, while the main mode of transportation is by bicycle or on foot, the car forms an important factor for elderly. The goal of the design is however to promote active ageing and therefore facilities for the car should be provided however the choice for a bicycle or going by foot should be as attractive as possible with the use of the design principles.
<table>
<thead>
<tr>
<th>CENTRE</th>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axe improving the legibility</strong></td>
<td>+ + +</td>
<td>+ -</td>
</tr>
<tr>
<td><strong>The park as entrance and meeting point</strong></td>
<td>+ + + + +</td>
<td>+ -</td>
</tr>
<tr>
<td><strong>Axe improving the accessibility</strong></td>
<td>+ +</td>
<td>+ +</td>
</tr>
<tr>
<td><strong>High amount of changes leading to unfamiliarity</strong></td>
<td>- -</td>
<td>- -</td>
</tr>
<tr>
<td><strong>Unsafe on main roads preventing elderly from entering the neighborhood</strong></td>
<td>- -</td>
<td>- -</td>
</tr>
<tr>
<td><strong>Limiting maintenance due to economic crisis</strong></td>
<td>- -</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STERRENE- KWARTIER</th>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Central axis improving the accessibility</strong></td>
<td>+ +</td>
<td>+ -</td>
</tr>
<tr>
<td><strong>The park as a meeting point</strong></td>
<td>+ +</td>
<td></td>
</tr>
<tr>
<td><strong>Green space around the neighborhood</strong></td>
<td>+ +</td>
<td></td>
</tr>
<tr>
<td><strong>Disappearance of facilities</strong></td>
<td>- -</td>
<td>- -</td>
</tr>
<tr>
<td><strong>Unsafe on main roads preventing elderly from leaving the neighborhood</strong></td>
<td>- -</td>
<td></td>
</tr>
<tr>
<td><strong>Limiting maintenance due to economic crisis</strong></td>
<td>- -</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DE AKERS</th>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dike as a central axis</strong></td>
<td>+ +</td>
<td>+ +</td>
</tr>
<tr>
<td><strong>Facilities such as health center and metro station beneficial for other neighborhoods</strong></td>
<td>+ +</td>
<td>+ +</td>
</tr>
<tr>
<td><strong>Unsafe on main roads preventing elderly from leaving the neighborhood</strong></td>
<td>- -</td>
<td>- -</td>
</tr>
<tr>
<td><strong>Feeling of unsafety preventing elderly from going out</strong></td>
<td>- -</td>
<td></td>
</tr>
<tr>
<td><strong>Limiting maintenance due to economic crisis</strong></td>
<td>- -</td>
<td>- -</td>
</tr>
</tbody>
</table>
22. SWOT: design task definition

22.1 SWOT analysis
The urban analysis combined with the GPS trackings, interview and movement diary data have resulted in a strength, weaknesses, opportunities and threats analysis (SWOT) of the neighbourhoods. The output from the SWOT analysis of each neighbourhood is further analysed in an confrontation matrix shown in table 2. By analysing each different combination of strengths, weakness, opportunity and threat the most important strategic issues are defined. Especially the places where strengths and opportunities as well as weakness and threats come together are of great importance. The strategic issues form the basis of the design task definition.

Centrality and accessibility of facilities
As has been discussed in the beginning of the analysis on city scale one of the biggest strengths of Spijkenisse is the centrality of facilities in almost every residential neighbourhood. However in the centre direct routes towards the facilities are blocked and the inner centre is turned inwards, which is comparable on a smaller scale to the centre of Sterrenkwartier.

Additionally in Sterrenkwartier daily neighbourhood facilities are under threat. It is likely that some facilities will disappear from the Sterrenkwartier, however as literature has proven it is of great importance to retain the essential daily facilities within a walkable distance (American Intitute of Architects, 1985; Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Burton and Mitchell, 2006; Carstens, 1985; Department of Transport, Local Government and the Regions, 2001; Gehl, 2011; Llewelyn-Davies, 2000; Mahmood et al., 2012; Michael, Green and Farquhar, 2006; Mollenkopf et al., 2004; Pearce, 1982; Rantakokko et al., 2012; Temelova and Dvorakova, 2012).

Sterrenkwartier can be further strengthened by for instance adding elderly specific facilities to the centre. Because some facilities are only available on city scale, the connection between the centre and residential neighbourhoods such as Sterrenkwartier is of importance.

Legibility and connections between the neighbourhoods
However, the GPS trackings and urban analysis have shown that the connections between the neighbourhoods are weak. The overall accessibility and legibility of the three neighbourhoods can be improved by strengthening and connecting the different axes. As a result the structure of the public space in combination with the accessibility of the facilities in the neighbourhood
part III. analysis of Spijkenisse

Connecting the centres of the neighbourhoods and 
there facilities

Connecting the central facilities to the existing 
neighbourhood axis

Improving the road structure and network of public 
spaces by connecting them to the central neighbourhood 
axes

Connecting the centres of the neighbourhoods and 
there facilities
Maintenance and safety
The design of the main city roads could be improved by maintaining and reducing the sightline blocking vegetation. However, due to the economic crisis combined with the high amount of greens, the maintenance is being reduced. This not only is a threat to the safety on the main city road but also for the overall attractiveness and safety of the public spaces such as parks alongside pedestrian routes. Further attention needs to be paid to the maintenance of the sidewalks as elderly pedestrians state that footways are often badly accessible which according to literature can cause them to feel unsafe (Burton and Mitchell, 2006; Bjornsdottir, Amadottir and Halldorsdottir, 2011; Mahmood et al., 2012; Rantakokko et al., 2012)
Next to the lack of traffic safety on the main city roads and their crossings social safety is an issue in de Akkers. This can partly be explained by the dead end streets and blind walls facing them.

22.2 Design task definition
The design task is summarised in six main assignments illustrated in figure 96a and b.
Firstly, the neighbourhoods should make use of the central location of their facilities and if necessary strengthening the centres making sure that daily facilities are within a walkable distance from the homes of elderly inhabitants.
However the location of the facilities are often turned inwards and direct routes are being blocked. Therefore the second task is to connect the central facilities to the existing neighbourhood axis.
The third design task is to use the existing neighbourhood axes to improve the structure of the road network and public space of the neighbourhoods and if necessary additional improvements next to the axis are being made.
Because some facilities can’t be expected to be located in every neighbourhood the fourth design task is to connect the pedestrian networks of the neighbourhoods and their centres with each other.
In order to do so the fifth design task is to improve the accessibility of the neighbourhoods for slow traffic from the main city roads and therefore improving the safety of the street crossings.
And finally, social safety of slow traffic routes is expected to improve by removing or replacing difficult to maintain greens, make buildings face the street where possible and combine different types of transportation.
Improving social safety by for instance removing or replacing high maintenance greens, make building face the street where possible and combining different types of transportation.
PART IV.
URBAN DESIGN: 
SPIJKENISSE’S ROUTE 
TOWARDS ACTIVE AGEING
part IV. urban design: Spijkenisse’s route to active ageing

figure 97. plan scale 1:15000 of the designed route (by the author)
23. Vision

23.1 Route
As a response the design task definition explained in chapter 22, a design has been made for the three selected neighbourhoods. A design in the form of a route has been chosen based on the findings of the urban analysis as well as to the literature, interviews and movement diary data. The location is shown in figure 97 on the left.

