The relationships between the perceived built environment, perceived safety, and travel satisfaction in Dutch rural areas

Niels de Jong
S4122682
Rijksuniversiteit Groningen
Spatial Planning and Design
Supervisor: Dr. S. Ramezani
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Abstract

Improving life satisfaction to create a better living environment is now more important than ever, due to the large population growth. Travel satisfaction is an important factor of life satisfaction, which is influenced by the perceived built environment and perceived safety. One way to increase life satisfaction is using active travel methods, such as cycling. This research aims to find out how the perceived built environment and perceived safety influence satisfaction when cycling in rural areas. This was done using a survey, which people could rate their cycling satisfaction, built environment, and perceived safety. The results show that the perceived built environment affects both the perceived safety and the satisfaction when cycling. Especially the perceived stress, which is influenced by the perceived built environment, such as the perceived quality of the infrastructure, is important for satisfaction. Also, the aesthetics of an area improves satisfaction, as it increases how comfortable people are when cycling and lowers stress levels. The results suggest that to improve the travel satisfaction when cycling in rural areas a focus must be on reducing dangerous situations between cars and cyclists, and improving the aesthetics surrounding bicycle pathways.

Keywords: travel satisfaction, perceived built environment, perceived safety, stress levels, rural areas.

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1. Introduction

Cycling is an important mode of transportation in the European Union, with a modal share of 8% (Interreg, 2020). It has several advantages compared to other transport modes. For example, it is more sustainable and less polluting than motorized travel modes (Interreg, 2020). Other advantages of cycling include factors such as better health (Yin et al., 2020; Kwarteng et al., 2018), and an increase in life satisfaction (Yin et al., 2020). These advantages are reasons for the European Commission to encourage a modal shift to more active travel modes, such as cycling and walking, as part of their green deal (European Environment Agency, 2020). Improving life satisfaction is an important issue for planners, because of the rapid increase in the world population (Mouratidis, 2021). A high urbanization rate makes urban life satisfaction more important to more people than before (Mouratidis, 2021). Cities have a lot of factors that can improve life satisfaction such as a higher income, and better amenities (Easterlin et al., 2011). However, cities also have problems that reduce life satisfaction, examples are congestion and pollution (Easterlin et al., 2011). This can lead to higher life satisfaction in rural areas when looking at these factors (Easterlin et al., 2011). Further research about the concept of life satisfaction must be conducted, especially in rural areas to get a better understanding of the concept (Easterlin et al., 2011). Furthermore, an important component of life satisfaction is how satisfied people are when traveling (Mouratidis, 2021). Travel satisfaction is influenced by the perceived built environment (Ma and Dill, 2015) and the perceived safety (Mouratidis, 2021).

When reviewing the academic literature, most articles about perceived safety and perceived built environment were studied in an urban setting. Factors such as commuting time and perceived safety have a large influence on trip satisfaction (Mouratidis, 2021). However, the built environment is rather area-specific. To get a better understanding of the concept of travel satisfaction and how the built environment influences it, more research should be done in areas with different built environment contexts (Blitz, 2021). The built environment of a rural area is different than: an urban area, commuting times are longer, lower population density, lower traffic volume, and the quality of infrastructure is lower (CBS, 2021). This can influence people's perception of the built environment, perceived satisfaction, and in turn the satisfaction when traveling (Ma and Dill, 2015). The three northern provinces (Friesland, Drenthe, and Groningen) were chosen as the research area because these are often regarded as one of the most rural areas of the Netherlands (CBS,2009).

Getting a better understanding of the built environment, perceived cycling safety, and how it influences trip satisfaction can lead to better policies that can improve travel satisfaction in rural areas by improving the perception of the built environment.

Aim and research question

This research aims to explore the relationship between the perceived built environment, perceived safety, and its impact on satisfaction when cycling as an indicator of life satisfaction in Dutch rural areas. This has led to the following main research question:

- How and to what degree does the perceived built environment influence the perceived cycling safety and in turn the satisfaction of cycling in Dutch rural areas?

The following sub-questions were created to support the research question:

- Sub-question 1: What is the relationship between the perceived built environment and perceived cycling safety in Dutch rural areas?
- Sub-question 2: What is the relationship between the perceived cycling safety and satisfaction with cycling in Dutch rural areas?
- Sub-question 3: What is the relationship between the perceived built environment and satisfaction with cycling in Dutch rural areas?
- Sub-question 4: How does social demographic data influence the perceived built environment, perceived safety, and satisfaction when cycling?

This research is structured in the following way. First, there is a literature analysis and the theory is explained, together with the conceptual framework and hypothesis. After that, the methodology is explained. Next are the results and how they compare with earlier research. Lastly, in the conclusion the research question is answered and compared to the hypotheses. Together with further research suggestions and implications for planning practice and policy making.