The route provides frail elderly and other inhabitants of the three neighbourhoods with a direct route connecting the facilities of the different neighbourhood centres both addressing the tasks found in literature as well as the urban analysis (Burton and Mitchell, 2006; Gehl, 2011; Handy et al., 2002; Lynch, 1972). Second, because it is designed especially for bicycles and pedestrians it hopefully encourages frail elderly reach their outdoor mobility goals by foot or by bicycle. Even more than they do so at the moment hereby encouraging active ageing which can postpone and even reverse the frailty process (Ruuskanen and Ruopila, 1995). Thirdly, the route is located on the axes of the neighbourhoods and as a result connecting the fragmented public space network, found to be a problem in the urban analysis. Which additionally adds to the legibility of the neighbourhoods (Michael, Green and Farquhar, 2006; Burton and Mitchell, 2006). Furthermore, by choosing the axes for the design location the route is embedded in the urban structure and therefore connected to the existing main neighbourhood and city roads connecting the route to other neighbourhoods (see figure 97).

The fifth strength of the route is that is surrounded by and connects several parks and other types of green public spaces. The presence of the green is of importance for comfortable and attractive pedestrian routes (Borst et al., 2008; Burton and Mitchell, 2006; Mahmood et al., 2012; Michael, Green and Farquhar, 2006; Sprado, 2011) and the route makes the parks more accessible, which is needed according to the answers given by elderly inhabitants in the interviews.

The fact that route leads through different types of neighbourhoods not only can make it an example for other neighbourhoods built during the same time periods, but additionally adds to the distinctiveness of the route due to the diverse types of architecture (Burton and Mitchell, 2006; Lynch, 1972; Michael, Green and Farquhar, 2006; Gehl, 2011; Cullen, 1968).

Finally, next to the design of the public space of the route civil and elderly facilities will be added and made more visible in de Akkers and Sterrenkwartier. Thus providing in the needs of elderly inhabitants expressed in the interviews and adding to the accessibility of the facilities within the needed walkable distance American Institute of Architects, 1985; Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Burton and Mitchell, 2006; Carstens, 1985; Department of Transport, Local Government and the Regions, 2001; Gehl, 2011; Llewelyn-Davies, 2000; Mahmood et al., 2012; Michael, Green and Farquhar, 2006; Mollenkopf et al., 2004; Pearce, 1982; Rantakokko et al., 2012; Temelova and Dvorakova, 2012).

23.2 Design principles application
While the route on the scale of the city does seem to meet the requirements set in the design task, the design needs to be implemented and visualised on street level. In order to make sure the design does meet the requirements for an elderly friendly public space the design principles need to be implemented (Cammelbeeck, 2013). And as a result showing how the design principles can be used in the practice of urban designers and planners.

As has been mentioned before the design principles are combined into an additional booklet (Cammelbeeck, 2013), they however will be explicitly named in the chapters on the design of the route. The choice to use
part IV.

urban design: Spijkenisse's route to active ageing
certain principles is directly derived from the design task set in the previous chapter and from walking alongside the route and determining what the obstacles are preventing the public space from being elderly friendly. Naturally not every principle needs to be implemented on every location, therefore only the principles used to improve the public space will be mentioned. The found obstacles and the design will be discussed and visualised in the next chapters.

Materialisation

To make sure the route will be recognisable on street level and will meet the requirements expressed in the principles, a constant materialization is used (see page 134). Firstly the use of green is important for the attractiveness and comfort of the route (Borst et al., 2008; Burton and Mitchell, 2006; Mahmood et al., 2012; Michael, Green and Farquhar, 2006; Sprado, 2011). The choice of trees and plants can additionally helps with the recognisability. Therefore one main type of tree and hedge is chosen, the ‘Hollanse Lindeboom’ and ‘Beukenheg’ both common in the Netherlands in urban environments and therefore likely to grow well. Furthermore one type of street lighting has been selected designed IPV in Delft. At night providing the necessary lighting (principle 26) and during the day they work as environmental features (principle 17). Next is the pavement. Smooth street pavement is principle 38 of the design catalogue (Cammelbeeck, 2013). While the catalogue refers to the use of larger elements (principle 38) here the chosen type of pavement is small bricks with straight edges. The reason for this choice is that in the Netherlands the surface mainly consists of sand and turf which is likely to settle and cause height differences. These height differences are easier passable with smaller pavement elements. And by laying it in a ‘elbow’ pattern it is as strong as possible.

Comfortable seating’s (principle 36) are provided by using benches from Velopa which are also available in higher types which are very comfortable for elderly
phase 1: improving the internal structure

phase 2: connecting the neighbourhoods

phase 3: connecting and improving the structure of the three neighbourhoods with the new route
(VelopA-Citystyle, 2012). Furthermore, on the locations where it is possible larger benches will be used which additionally can be perceived as environmental features (principle 17).

The type of pavement chosen for the bicycle lane is red tarmac, often used in the Netherlands for separate bicycle lanes and comfortable and safe due to its smooth surface.

And finally the border between the footpath and bicycle lane is designed to drain the water through small grates (principle 39) and with the use of a concrete band which provides a gentle change in level (principle 34).

23.3 The strategy phases
Because of the length of the route it is wise and more feasible to develop the design in phases. Figure 107 shows the three developments phases.
Phase one improves the internal structure of the three neighbourhoods. The designs focus of the improvement of the axes found in the urban analysis, hence making sure the inhabitants can make use of the neighbourhood facilities.
Phase two connects the different neighbourhoods and their improved structures to each other. The designs for this phase mainly focus on the crossings of the main city roads and the legibility of the route on decision points.
Phase three has connected the neighbourhood axes and therefore the foundation of the route has been created. And as a result the basic conditions are set for an elderly friendly public space. However, the route itself provides the neighbourhoods with new locations of interest for urban renewal due to the improved accessibility and quality of the public space. Therefore phase three consists of designs for promising locations on the route.
24. Phase 1: improving the neighbourhood structure

24.1 Centre

The urban analysis has illustrated several axes in the centre which are of interest for urban renewal. For the purpose of connecting the different neighbourhoods one axis has been chosen, running from the Stadhuispassage alongside the Marrewijkflat up until the Randweg. Phase one of the design focuses on two locations on this axis in the centre. First the Stadhuispassage.

Stadhuispassage

The shopping malls due to their large size and closing time at around 5 p.m. have been labelled in the analysis and SWOT as important threats, mainly because they block direct routes. This is especially the case for the Stadhuispassage, shown in figure 109 and 111. The internal passageway is the connection with the inner centre from the south side of the centre where among others the metro station is located and therefore when closed forms an important obstacle.

The design (figure 110 and 112) therefore opens the passageway by removing the roof and connects it to the surrounding public space by using the same pavement throughout the former passageway and turning it into a pedestrian street. Additionally to access the new street a main city road has to be crossed. Therefore the street crossing is now signal controlled. Furthermore, the shops were faced into the passageway and by adding an entry and a clear sign towards the main street the entrance to the inner centre is clearly marked.