2. Theoretical framework

As mentioned before this research aims to discover the relationships between the perceived built environment, perceived safety, and satisfaction when cycling in rural Dutch areas. Earlier research has already shown that these variables are interconnected in urban areas.

2.1 Perceived built environment

The best way to analyse the influence of the built environment on subjective wellbeing and life satisfaction is to use the perceived built environment (Ettema, et al., 2015). Additionally, Ma et al. (2014) explain in their study that the perceived built environment influences one's cycling behaviour. Therefore it is important to not only focus on the objective design of the built environment, but also on how people perceive it (Ma and Dill, 2015). Perceived built environment can be defined as how people perceive their built environment. For example do they think there are enough bicycle paths in their neighbourhood (Ma and Dill, 2015). The article by Blitz (2021) identified key indicators of the perceived built environment that influence the satisfaction with cycling for future research in other areas to get a better understanding. These indicators are the perceived quality of the cycling infrastructure, perception of the traffic volume, and the aesthetics of the surrounding area (Blitz, 2021). Additionally, the factor perceived accessibility is added to the list of key indicators in this research as it can also affect the travel satisfaction (Lättmann et al., 2019; Ma and Dill, 2015).

Perceived quality of the cycling infrastructure

The perceived quality of the cycling infrastructure includes factors such as the perception of the number of cycle lanes in the area, separation between cars, and bike-friendly intersections (Blitz, 2021). Poor quality of the cycling infrastructure leads to more dangerous situations and lowers both the perceived safety and travel satisfaction (Nuñez et al., 2018).

Perceived accessibility

The perceived accessibility influences satisfaction during cycling. In the research done by Lättmann et al. (2019) a significant relationship was found between perceived accessibility and travel satisfaction. A reason for this is that poor accessibility increases stress and time pressure (Ettema et al., 2010). Both stress and time pressure can lead to negative moods which reduce travel satisfaction (Gao et

al., 2017). The accessibility also influences the bikeability of an area, the reason for this is that better accessibility increases the convenience and comfort when riding a bike (Lowrey et al., 2012). This in turn increases travel satisfaction (Lowrey et al., 2012; Calvey et al., 2015).

Traffic volume

According to Kerr et al. (2016), high amounts of motorized traffic have a negative relationship with perceived safety. The opposite is true for large amount of cyclists, as these increase the perceived safety (Aldred & Jungnickel, 2014). This is confirmed by Jacobsen (2015), who concludes that an increased number of cyclists reduces the collisions with cars, which can increase the perceived safety. Both the motorized traffic volume and the bicycle traffic volume influence the comfort when cycling (Li et al., 2012). Li et al. (2012) explain that with low bicycle traffic the comfort level people feel when cycling is higher on separated bicycle roads compared to on-street bicycle lanes because it reduces the chance of collision with motorized traffic. However, with more bicycle traffic on separated bicycle lanes, the comfort level decreases slightly and the comfort level on street bicycle lanes increases a little. A possible explanation according to Li et al. (2012) is that higher bicycle traffic volume increases the interaction with other cyclists, which reduces the effective space for cycling.

Aesthetics

The aesthetics of the surrounding area increase the modal share of cycling (Liao, 2016), as it increases the willingness to cycle (Wahlgren and Schantz, 2016). Green areas can be seen as a strong motivator to cycle (Winters et al., 2016), specifically for short to medium-length journeys (Liao, 2016). These green areas also lead to short-term stress reduction (Parsons and Daniel, 2002). Not only green areas increase travel satisfaction, but also cultural areas (Blitz, 2021). The aesthetics do not only reduce stress and increase willingness to cycle, but it also increases the enjoyment and pleasantness of a trip (Blitz, 2021).

2.2 Perceived safety when cycling

Perceived cycling safety can be seen as how safe people feel when cycling (Branion-Calles et al., 2019). A low perceived safety will lead to lower comfort and higher stress levels when using active travel modes (Legrain et al., 2015), which will lower travel satisfaction (Chaterjee et al., 2019; Legrain et al., 2015). So, perceived safety is an important factor for the modal share of active travel modes (Branion-Calles et al., 2019). According to Branion-Calles et al. (2019) the main factor that influences the safety is the quality of the cycling infrastructure. Not only the objective quality is important, but the perceived quality of the cycling network also plays a large role in the willingness to cycle (Wang et al., 2019). Additionally, the perceived quality also affects the amount of stress people perceive during cycling (Nuñez et al., 2018). This in turn increases the amount of stress people perceive during their cycling trips (Nuñez et al., 2018; Blitz, 2021). This is especially related to the traffic volume. In areas with low motorized traffic volume, people will rate the perceived quality of infrastructure higher than in areas with a high traffic volume (Ma et al., 2014). Additionally, the type of biking infrastructure is as important as the traffic volume, especially roundabouts and junctions are perceived as unsafe. Also, the separation between cars and cyclists is an important factor for the perceived safety (Manton, et al., 2016).