Used principles

01 incremental and small scale changes
05 direct routes
15 small blocks
19 signal controlled crossings
31 buildings facing the street
32 visible and obvious entrances
38 smooth street pavement
39 small grates and drains
figure 111.
Section and plan current situation Stadhuispassage, scale 1:500 (by the author)
part IV. urban design: Spijkenisse’s route to active ageing

figure 112.
Section and plan design phase one Stadhuispassage, scale 1:500 (by the author)
part IV. urban design: Spijkenisse’s route to active ageing
part IV. urban design: Spijkenisse’s route to active ageing

Marrewijkflat

The Marrewijkflat is an enormous flat in the city centre. (see figure 114). It might be justifiable to say that the flat forms a border and due to the time when it was built is likely to need a renovation or even needs be broken down, however this are large and expensive interventions. While smaller scale changes to the public space can improve the situation substantially and in addition small scale changes are preferred by elderly to keep them familiar with their neighbourhood (Burton and Mitchell, 2006; Calkins, 1988; Patoine and Mattoli, 2001). The main problem around the Marrewijkflat is the enormous amount of car parks and combined with ill maintained bushed and trees the public space forms a border for people coming from the city roads and neighbourhoods such as Sterrenkwartier in the south and west of the centre (see figure 116). Therefore the road leading from the main city road is extended in the design, towards the flat combined with a separate bicycle lane next to the widened sidewalks lined with trees (see figure 115 and 117). The curve of the road starts with the addition of a playground which shows some life on this otherwise quiet location. The route goes alongside the shape of the building and passes by new playing courts, benches and street lights eventually ending up in the corner where the street market is located two times a week and a new bike park is added, making the city centre more attractive for cyclists. Furthermore the parking alongside the street has been replaces by trees which breakup the large building front. And the cars have been moved to the parking lots which now are surrounded by used greens spaces.

Used principles

01 incremental and small scale changes
03 gently winding streets
23 green barriers and buffers
24 assigned parking spaces
26 street lights
22 clear street zoning
28 lively green spaces and squares
29 comfortable public seatings
38 smooth street pavement
39 small grates and drains
figure 116.
Section and plan current situation of the public space around the Marrewijkflat, scale 1:1500 (by the author)
figure 117.
Section and plan design phase one public space around Marrewijkflat, scale 1:1500 (by the author)
part IV. urban design: Spijkenisse’s route to active ageing
24.2 Sterrenkwartier

Route

One of the great strengths of Sterrenkwartier is the park in the middle of the neighbourhood combined with several functions and the central location of the neighbourhood centre. However, these strengths are not strongly connected. Furthermore, Sterrenkwartier would benefit from a stronger connection with the centre due to the limited amount of facilities which can be expected in a neighbourhood centre. By strengthening the axis from North to South the internal structure as well as the accessibility of the centre can be improved.

Figures 120 and 124 shown the design intervention regarding the new route in phase one for the Sterrenkwartier. The route through the park has now become the central axis for the slow traffic in the centre. In the park several buildings face the road adding to the safety, which is further improved by adding street lighting. When cyclists or pedestrians leave the park the lanes and footways lead them past the neighbourhood centre where the sidewalk has been widened and cars can no longer park in front of the entrance on the East. In addition elderly specific facilities such as a GP and a pharmacist have been added to the centre. When pedestrians and cyclists keep following the route straight ahead it will connect them directly to to park of the North and the road towards the city centre.

Used principles

01 incremental and small scale changes
05 direct routes
20 traffic islands
26 street lights
29 wide sidewalks
38 smooth pavement
39 small grates and drains
part IV. urban design: Spijkenisse’s route to active ageing
Phase one focuses on improving the internal structure of the neighbourhoods. In the case of Sterrenkwartier it is essential that the neighbourhood centre with its daily facilities does not disappear and therefore should be strengthened by adding elderly specific facilities and connecting it to the route as been explained in the previous section. And as a result making it possible for elderly to meet people and get help if they need it. However, the public space in the centre itself lacks environmental features and comfortable public seatings making it uncomfortable for elderly to stay and meet people. Therefore in the middle of the square two ‘islands’ have been created with trees, street lights and comfortable public seatings. In addition the new pavement is the same as the pavement along the route, visually connecting the centre square to the surrounding public space.

**Used principles**

01 incremental and small scale changes  
26 street lights  
29 Informal green spaces and squares  
36 comfortable public seatings  
38 smooth pavement
figure 123. Section and plan current situation centre Sterrenkwartier, scale 1:1500 (by the author)
figure 124.
Section and plan design phase one centre Sterrenkwartier scale 1:1500 (by the author)
part IV. urban design: Spijkenisse’s route to active ageing
24.3 De Akkers

Nieuwe Westdijk

De Akkers has a lack of direct connections due to the high amount of dead end streets. Therefore the Nieuwe Westdijk forms a great opportunity to improve the accessibility and legibility of the neighbourhood. However, the green on the dike is at the moment badly maintained and filled with bushes blocking the view on the neighbouring houses (see figure 126). Additionally, the dike is now only designed as a cyclist path while it is one of the few possibilities to cross the main city road and therefore used by pedestrians. The pedestrians, in particular elderly in general feel unsafe on these types of roads due to the lack of clear zoning and therefore being afraid of being run over. By removing the bushes and replacing them with more low maintenance grass and adding benches and a sidewalk the issues can be resolved and an elderly friendly route to the park and neighbourhood centre is created (see figure 127).

Used principles

01 small and incremental changes
22 clear street zoning
25 wide sidewalks
30 maintenance
36 comfortable public seatings
38 smooth pavement
Figure 128.
Section and plan current situation of the Nieuwe Westdijk, scale 1:400
(by the author)
part IV. urban design: Spijkenisse’s route to active ageing

figure 129.
Section and plan design phase one the Nieuwe Westdijk, scale 1:400
(by the author)
part IV. urban design: Spijkenisse’s route to active ageing
Zomerakkers

In line with the Nieuwe Westdijk, the Zomerakkers leads from the metro station towards the south of the Akkers. The interviews found that elderly gave de Akkers a low score when it came to safety. This street is probably an example why, as shown in figure 126. Firstly the building on the right is faced with its back towards the street making that side of the street unattractive to walk by. On the other side of the street in theory there is enough space to pass the building, however due to the galleries above the ground floor you are not inclined to use the right part of the sidewalk. Especially not by frail elderly who find it hard to distinguish private from not private spaces. Therefore the street leaves just 1.7 meters to walk along this street (see figure 128).

By moving the green to underneath the windows of the residential building and moving the street lights to the other side of the road a total of 4.3 meters is now left and a clear street zoning is provided (see figure 129). The water for the bushes underneath the window can be provided by leading the drainage towards the bushes. The safety on the street is improved by adding windows to the sports hall on the right of the road.

Furthermore there are no benches to be found in on this street. By adding benched the design adds to the comfort of the public space and leaves 3.2 meters for elderly and other inhabitants to safely walk on.

**Used principles**

01 small and incremental changes
22 clear street zoning
27 devoid of clutter
31 buildings facing the street
36 comfortable public seatings
38 smooth street pavement
figure 128.
Section and plan current situation
Zomerakkers, scale 1:200
(by the author)
figure 129.
Section and plan design phase one
Zomerakkers, scale 1:200
(by the author)
25. Phase 2: connecting the neighbourhoods

25.1 Centre + Sterrenkwartier

Figure 131 illustrates one of the main weaknesses in the design of Spijkenisse, the lack of connections between neighbourhoods and the difficulty to cross the main city roads. The connection between Centre and Sterrenkwartier is particularly difficult because of the sidewalk which is missing on the centre side of the crossing (see figure 133). Firstly the safety of the crossing needs to be improved by adding a pedestrian controlled crossing. The signal controlled crossing not only improves the safety but adds a clear orientation point to show where the route continuous. Furthermore, by using a different type of pavement for the bicycle lane going toward than the one going towards the residential neighbourhood it is clear that the route continuous on the North side of the crossing (see figure 134).

*Used principles*

01 small and incremental changes
19 signal controlled crossings
22 clear street zoning
25 wide sidewalks
38 smooth street pavement
Figure 133.
Plan current situation crossing at the Randweg scale 1:500
(by the author)
figure 134.
Plan design phase two for crossing at the Randweg, scale 1:500
(by the author)
part IV. urban design: Spijkenisse’s route to active ageing
25.2 Sterrenkwartier + de Akkers

When it comes to connecting Sterrenkwartier to de Akkers there is a total of four exemplary design interventions. The four designs will be discussed in this section.

Lenteakkers

The first design intervention location on the route is located in the centre of de Akkers (see figure 135). It leads from the axes improved in phase one towards the residential neighbourhood on the West. This street provides a wide and open public space where people can walk. However, the facilities located on the street are not clearly visible and there are no places to rest and stay to meet people (see figure 136). Therefore the design shown in figure 137 and 139 provides benches to rest and clear street signs pointing out the facilities. Furthermore, the pedestrian zone underneath the arcade on the left is now unattractive to walk through due to the fact that it is dark and for frail elderly unclear if it is private or not. By continuing the new pavement underneath the arcade and add lighting the arcade becomes more attractive to walk underneath. And when the shops are open they can make use of the space to as an display area and as a result the uses are made more visible. Furthermore, changing the configuration of the bicycle racks adds to the configuration of the street. Combined with the trees, the route is now clearly marked and zoned.

Used principles

01 Small and incremental changes
21 clear signs and symbols
22 clear street zoning
26 street lights
27 devoid of clutter
33 buildings reflecting there use
36 comfortable public seating
38 smooth pavement
39 small and smooth grates and drains.
figure 138. Section and plan current situation
Lenteakkers, scale 1:200
(by the author)
figure 139.
Section and plan design phase two
Lenteakkers, scale 1:200
(by the author)
The middle of the residential Akkers

Figure 141 shows an important decision point for people by bike or on foot who are leaving de Akkers and want to go in the direction of the Sterrenkwartier or the centre. At the moment the concrete construction of the metro line makes people inclined to think that they need to follow the line which will lead them to the centre. This metro line however takes them on a substantial detour alongside the less safe and uncomfortable main city roads. Additionally the equal crossing shown on figure 141 and 143 can be cause for confusion for frail elderly. Therefore the design (figure 142 and 144) changes the equal crossing into a staggered junction, adding to the legibility. Additionally the route is marked by attractive and lively green spaces by adding playing fields and a playground. And on the crossing of the road a small square had been made providing a large bench for inhabitants to sit on and watch the playing children. Next to the bench an information post for people is placed to learn what is happening on the newly designed route. By combining the large bench and information post with clear signs showing the different directions and a large tree as environmental features people will be more inclined to follow the route.

Used principles
01 small and incremental changes
08 direct routes
08 quiet routes and zones
17 environmental features
18 avoid cross roads
21 clear signs and symbols
25 wide sidewalks
28 lively green spaces and squares
38 smooth pavement
figure 143.
Section and plan current situation of the route in the middle of de Akkers, scale 1:500 (by the author)
figure 144.
Section and plan design phase two the route in the middle of de Akkers,
scale 1:500 (by the author)
part IV. urban design: Spijkenisse’s route to active ageing
Zeefvoorde

The location of Zeefvoorde is a typical example of a ‘Bloemkolenwijk’ of the 1980s. With a high amount of winding streets and streets ending in parking spaces. Figure 146 shows the lack of structure in the neighbourhood and the cars blocking the sidewalks.

The design makes use of the fact that the bicycle lane only moves in one direction which adds to the legibility of the route (see figure 148 and 149). By adding a wide sidewalk and turning around the cars into clear assigned parking spaces the route has become clear and safer for elderly to walk along. Furthermore the small sidewalk along the side of the houses was designed as leftover space and probably therefore badly maintained. In the new design it is replaces with a hedge marking the route (see figure 147 and 149).

**Used principles**

- 01 small and incremental changes
- 24 assigned parking spaces
- 25 wide sidewalks
- 38 smooth street pavement
figure 148.
Section and plan current situation
Zeefvoorde, scale 1:500 (by the author)
figure 149.
Section and plan design phase two
Zeelvoorde, scale 1:500 (by the author)
part IV. urban design: Spijkenisse’s route to active ageing
part IV. urban design: Spijkenisse’s route to active ageing

Schopvoorde

The last design location discussed in this chapter on phase two is directly at the border between Sterrenkwartier and the residential side of de Akkers. It is marked by a large elderly housing complex and a tunnel leading underneath the main city road. Figure 151 shows that the homes are nicely located at the edge of a large green space, however it is not being used. Furthermore the junction does not give any indication as to where you need to go. Unfortunately when designing different options for this location it proved to be impossible to change the cross road and at the same time giving cyclists a chance to go in all the four directions without having to move the tunnel or other larger costly changes. Therefore the choice has been made to add a post with clear signs pointing in every direction. Additionally a seating area has been designed with a ‘jeu de boule’ field providing a space for the elderly inhabitants of the homes and other passersby to sit there and watch people coming by in a quiet setting (see figure 152 and 154).

used principles

01 small and incremental changes
21 clear signs and symbols
08 quite routes and zones
25 wide sidewalks
38 smooth pavement
36 comfortable public seatings

figure 150.
Location of the design on the route (by the author)

figure 151.
Picture of Schopvoorde in 2012 (by the author)

figure 152.
Artist impression of the design for Schopvoorde (by the author)
figure 153.
Section and plan current situation crossing Schopvoorde with main city road, scale 1:500 (by the author)
figure 154.
Section and plan design phase two crossing Schopvoorde with main city road, scale 1:500 (by the author)
part IV. urban design: Spijkenisse’s route to active ageing
26. Phase 3: improved route

As has been said in 23.3 phase three consists of designs for promising locations on the route. Due to the new connection and therefore the added accessibility of the locations alongside the route have become more attractive for facilities to settle. As a result these locations become even more attractive for urban renewal and thus making it possible to further improvement of the conditions for the elderly inhabitants. Important locations for phase three are Lentakkers and the centre of Sterrenkwartier.

Lenteakkers

Lenteakkers is at the moment a side street of the neighbourhood centre of de Akkers with a side entrance to the shopping mall and facilities such as a bank. Some of these facilities are of great importance for the elderly inhabitants such as the neighbourhood centre and the health centre. The visibility of the facilities has been improved in phase two and the street has become an important part of the new route leading from the neighbourhood axis. With the newly established connections and added benches and trees the public space invites people to sit and stay. However, while the basic conditions are set, such as buildings facing the street and the presence of facilities such as the neighbourhood centre the overall quality of the route and centre of the Akkers could be improved. In phase three the route is strengthened by making use of the public space on the rights (see figure 157) by expanding the neighbourhood centre and moving the facades of the facilities to the side of the street and as a result make socially important and elderly specific amenities clearly visible and a strong part of the neighbourhood (see figure 156 and 157).