2.3 Satisfaction when cycling

Travel satisfaction can be defined as the fulfilment of one's needs and how much enjoyment people get from a task, which in this case is cycling (Calvey et al., 2015). This is a rather subjective topic, but in earlier research key factors were identified, which are accessibility, quality of the infrastructure, aesthetics, traffic volume, and perceived safety (Blitz, 2021; Calvey et al., 2015). Factors that are

often used for statements in research are comfort and enjoyment (Calvey et al., 2015; Blitz, 2021). Both of these factors can be related to the definition of travel satisfaction, which is the fulfilment of one's needs and how much pleasure people get when traveling (Calvey et al., 2015).

2.4 Social demographic data

Social demographic aspects also has an impact on the perceived built environment, perceived safety, and satisfaction when cycling (Blitz, 2021). According to Blitz (2021) and Gotschi et al. (2018) females often feel less safe when biking than males. They also enjoy their biking trip less than their male counterparts. This is supported by Glasgow et al. (2018), who conclude that females feel less relaxed and more stressed when cycling compared to males because they feel less safe. Additionally, females also often rate more intersections as dangerous, which lowers their perceived quality of the infrastructure (Manton et al. 2016).

Age also has an impact. Older people often feel less comfortable when cycling compared to younger people, which impacts travel satisfaction (Blitz, 2021). However, there is no difference in perceived safety between young and old people (Blitz, 2021). Older people are also less likely to cycle to a destination than younger people (Ma and Dill, 2015). According to Blitz (2021) age does not influence perceptions of the built environment.

3. Conceptual framework

The theoretical framework has led to the following conceptual framework (Figure 1). In this conceptual model the perceived built environment influences the satisfaction with cycling directly, but also indirectly with the factor perceived cycling safety. All of these variables are in turn influenced by socio-demographic characteristics.

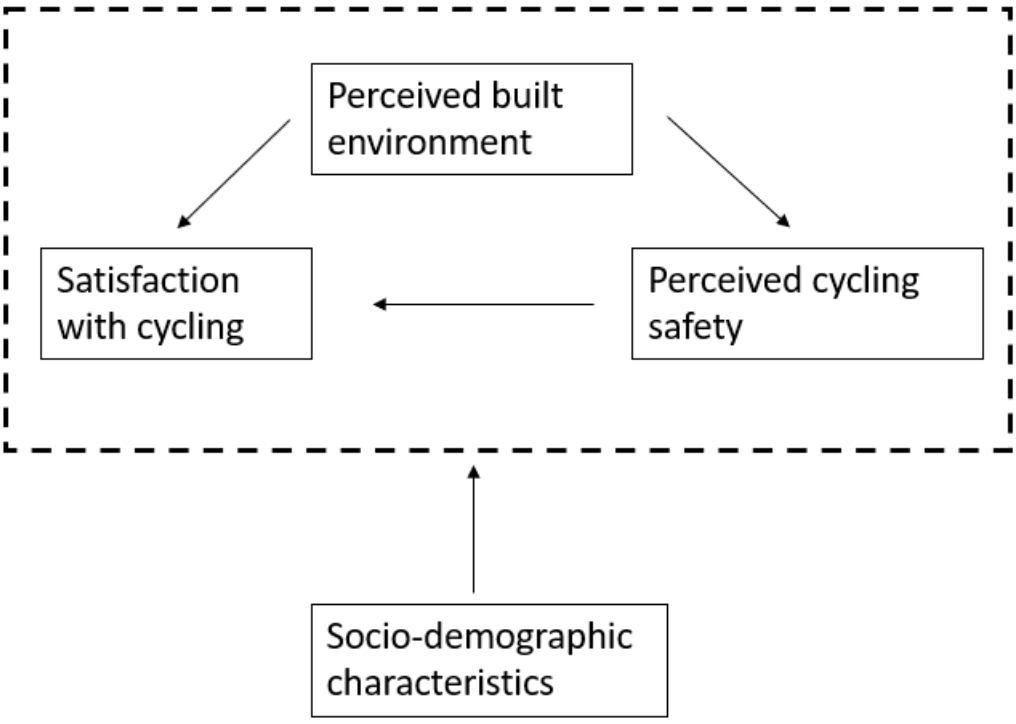

Figure 1: Conceptual framework

3.1 Hypotheses

The theoretical and conceptual framework have led to the following hypotheses:

- Hypothesis 1: Better perceived quality of infrastructure will lead to a higher perceived cycling safety.
- Hypothesis 2: There will be a direct positive relationship between perceived cycling safety and satisfaction with cycling.
- Hypothesis 3: There will also be a direct effect between the perceived built environment and satisfaction with cycling.
- Hypothesis 4: The social demographic data have a correlation with perceived safety and satisfaction when cycling.

4. Methods

4.1 Methodology

This research was done using a quantitative method using surveys in Dutch rural villages in the provinces of Friesland, Groningen, and Drenthe. These provinces were chosen as they are often regarded as the most rural areas in the Netherlands (CBS, 2021). In the survey, the key intention is to gather information about the perceived safety, perceived built environment, and the satisfaction of cycling. A quantitative method was chosen in this research as it is the best way to analyse and generalise the relationships between the variables and answer the research question compared to a qualitative method according to Ma and Dill (2015).

4.2 Survey

In the data collection, the same method was used as Ma and Dill (2015) and Blitz (2021). Respondents had to respond to the statements about the perceived built environment, perceived safety, and travel satisfaction when cycling, on a 5-point Likert scale from completely disagree to completely agree. The reason for this style of data collection is that according to Ma and Dill (2015) this is the best way to collect subjective data in a quantitative way.

Socio-demographic data, such as age and gender, were also collected. This was done to check if there is any gender or age bias in this research. Besides, this data is also used to see if gender or age has any influence on the perceived built environment, perceived cycling safety, and satisfaction when cycling.

Blitz (2021) provides a list of important perceived built environment factors that influence satisfaction when cycling. This includes factors such as cycling infrastructure quality, traffic volumes, and aesthetics (Blitz, 2021). This research will use a similar way to structure the survey. As can be seen in Appendix A the statements about the perceived built environment are divided into four categories, which are accessibility, quality of the cycle infrastructure, perceived traffic volume, and aesthetics. The factor accessibility is added to the list of important perceived built environment factors, similarly to the research done by Lättmann et al. (2019) and Ma and Dill (2015).

4.3 Data collection and analysis

The data collection was done in Dutch villages in the northern part of the Netherlands using Qualtrics. Most of the respondents were from the villages of Sint Nicolaasga, Schasterbrug, and Joure. Sint Nicolaasga is a medium-sized village with a population of 3290 inhabitants (CBS, 2021). It has some shops such as a supermarket and two elementary schools. Schasterbrug is a smaller village with a population of 805 inhabitants. This village is notable because of its linear development around the main road. It does not really have shops or other services, besides one elementary school. Compared to these villages, Joure is a somewhat bigger town with a population of 13900 (CBS, 2021). This also results in more shops and services. This leads to that Joure being somewhat of a hub for the surrounding area. Most of the data collection was done in these villages by going from door to door and asking them if they want to participate in the research. Also, pamphlets were distributed in these villages to get a higher response rate. These pamphlets can be seen in Appendix B The focus was to have a large variability in the built environment, so different villages were chosen with different built environment characteristics. The different built environment characteristics were: differences in population, distance to a bigger town, and difference in the quality of the infrastructure. To get some more respondents the convenience sampling technique was used, so the

invitations for the research were sent to people known to the researcher. This resulted in a higher variability because it included more villages.

The data was analysed using the spearman correlation test to find the relationships between the studied variables. This is an easy method to analyse relationships between ordinal variables. The spearman correlation test was used to analyse both the relationships between the individual statements of the variables and the merged means of perceived safety and satisfaction when cycling.

4.5 Ethical considerations

Privacy is important for doing research so the results will be stored anonymously. So, this research will not publish the names of the respondents. However, the data was not always anonymous. Some people needed help with filling in the survey digitally, and a few people wanted to fill it in on paper. This resulted in less anonymous data for these respondents. The researcher made sure in these occasions, that the respondent knew that the data was less anonymous for them. The researcher also made sure to tell the respondents that the research was voluntary and that they could leave it at any time. Integrity is important for doing research (Punch, 2014). This means that the data will not be falsified and the researcher will adhere to a professional and academic code of conduct.

5. Results

The main focus of this research is on four main variables: socio-demographic data, perceived built environment, perceived cycling safety, and satisfaction with cycling, which will be discussed separately.

5.1 Socio-demographic data

During the data collection, 81 people participated by filling in the survey. 53% of the respondents were female and 47% of the respondents were male (Figure 2). Also the age was asked, with the largest age group being 18-24 with 27 respondents (Figure 3). According to the spearman correlation test, there are some correlations between age and the perceived built environment, perceived cycling safety, and the satisfaction with cycling. First of all, older people agreed more on statements 9 (*There are too many parked cars)* and 10 (*There are many cars on the road)* compared to younger people. Another statement that has the same pattern is statement 13 (*Because of aesthetics of the area, I often take the bike*) as can be seen in Table 1.