Used principles

32 visible and obvious entrances
09 walkable distance to facilities
part IV. urban design: Spijkenisse’s route to active ageing

figure 158, 159, 160 and 161
Artist impression of the centre of Sterrenkwartier in phase one and phase three (by the author)
Sterrenkwartier
With the addition of the connection from North to South the accessibility of the neighbourhood centre of Sterrenkwartier has been improved (figure 162). However, the road now leads alongside the backs of the facilities. In phase three the accessibility of the centre is further improved by adding a direct connection from the new route towards the centre and bicycle parking (see figure 163).

Adding housing on top of the centre creates entrance alongside the route and makes it possible for people to start a home business. And as a result making it more attractive for facilities to stay in the centre or for services such as the GP or physical therapist to move here from other locations in the neighbourhood. In addition the new housing could provide the municipality and property developers with a location for dwellings suited for elderly and other frail population groups.

By opening up the building blocks the accessibility and visibility of the centre is further improved (figures 158 to 161)

*Used principles*

32 visible and obvious entrances
09 walkable distance to facilities
figure 162
Section and plan design phase one centre Sterrenkwartier, scale 1:1500
(by the author)
figure 163.
Section and plan design phase three, centre Sterrenkwartier, scale 1:15
(by the author)
figure 164. Vision map for Spijkenisse: possibilities for improved routes, connecting the neighbourhoods and their centres. Scale 1:45,000 (by the author)
27. Reflection on design

The new route provides frail elderly with a elderly friendly bicycle and pedestrian connection between the three different neighbourhoods with the use of the design principles. The design is the answer to the general design task definition set in chapter 22, which next to the needs of the frail elderly expressed in the interviews, physical activity diaries and GPS trackings is based upon a general urban analysis of the city. Therefore the route should be in the interest of many inhabitants of the city and as shown in figure 164 could be exemplary for different locations in Spijkenisse.

However, in the context of the graduation project it is important to reflect upon which preconditions have been found to be essential for urban planners, designers, the municipality and other practitioners to create elderly friendly public spaces in a case such as Spijkenisse and to determine the feasibility of the design in general.

Important preconditions for easy accessible public spaces in Spijkenisse

The design for Spijkenisse is the result of a combination of research findings from GPS tracking, urban analysis, data from interviews and physical activities diaries and literature review studies resulting in the design principles. The design principles combined in the design principle book can be defined as preconditions for elderly friendly public spaces in general and additionally the book indicates which principle might be of interest for which type of practitioner (Cammelbeeck, 2013). As has been stated before some principles are not only preconditions for elderly friendly public spaces but for pedestrian friendly public spaces in general. The same can be said for the design. There are however several aspects to the design which might have been designed differently if elderly would not have been the main focus of this study and design for Spijkenisse.

Firstly the preservation and strengthening of the neighbourhood centre of Sterrenkwartier. One of the most if not the most important design principle for elderly friendly cities is a walkable distance to facilities. While other population groups do benefit from nearby facilities, for elderly a walkable distance is shorter than for others and the presence of facilities is essential for them to remain independent (American Intitute of Architects, 1985; Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Burton and Mitchell, 2006; Carstens, 1985; Department of Transport, Local Government and the Regions, 2001; Gehl, 2011; Llewelyn-Davies, 2000; Mahmood et al., 2012; Michael, Green and Farquhar, 2006; Mollenkopf et al., 2004; Pearce, 1982; Rantakokko et al., 2012; Temelova and Dvorakova, 2012). Therefore from an frail elderly perspective the preservation of neighbourhood centres such as that of Sterrenkwartier is essential, while for other population groups with a higher mobility the improvement of the accessibility of the city centre would have been sufficient. Additionally the literature review and data from the Erasmus MC have shown the growing importance of civil as well as heath related facilities such as the general practitioner, apothecary, physical therapist and neighbourhood centre.

Secondly, familiarity is an important aspect to creating elderly friendly public spaces. More than other population groups frail elderly have difficulties coping with changes which can cause disorationention. While from other perspectives large scale interventions such as the demolishment of the Marrewijkflat could have been justifiable in the case of frail elderly design small scale changes to the public space are preferred (Burton and Mitchell, 2006; Calkins, 1988; Patoine and Mattoli, 2001).

Thirdly, in general frail elderly have much more difficulties coping with obstacles related to safety than others who for instance don’t have difficulty walking (Burton and Mitchell, 2006; Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Mahmood et al., 2012; Rantakokko et al., 2012). Therefore for the design of elderly friendly
public spaces which encourage active ageing traffic safety should be kept in mind by making use of traffic islands, wide sidewalks, clear street zoning and signal controlled crossings (Borst et al., 2008; Burton and Mitchell, 2006; Langlois, 1997; Michael, Green and Farquhar, 2006; Mahmood et al., 2012). An additional safety concern is the fear of falling and as a result principles such as smooth pavement, small grates and drains and avoiding clutter are of great importance. And for the municipality in particular the upkeep and maintenance of the public space should be a priority (Burton and Mitchell, 2006; Bjornsdottir, Arnadottir and Halldorsdottir, 2011; Mahmood et al., 2012; Rantakokko et al., 2012).

Feasibility
The design can be developed in three stages and consists of several small scale and relatively low cost changes of which frail elderly and other inhabitants will benefit greatly socially as well as physically. During this three stages the municipality plays an important role as most of the interventions take place in the public space they mostly own. Although this means that the costs are predominantly for the municipality there are some aspects to the design which could divide the costs and make it attractive for the municipality to invest in.
Firstly, many of the interventions are done to lower the maintenance of the greens which lowers the costs on the longer term.
Secondly, the repaving of the route can be done simultaneously with maintenance works on the underground infrastructure such as the sewerage.
And finally, nationally as well as on the European scale there is a growing interest in active aging and the role of the built environment. Especially the funding and knowledge connected to European Innovation Partnership on Active and Healthy Ageing might be of interest for the realization of the design (European Union, 2012).
PART V. CONCLUSION

figure 165. active elderly in a park (Gemmell, 2011)
28. Conclusion

The main research question set at the beginning of this graduation project was: What kind of spatial interventions in the public space are required to enhance the independence of frail elderly within the current context of Dutch neighbourhoods?

An important part of this question has been answered by reviewing mainly academic peer reviewed literature. The literature showed the importance of active ageing when preventing frailty from worsening which can lead to adverse health outcomes such as functional loss which in turn negatively affects the independence of frail elderly. Therefore, in order to enhance the independence of frail elderly the spatial interventions need to encourage active ageing. Literature from different fields such as health, planning and gerontology put forward 40 spatial interventions related to the six themes of comfort, legibility, distinctiveness, accessibility, comfort and safety.

The diversity of fields which have put forward intervention which can encourage active ageing emphasizes the importance of urbanism working together with different fields. While the literature found on the subject has scarcely been done by people in the urbanism field, there is an important role for urban designers and planners. Firstly because many of the 40 interventions have never been put in the context of a design. And secondly the interventions named in literature are in general not being visualized which makes them difficult to implement in a spatial design.