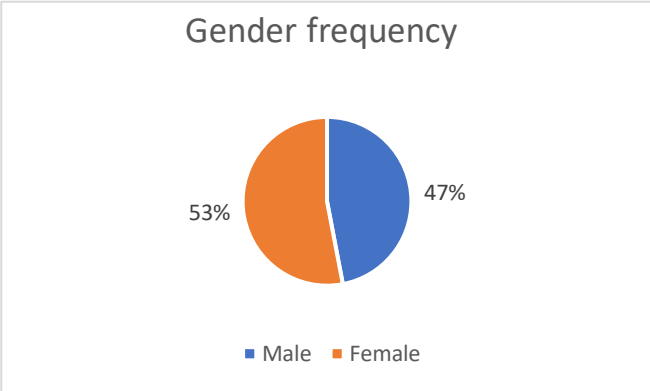

Figure 2: Gender distribution of the sample

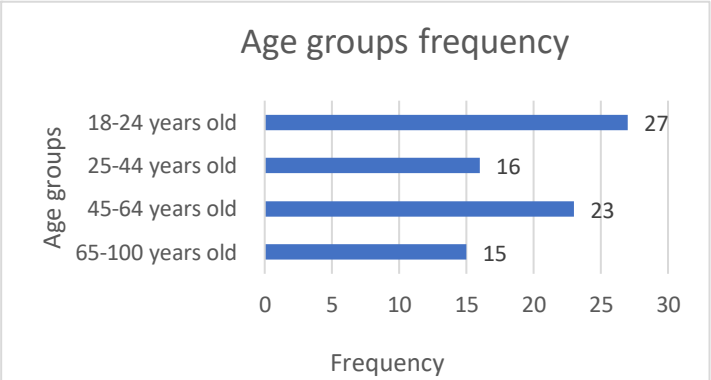

Figure 3: Age distribution of the sample

When looking at the perceived safety there is a correlation between age and perceived safety. Older people responded more often that they disagree with statement 14 (*I feel safe when cycling*) than younger people. However, the statements about satisfaction show the opposite, here older people agreed more often with the statement that they perceive a lot of enjoyment when cycling than younger respondents (statement 16). This is different from the research done by Blitz (2021), who concluded that age has no impact on safety and that older people enjoyed their trips less than younger people.

Statements	P- value	Correlation coefficient	Strength
Gender & there are many cyclist on the road	0,041	-0,228	Weak
Gender & there are too many parked cars	0,027	-0,245	Weak
Age groups & there are too many parked cars	0,036	-0,232	Weak
Age groups & there are too many cars on the road	0,000	-0,380	Moderate
Age groups & because of the aesthetics I often cycle	0,000	-0,380	Moderate
Age groups & I feel safe when cycling	0,029	0,242	Weak
Age groups & I perceive a lot of enjoyment when cycling	0,039	-0,230	Weak
Gender: Male= 1/ Female=0	Age groups: (18-24)= 1, (25-44)=2, (45-64)=3, (65-100)=4		

Table 1 Significant correlations for socio-demographic data

There are some correlations with the gender of the respondents, especially with the statements about traffic volume. Females are more likely to agree with statements 8 (*There are many cyclists on the road*) and 9 *(There are too many parked cars*) as can be seen in Table 1. There is no correlation found that females feel more unsafe and more stressed than males (see Appendix C), which was proven in earlier research (Glasgow et al., 2018; Blitz, 2021; Gotschi et al., 2018). However, there is a correlation between females and statement 9 about their perception of the amount parked cars, which is related to perceived dangerous situations (Blitz, 2021). So some evidence is found that females perceive more situations as dangerous. However, this is only one statement, other statements about dangerous situations such as the ones about the quality of infrastructure show no correlation (statements 5, 6, and 7).

5.2 Relationships between the perceived built environment and perceived safety

According to the spearman correlation test, there are a few relationships between the perceived built environment and the perceived safety, as can be seen in Table 2. Only two statements of the perceived quality of the cycling infrastructure have a relationship with perceived safety, which are statements are 5 (*There is sufficient separation between cars and bicycles near high traffic density locations*) and 7 *(There are enough junctions that keep the cyclist in mind*) (see Table 2). Both of these statements are related to the quality of the infrastructure and this confirms the outcomes of earlier research done by Nuñez et al. (2018) and Blitz (2021) that the perceived quality of the infrastructure

influences the perceived safety. However, only statement 5 and statement 7 have a correlation according to the analysis. This is not the case for the other statement about the perceived quality of the cycling infrastructure. Statement 6 about if there are enough cycle lanes in and surrounding the village shows no correlation. This is different from earlier studies done by Nuñez et al. (2018) and Blitz (2021), in which a significant relationship was found. This is also different from the research done by Branion-Calles et al. (2019), who concluded that the objective quality of the infrastructure, especially the number of cycling lanes, is a significant factor for the perceived safety. It is interesting to see that only the statements about the perceived quality of the cycling infrastructure that are more directly related to dangerous situations show a relationship, with perceived safety. An explanation for this can be the differences between rural and urban areas. Researches in urban areas often focus on the number and length of bicycle lanes and motorised traffic volumes, such as the research done by Li et al. (2012) and Blitz (2021). In this research, the motorised traffic volume does not show any correlations with perceived safety and satisfaction when cycling (see appendix G). Motorised traffic has less impact on perceived safety in rural areas might be due to that there is less traffic (CBS, 2021).

Statements	**P-value**	**Correlation coefficient**	**Strength**
My hobbies/recreational areas are easy to access by bike & I do not feel a lot of stress when cycling	0,044	0,225	Weak
There is sufficient separation & I feel safe when cycling	0,000	0,416	Moderate
There are enough bike friendly junctions & I feel safe when cycling	0,017	0,264	Weak
There are adequate green areas & I do not feel a lot of stress when biking	0,018	0,263	Weak
Because of aesthetics I often cycle & I do not feel a lot of stress when cycling	0,001	0,369	Moderate

Table 2: Significant correlations between perceived built environment and perceived safety

The other statement in the variable perceived safety is statement 15 about how much stress people perceive during their biking trip. As can be seen in Table 5, only one of the statements has a correlation, which is the statement about the accessibility to hobby and recreational areas. This outcome confirms earlier research by Ettema et al. (2010) that great accessibility leads to lower stress levels. However, the other accessibility statement (*The supermarket is easy to access by bike*) does not correlate according to the analysis as can be seen in Appendix D.

None of the statements about the perceived quality of the cycling infrastructure show correlations with stress levels as can be seen in Appendix D. This is different than other similar research. Nuñez et al. (2018) found in their research that there is a relationship between the perceived quality, perceived safety, and stress. However, this is not the case in this research. Also, none of the traffic volume statements show any correlation between the amount of stress and perceived safety (see Appendix D). This is contradicting the research done by Kerr et al. (2016) and Manton et al. (2016), both of which conclude that more motorized traffic results in a more dangerous situation, which results in lower perceived safety (Kerr et al., 2016; Manton et al., 2016) and higher stress levels (Nuñez et al., 2018). The other traffic volume statement about the number of cyclists on the road also shows no correlation with the perceived safety and stress levels, while other research has proven that more cyclist increases the perceived safety (Aldred and Jungnickel, 2014), reduce collisions with cars (Jacobsen, 2015), which in turn decreases the stress levels (Nuñez et al., 2018). A reason for this difference in this research might be that in rural areas, there is a lower traffic volume (CBS, 2021).

There are some correlations between the aesthetics statements and the perceived stress levels as can be seen in Table 2. First of all, there is a correlation between the amount of green around cycling routes (see statement 12) and the amount of stress people perceive (see statement 15). Also statement 13 (*Because of aesthetics of the area, I often cycle)* shows a correlation with statement 15 about the stress people perceive during cycling. This is similar to research done by Parsons and Daniel (2002), who conclude that green and aesthetic landscapes lead to short-term stress reductions.

The merged perceived safety means show some differences when looking at the correlations. Statements 4 (*My hobbies/recreational areas are easy to access by bike*) and the statements 11 (*Cycling routes are nice to ride trough*) and 13 (*Because of aesthetics of the area, I often cycle*) do not correlate with the merged means. The other statements that already showed relationships stayed the same as can be seen in Appendix G.

5.3 Relationships between perceived built environment and satisfaction when cycling

There are a lot more relationships between the perceived built environment with satisfaction when cycling compared to perceived safety. First, both statements (statements 3, 4) about the perceived accessibility have a relationship with the satisfaction when cycling, although with different statements. Statement 3 about the perceived accessibility to the supermarket shows a direct positive relationship with how comfortable people feel on the bike (statement 17). However, accessibility to recreational and hobby areas (statement 4) shows no correlation as can be seen in Appendix E. The correlation of statement 3 (*The supermarket is easy to access by bike*) can be explained by the research of Lowry et al. (2012). In their research, they show that the comfort of cycling in a certain area is influenced by the accessibility to important destinations (statement 14). Better accessibility increases the comfort when cycling because people can travel easily by bike towards important destinations (Lowrey et al., 2012). However, this does not explain why statement 4 does not correlate with how comfortable people feel on a bike. This is the opposite with statement 16 about how much enjoyment people feel during cycling. With this statement, only the accessibility to recreational and hobby areas shows a correlation (statement 4). This is not the case for the accessibility to the supermarket (statement 3).