Therefore the next steps have been to do an empirical research on the spatial context of Spijkenisse where the design needed to be implemented and to collect the 40 interventions in a catalogue and spatially translate them to make them applicable for urban designers and planners.

In the empirical research of the graduation project a variety of methods were used to determine which hindrances frail elderly inhabitants of spijkenisse were experiencing in the public space of the neighbourhood which prevented them from full filling their outdoor mobility goals. The combination of the findings from the urban analysis based on the in literature found themes on the one hand and the GPS trackings, physical activity diaries and interview data collected by the Erasmus MC and TNO on the other have proven to be very helpful to determine the spatial hindrances frail elderly experience. The collaboration between the data have put forward that in Spijkenisse the accessibility of the services and facilities was under threat due to the lack of connections between the neighbourhoods and that certain roads and public spaces had become illegible and uncomfortable due to their ill maintenance and the fragmentation. The design task derived from the data and urban analysis has proven to be essential when determining what kind of spatial interventions needed to be implemented from the design catalogue.

The design has shown the importance of the street level next to the neighbourhood scale as this is where elderly are likely to first and foremost encounter hindrances preventing them from being active. In the context of Spijkenisse almost every design principle has been used to design accessible public spaces, however the creating a walkable distance to facilities, widening of sidewalks, addition of clear street zoning and principles related to the legibility of the route have proven to be essential. The designed route has shown that with small and easy changes the built environment can be substantially be improved for frail elderly such as adding benches, using smooth pavement, reducing and maintaining existing vegetation and removing obstacles such as bollards from the sidewalks.

Because of the specific context of Spijkenisse and other design locations it is impossible to state which exact principles should be used when designing elderly friendly public spaces, although the design principles can be considered to be important preconditions in general. In
addition the design can be of specific interest for other Dutch New Towns which are likely to face the same urban problems as Spijkenisse due the fact they were built with similar urban design believes during the same almost the same time period.

In general the conclusion is that the collection of principles in the design catalogue based of literature research in combination with a funded and justifiable design task can result in a design which encourages active ageing and therefore enhances the independence of frail elderly in the context of Dutch neighbourhoods.
What kind of spatial interventions in the public space are required to enhance the independence of fragile elderly within the current context of Dutch neighbourhoods?

**LITERATURE RESEARCH**
Which neighbourhood design interventions in the public space encourage frail elderly to age actively?

This research draws primarily on recent peer-reviewed literature in a broad array of urbanism and gerontology fields.

**EMPIRICAL RESEARCH**
Which hindrances do frail elderly inhabitants of Spijkenisse experience in the public space of their neighbourhood that prevent them from fulfilling their out-door-mobility goals?

**DESIGN PRINCIPLES**
Which urban design principles or patterns are essential for practitioners to create elderly friendly public spaces that stimulate active ageing?

Using the pattern language format of Alexander to translate research findings into spatial urban design principles.

**URBAN DESIGN**
Which urban design principles or patterns need to be embedded into the current context of Dutch cities in order to create easy accessible public spaces for elderly?

Testing urban design principles in representative types of public spaces in the case of Spijkenisse, resulting in designs for the public space of exemplary locations.

**METHODLOGY SCHEME**
Methodology scheme illustrating the research activities with the related questions, methods and products (by the author).
The purpose of this chapter is to look back at the research done for the graduation project and reflect if the used approach has worked to achieve the aim set at the beginning of the project. And additionally give recommendations on what can be learned for future research and graduation projects. The reflection and recommendations will focus on four aspects which have been set in the Graduation Manual Master Architecture, Urbanism and Building Sciences at Delft University of Technology academic year 2012-2013 (TU Delft faculteit Bouwkunde, 2012);
- The relationship between the project and the wider social context.
- The relationship between research and design.
- The relationship between the theme of the studio and the subject/case study chosen by the student within this framework (location/object).
- The relationship between the methodical line of approach of the studio and the method chosen by the student in this framework.

However two aspects on the methodology and theme of the studio have been combined in the third aspect.

The relationship between the project and the wider social context
The starting point of this graduation project is the ageing population. This unprecedented demographic change, which started in the developed world in the nineteenth century and more recently in developing countries, is already transforming many societies (United Nations, 2009). The United Nations has warned the Governments of developing countries in their World Ageing Report 2009. “The ageing process is expected to accelerate in the near future, particularly in developing countries. Because they have a shorter time to adapt to the changes associated with population ageing, it is urgent that the Governments of developing countries begin taking steps to face the challenges and make the best of the opportunities that population ageing brings.”(United Nations, 2009: p 15) While developing countries such as the Netherlands are adapting their policy more towards an ageing society, the focus has mainly been on economic related issues such as the affordability of health care and pensions.

Academic research has shown the importance of the built environment as one of the aspects which influences the amount of activity undertaken by inhabitants of urban neighbourhoods (van Lenthe, Burg and Mackenbach, 2005). And it is exactly this activity, also known as active ageing, that can reduce, prevent or postpone social, physical and psychological frailty. Which in turn can lead to the preventing, reducing and postponing of adverse health outcomes such as admission into an institution or even death which governments and the society as a whole would like to avert.

All the steps undergone during this graduation projects have been focused on the relationship between the spatial design of the built environment and the societal desire to let the growing group of elderly age actively and consequently enhance their independence.

The relationship between research and design
The combination of different types of research methodologies has played an important part in the development of this graduation project.

Firstly the literature review has been the basis for the definition of the problem statement, research questions and has been done to establish which design interventions in the public space encourage frail elderly to age actively. The literature research put forward themes on which the urban analysis of Spijkenisse was based. Furthermore, by translating the literature findings from fields such as gerontology into spatial design principles the findings have been directly implemented in the design.

Next to literature research, GPS trackings, interviews and physical activity diaries have been used to establish
the design task. The combination of these different types of research methods has strengthened the design directly. There are however some aspects of interest for discussion and reflection.

Firstly many of the design principles found have never been tested in the reality of the public space for a city. Therefore the causality that the design and implementation of the principles will lead to active ageing is not guaranteed.

Secondly, the practice of urban planning and design and academic research constantly evolves therefore the design catalogue should not be considered to be a set handbook which can’t be changed.

And finally, while the interviews, GPS trackings and physical activity diaries have been helpful they are snapshots of a limited period in time. Circumstances such as the weather, construction works on the road and so and can influence the data greatly. While these influences can be partly overcome by a substantial amount of data and a call back which has been done by Erasmus MC, the limited time frame has not made it possible to include these findings or amount of data. Additionally, as has been explained in the introduction part of this thesis, participants had the choice to be tracked by the GPS and fill in the physical activity diaries or only to participate with the interviews. Consequently, a limited amount of the participants agreed to participate with the GPS tracking and physical activity diaries. In the neighbourhoods chosen a total of 28 people participated. Unfortunately this is not a great amount of participants. However, because people were followed for a total of 7 days it does give a good indication on which routes people generally choose to reach certain destinations.

The maps generated by TNO of the GPS tracks showed some outliers which diffused the images (See appendix B). Therefore the maps have been further been cleaned up by the author, however this has been subject to some interpretation. Consequently for further research GPS tracking maps produced by experts at TNO will be of interest.