Statements	P-value	Correlation coefficient	Strength
The supermarket is easy to access by bike & I feel comfortable when cycling	0,046	0,222	Weak
My hobbies/recreational areas are easy to access by bike & I perceive a lot of enjoyment when cycling	0,018	0,263	Weak
Cycling routes are nice to ride trough & I feel comfortable when cycling	0,014	0,237	Weak
There are adequate green areas & I feel comfortable when cycling	0,023	0,254	Weak
Because of aesthetics I often cycle & I perceive a lot of enjoyment when cycling	0,000	0,393	Moderate
Because of aesthetics, I often cycle & I feel comfortable when cycling	0,005	0,311	Moderate

Table 3: significant correlations between built environment and satisfaction

None of the statements about the perceived quality and traffic volume show a correlation with either statement 16 (*I perceive a lot of enjoyment when cycling*) or statement 17 (*I feel comfortable when cycling*). This is different from earlier research such as Blitz (2021) and Li et al. (2012). A possible reason why there is a difference is that they use more sophisticated statistical analysis methods, that analyses all three variables in one test.

All the aesthetics statements show a correlation with how comfortable people feel when cycling (see Table 3). However, this is not the case for statement 16 (*I perceive a lot of enjoyment when cycling)* which only shows correlations with the following statement: '*Because of the aesthetics I often cycle*'. This is different than other research's as these prove that the aesthetics lead to a more pleasant and enjoyable bike ride (Blitz, 2021). It proves however that the aesthetics improve the willingness to cycle because it is enjoyable. This confirms earlier research done by Liao (2016) and Walhgren et al. (2016).

Similarly, the perceived satisfaction statements show almost the same correlations as the individual statements when merged. Especially the aesthetics statements show similar relationships as can be seen in Appendix G. With the accessibility statements, only the accessibility of the supermarket shows a correlation. This is expected as this is also the only accessibility statement that showed a correlation before merging the satisfaction statements. What is unexpected is that an extra correlation showed up when doing this analysis. Statement 6 about if there are sufficient bicycle paths in the surrounding area showed a relationship with the mean average of the variable satisfaction when cycling, while this was not the case when analysing the statements individually (see Table 3). This is a similar outcome to the research done by Blitz (2021) and Lowrey et al. (2012). However, it does not explain why it shows no correlation for the individual statements.

5.4 Relationships between perceived safety and satisfaction when cycling

The perceived cycling safety correlates with almost all the satisfaction when cycling statements, except the statement about the enjoyment people perceive (see statement 16). First, the perceived cycling safety correlates with the amount of stress perceived (see statements 14 and 15) with a direct relationship, as can be seen in Table 4. This is similar to the research done by Nuñez et al. (2018) that perceived safety influences stress levels when they are cycling. The amount of stress during cycling also has a direct relationship with how comfortable people are during their cycling trip (see statement 17). Similarly, the stress levels also correlate with how comfortable people are as can be seen in Table 4. Legrain et al. (2015) provide a reason for these correlations, in their research, they conclude that the poor perceived safety also leads to more stress, which in turn decreases how comfortable people are during their trip. Also the stress levels people experience during cycling influences the enjoyment people feel when cycling (see statement 15 and 17). Higher stress levels influence reduces the enjoyment of the trip as it is a negative mood (Chaterjee et al., 2019; Legrain et al., 2015; Gao et al., 2017).

Statements	**P-value**	**Correlation coefficient**	**Strength**
I feel safe when cycling & I do not feel a lot of stress when cycling	0,003	0,329	Moderate
I feel safe when cycling & I feel comfortable when cycling	0,002	0,324	Moderate
I do not feel a lot of stress when cycling & I perceive a lot of enjoyment when cycling	0,010	0,286	Weak
I do not feel a lot of stress when cycling & I feel comfortable when cycling	0,012	0,227	Weak

Table 4: Significant relationships between perceived safety and satisfaction

6. Conclusion

This research aims to answer the research question: *'How and to what degree does the perceived built environment influence the perceived cycling safety and in turn the satisfaction of cycling in Dutch rural areas?*' In order to answer this research question, a quantitative analysis using a survey was used. This data was statistically analysed using the spearman correlation method in order to uncover these relationships.

Looking at the results of the analysis can be concluded that the built environment can influence the perceived safety and cycling satisfaction similar to earlier research in more urban areas. However, this is not the case for all the statements of the perceived built environment. Traffic volume shows no correlation with perceived safety and the travel satisfaction when cycling. Likewise, the statement about how much enjoyment people perceive during their cycle trip shows only two relationships with the accessibility to recreation/hobby areas and the willingness to cycle because of aesthetics statements.