For the purpose of this research it would have been of interest to compare the tracks and outdoor mobility goals of different neighbourhood inhabitants, unfortunately due to the amount of participants and the fact no tracks were available of participants of de Akkers the different neighbourhoods have been combined. Therefore, it will be very interesting to see the outcomes of the research done by Erasmus MC with all the GPS tracks and physical activity diaries.

The relation between the theme/methodological line of approach of the studio and the project

The project is part of the Graduation Studio Urban Regeneration. The research and design studio of urban regeneration is concentrated on methods of public intervention, urban design, sustainable development, heritage preservation, and strategic planning that contribute to urban regeneration strategies. It aims to provide an improved physical environment and social and economic opportunities for citizens. Moreover, it takes account of the ever changing requirements of users and dynamics of population characteristics. The project fits directly into the profile of the studio as it aims to provide an improved physical environment and as a result improves the opportunities for frail elderly in the current context of their neighbourhood. The methods used to establish this aim such as urban design and strategic planning in the form of a route are often used in the studio. Furthermore, the ageing of the population is a demographic change which is seen all over the world and especially in Europe due to the baby boom after the Second World War.
BIBLIOGRAPHY


Memory Loss and Aging, Washington, DC, AARP Andrus Foundation, and New York: the Dana Alliance for Brain Initiatives.


van-Bellen, S. 2012. Urban Environments for Walking: design criteria for creating urban environments for people to walk. MSc, Delft University of Technology.


**Appendix A: data activity diaries + interviews**

<table>
<thead>
<tr>
<th>Nummer Wijk</th>
<th>Geen</th>
<th>Centrum</th>
<th>Oosterhout</th>
<th>Sterrenkaster</th>
<th>Eendracht</th>
<th>Oud-Oost</th>
<th>Noord</th>
<th>Wijk Kwetsbaar</th>
<th>Aantal dagen gevolg</th>
<th>Aantal leefpatstuur</th>
<th>Geen Sport</th>
<th>Gezondheid</th>
<th>Boodschappen/Winkelen</th>
<th>Cafe/restaurant</th>
<th>Entertainment</th>
<th>Publiek voorzieningen</th>
<th>Familie/vrienden</th>
<th>Speciale vragen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Walkable distance of services Fri+ elderly Spijkennisse

<table>
<thead>
<tr>
<th>Service Category</th>
<th>Yes</th>
<th>No</th>
<th>I don't know</th>
<th>Irrelevant</th>
<th>No answer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus-, tram- or tube stop</td>
<td>92.6%</td>
<td>5.6%</td>
<td>0.6%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Supermarket</td>
<td>81.2%</td>
<td>18.5%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Vegetable shop</td>
<td>72.0%</td>
<td>26.5%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Bakery</td>
<td>80.4%</td>
<td>19.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Butcher</td>
<td>66.8%</td>
<td>32.6%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Local convenience store</td>
<td>66.5%</td>
<td>28.2%</td>
<td>2.5%</td>
<td>2.2%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Hairdresser</td>
<td>73.8%</td>
<td>20.0%</td>
<td>2.8%</td>
<td>2.8%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>ATM</td>
<td>71.4%</td>
<td>27.1%</td>
<td>1.2%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Apothecary</td>
<td>65.6%</td>
<td>33.5%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Public park</td>
<td>69.6%</td>
<td>28.3%</td>
<td>1.5%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Bar</td>
<td>63.4%</td>
<td>27.1%</td>
<td>8.9%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Neighbourhood association building</td>
<td>55.4%</td>
<td>27.1%</td>
<td>17.2%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Place of worship</td>
<td>55.3%</td>
<td>40.9%</td>
<td>5.2%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Library</td>
<td>51.7%</td>
<td>38.8%</td>
<td>8.9%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Post office</td>
<td>32.6%</td>
<td>44.6%</td>
<td>0.3%</td>
<td>22.2%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Gym</td>
<td>42.5%</td>
<td>31.7%</td>
<td>25.2%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Library</td>
<td>29.0%</td>
<td>68.9%</td>
<td>1.2%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Laundry service</td>
<td>27.4%</td>
<td>56.0%</td>
<td>10.8%</td>
<td>5.5%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Swimming pool</td>
<td>18.8%</td>
<td>80.0%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Hiking or biking trail</td>
<td>34.2%</td>
<td>12.3%</td>
<td>52.6%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Train station</td>
<td>0.0%</td>
<td>25.2%</td>
<td>0.3%</td>
<td>74.2%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### Walkable distance of services Fri+ elderly Centre

<table>
<thead>
<tr>
<th>Service Category</th>
<th>Yes</th>
<th>No</th>
<th>I don't know</th>
<th>Irrelevant</th>
<th>No answer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus-, tram- or tube stop</td>
<td>92.9%</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Supermarket</td>
<td>85.7%</td>
<td>14.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Vegetable shop</td>
<td>92.9%</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Bakery</td>
<td>92.9%</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Butcher</td>
<td>92.9%</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Local convenience store</td>
<td>75.0%</td>
<td>17.9%</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Hairdresser</td>
<td>89.3%</td>
<td>7.1%</td>
<td>3.6%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>ATM</td>
<td>92.9%</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Apothecary</td>
<td>75.0%</td>
<td>21.4%</td>
<td>3.6%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Public park</td>
<td>71.4%</td>
<td>28.6%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Bar</td>
<td>75.0%</td>
<td>7.1%</td>
<td>17.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Neighbourhood association building</td>
<td>17.8%</td>
<td>42.9%</td>
<td>39.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Place of worship</td>
<td>71.4%</td>
<td>25.0%</td>
<td>3.6%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Fitness centre</td>
<td>60.7%</td>
<td>17.9%</td>
<td>21.4%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Post office</td>
<td>46.4%</td>
<td>32.1%</td>
<td>0.0%</td>
<td>21.5%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Gym</td>
<td>46.4%</td>
<td>21.4%</td>
<td>28.6%</td>
<td>3.6%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Library</td>
<td>78.6%</td>
<td>17.8%</td>
<td>3.6%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Laundry service</td>
<td>50.1%</td>
<td>32.1%</td>
<td>10.7%</td>
<td>7.1%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Swimming pool</td>
<td>28.6%</td>
<td>71.4%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Hiking or biking trail</td>
<td>32.3%</td>
<td>10.7%</td>
<td>57.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Train station</td>
<td>0.0%</td>
<td>32.1%</td>
<td>3.6%</td>
<td>64.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
### Walkable distance of services all elderly Sterrenkwartier

<table>
<thead>
<tr>
<th>Are these services within a 10 minute walking distance from your home?</th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
<th>Irrelevant</th>
<th>No answer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus-, tram- of tube stop</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Supermarket</td>
<td>79,5%</td>
<td>20,5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Vegetable shop</td>
<td>79,5%</td>
<td>20,5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Bakery</td>
<td>79,5%</td>
<td>20,5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Butcher</td>
<td>70,5%</td>
<td>29,5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Local convenience store</td>
<td>79,6%</td>
<td>20,4%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Hairdresser</td>
<td>65,4%</td>
<td>20,0%</td>
<td>0%</td>
<td>14,6%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>ATM</td>
<td>75,0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Apothecary</td>
<td>53,3%</td>
<td>46,7%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Public park</td>
<td>32,8%</td>
<td>61,0%</td>
<td>6,2%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Bar</td>
<td>68,4%</td>
<td>24,4%</td>
<td>6,2%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Neighbourhood association building</td>
<td>42,5%</td>
<td>33,3%</td>
<td>24,2%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Place of worship</td>
<td>38,7%</td>
<td>61,3%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Fitness centre</td>
<td>47,0%</td>
<td>47,0%</td>
<td>6,0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Post office</td>
<td>0%</td>
<td>88,6%</td>
<td>0%</td>
<td>11,4%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Gym</td>
<td>10,6%</td>
<td>47,0%</td>
<td>42,4%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Library</td>
<td>11,4%</td>
<td>88,6%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Laundry service</td>
<td>10,6%</td>
<td>83,3%</td>
<td>6,1%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Swimming pool</td>
<td>0%</td>
<td>100,0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Hiking or biking trail</td>
<td>15,1%</td>
<td>15,1%</td>
<td>69,8%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Train station</td>
<td>0%</td>
<td>20,5%</td>
<td>0%</td>
<td>79,5%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Safety All elderly Spijkenisse**

**Walkable distance of services**

<table>
<thead>
<tr>
<th>Are these services within a 10 minute walking distance from your home?</th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
<th>Irrelevant</th>
<th>No answer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus-, tram- of tube stop</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Supermarket</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Vegetable shop</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Bakery</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Butcher</td>
<td>92,9%</td>
<td>7,1%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Local convenience store</td>
<td>78,6%</td>
<td>21,4%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Hairdresser</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>ATM</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Apothecary</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Public park</td>
<td>71,4%</td>
<td>21,5%</td>
<td>7,1%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Bar</td>
<td>71,4%</td>
<td>14,3%</td>
<td>14,3%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Neighbourhood association building</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Place of worship</td>
<td>85,7%</td>
<td>14,3%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Fitness centre</td>
<td>78,6%</td>
<td>14,3%</td>
<td>7,1%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Post office</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Gym</td>
<td>64,3%</td>
<td>7,1%</td>
<td>28,6%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Library</td>
<td>7,1%</td>
<td>57,1%</td>
<td>7,1%</td>
<td>28,6%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Swimming pool</td>
<td>64,3%</td>
<td>35,7%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Hiking or biking trail</td>
<td>7,1%</td>
<td>92,9%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Train station</td>
<td>57,1%</td>
<td>42,9%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>75,2%</td>
<td>24,8%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Safety All elderly Spijkenisse

- At night the neighbourhood streets are not sufficiently lit: 4,6% agree, 90,0% don't agree, 5,2% irrelevant, 0,1% other, total 100,0%
- I am concerned with traffic safety when I walk through my neighbourhood: 85,5% agree, 14,5% don't agree, 0% irrelevant, total 100,0%
- My neighbourhood is badly maintained: 22,5% agree, 77,5% don't agree, 0% irrelevant, total 100,0%
- In my neighbourhood the footways are badly accessible: 28,5% agree, 68,5% don't agree, 0% irrelevant, total 100,0%
- I am afraid of crime and being bothered when I walk through my neighbourhood in the dark: 41,6% agree, 44,6% don't agree, 13,8% irrelevant, total 100,0%

### Safety Centre

- At night the neighbourhood streets are not sufficiently lit: 3,6% agree, 82,1% don't agree, 7,1% irrelevant, total 100,0%
- I am concerned with traffic safety when I walk through my neighbourhood: 14,3% agree, 85,7% don't agree, 0% irrelevant, total 100,0%
- My neighbourhood is badly maintained: 17,9% agree, 82,1% don't agree, 0% irrelevant, total 100,0%
- In my neighbourhood the footways are badly accessible: 32,1% agree, 64,3% don't agree, 3,6% irrelevant, total 100,0%
- I am afraid of crime and being bothered when I walk through my neighbourhood in the dark: 50,0% agree, 32,1% don't agree, 17,9% irrelevant, total 100,0%
<table>
<thead>
<tr>
<th>How would you define your neighbourhood?</th>
<th>Spijkenisse</th>
<th>Centrum</th>
<th>Sterrenkwartier</th>
<th>Akkers</th>
</tr>
</thead>
<tbody>
<tr>
<td>The street where I live</td>
<td>21,8%</td>
<td>14,3%</td>
<td>4,8%</td>
<td>23,1%</td>
</tr>
<tr>
<td>The street where I live and several surrounding streets.</td>
<td>31,5%</td>
<td>7,1%</td>
<td>38,1%</td>
<td>46,2%</td>
</tr>
<tr>
<td>The district where I live</td>
<td>46,7%</td>
<td>78,6%</td>
<td>30,7%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0,0%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>0,0%</td>
</tr>
<tr>
<td>Total</td>
<td>100,0%</td>
<td>100,0%</td>
<td>100,0%</td>
<td>100,0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much time do you on average spend outside your neighbourhood during a week day?</th>
<th>Spijkenisse</th>
<th>Centrum</th>
<th>Sterrenkwartier</th>
<th>Akkers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 hours</td>
<td>37,3%</td>
<td>35,7%</td>
<td>20,0%</td>
<td>28,6%</td>
</tr>
<tr>
<td>1 - 2 hours</td>
<td>50,0%</td>
<td>42,9%</td>
<td>55,0%</td>
<td>50,0%</td>
</tr>
<tr>
<td>3-5 hours</td>
<td>10,3%</td>
<td>10,7%</td>
<td>20,0%</td>
<td>21,4%</td>
</tr>
<tr>
<td>6-10 hours</td>
<td>2,4%</td>
<td>10,7%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>more than 10 hours</td>
<td>0,0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>100,0%</td>
<td>100,0%</td>
<td>100,0%</td>
<td>100,0%</td>
</tr>
</tbody>
</table>

**Safety Sterrenkwartier**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>Don't agree</th>
<th>Irrelevant</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>At night the neighbourhood streets are not sufficiently lid</td>
<td>4,8%</td>
<td>95,2%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>I am concerned with traffic safety when I walk through my neighbourhood</td>
<td>4,8%</td>
<td>95,2%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>My neighbourhood is badly maintained</td>
<td>28,6%</td>
<td>71,4%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>In my neighbourhood the footways are badly accessible</td>
<td>4,8%</td>
<td>95,2%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>I am afraid of crime and being bothered when I walk through my neighbourhood in the dark</td>
<td>47,6%</td>
<td>38,1%</td>
<td>14,3%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
</tbody>
</table>

**Safety Akkers**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>Don't agree</th>
<th>Irrelevant</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>At night the neighbourhood streets are not sufficiently lid</td>
<td>0,0%</td>
<td>100,0%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>I am concerned with traffic safety when I walk through my neighbourhood</td>
<td>7,1%</td>
<td>92,9%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>My neighbourhood is badly maintained</td>
<td>42,9%</td>
<td>57,1%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>In my neighbourhood the footways are badly accessible</td>
<td>28,6%</td>
<td>71,4%</td>
<td>0,0%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>I am afraid of crime and being bothered when I walk through my neighbourhood in the dark</td>
<td>71,4%</td>
<td>21,4%</td>
<td>7,2%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
</tbody>
</table>
Appendix B: GPS Tracks