In order to get a better understanding, several sub-questions were created. The first sub-question: *'What is the relationship between perceived built environment and perceived cycling safety in Dutch rural areas?*' can be answered. There is evidence that the built environment influences the perceived safety, especially the quality of the infrastructure that relates to dangerous situations. Examples are statement 5 about sufficient separation and statement 7 about bike-friendly junctions. As said before none of the traffic volume statements show any correlation. Similarly, the statements about sufficient bike lanes also do not show a correlation with perceived safety. This is different from earlier research. The statement about stress also does not show any correlation with the quality of infrastructure and traffic volume statements, while it should show some correlation according to earlier research. The stress statements do however show correlations with the aesthetics, which is in line with earlier research that the aesthetics decrease stress levels. This is the same for accessibility, which also shows a correlation with stress levels. This means that hypothesis one can be confirmed. Sub-question 2: *'What is the relationship between the perceived cycling safety and satisfaction with cycling in Dutch rural areas?*'. There is evidence of a direct positive relationship between perceived safety and satisfaction. Almost all statements about perceived safety and satisfaction when cycling show relationships. Except statement 14 about how safe people feel and statement 16 about enjoyment. This means that also hypothesis 2 can be confirmed. Sub-question 3: *'What is the relationship between the perceived built environment and satisfaction with cycling in Dutch rural areas?*'. This relationship can be described as that aesthetics are important to travel satisfaction. All aesthetics statements show a correlation with the mean of the merged satisfaction statements. When looking at it individually the aesthetics show correlations with how comfortable people feel. Also, accessibility is important for travel satisfaction as can be seen in Table 3. When looking at the merged mean of travel satisfaction there is also a correlation with the statement about sufficient bike lanes in the area. This means that also hypothesis 3 can be confirmed. Sub-question 4: *'How does social demographic data influence the perceived built environment, perceived safety, and satisfaction when cycling?*'. Gender mainly influences their perception of traffic volume but does not influence the perceived safety or satisfaction. This is different than similar research. The age however does show some correlation with how safe they feel. Older people feel more unsafe on their bikes than younger people. However, older people do enjoy their trips more. Also, age influences their perception of traffic volume, which is also different from earlier research. This means that also hypothesis 4 can be confirmed.

6.1 Policy recommendations

With these results the following policy recommendations can be made. The amount of bicycle paths do not impact the perceived safety and cycling satisfaction. More important is to reduce the number of dangerous situations for cyclists and in turn increase the perceived safety and travel satisfaction. This can be done by making junctions more bike-friendly and in some cases increasing the separation between cars and cyclists. Also, the aesthetics are important for travel satisfaction and can be improved to increase the willingness even further, so this can be improved by making more green areas.

6.2 Limitations and future research

To conclude, there is evidence that the perceived built environment influences the perceived safety and satisfaction when cycling. However, not all the factors that were proven in earlier research show a correlation. The reason that some statements do not show a correlation, which is the case in similar research might be because of the type of analysis in this research. In this case the spearman correlation test was used. This analytical test only analyses whether there is a monotonic association. There might be other kinds of relationships between the statements that can be analysed with more sophisticated statistical analysis methods such as the mediator regression analysis. Another reason might be the low variability of this research because the convenience sample technique was used. Also, only 81 people participated in this research, because of the low response rate. This reduces the variability and representability of the sample. Having a larger sample size can lead to other results. One of the recommendations is in this case to conduct similar research in a rural setting with a larger sample size and a more sophisticated analysis method. Another reason why some of the statements show no correlation is that these relationships are less present in rural areas compared to urban areas. In the case of the traffic volume, according to the CBS (2021), there is less motorized traffic in the rural areas compared to urban areas, so it is less of a problem.

Another future recommendation is to compare the travel satisfaction, perceived safety, and perceived built environment in rural and urban areas. This can lead to a better understanding of these concepts and can lead to better policy advice on how to improve the perceived safety and satisfaction when cycling in both urban and rural areas.

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8. Appendices

Socio-demographic data		
Question 1: What is your gender	1 Male 0 Female	Nominal
Question 2: What is your age	1 (18-24) 2 (25-44) 3 (45-64) 4(65-100)	Ordinal
Statements perceived built environment (accessibility)		
Statement 3: The supermarket is easy to access by bike	1 completely agree 2 agree 3 neither agree or disagree 4 disagree 5 Completely disagree	Ordinal
Statement 4: My hobbies/recreational areas are easy to access by bike		
Statements perceived built environment (quality of infrastructure)		
Statement 5: There is sufficient separation between cars and bicycle near high traffic density locations	1 completely agree 2 agree 3 neither agree or disagree 4 disagree 5 Completely disagree	Ordinal
Statement 6: There are sufficient bicycle lanes in and surrounding my village		
Statement 7: There are enough junctions that keep the cyclist in mind		
Statements perceived built environment (traffic volume)		
Statement 8: There are many cyclist on the road	1 completely agree 2 agree 3 neither agree or disagree 4 disagree 5 Completely disagree	Ordinal
Statement 9: There are too many parked cars		
Statement 10: There are too many cars on the road		
Statements perceived built environment (aesthetics)		
Statement 11: Cycling routes are nice to ride trough	1 completely agree 2 agree 3 neither agree or disagree 4 disagree 5 Completely disagree	Ordinal
Statement 12: There is adequate green areas in the area		
Statement 13: . Because of aesthetics of the area, I often cycle		

Statements perceived safety		
Statement 14: I feel safe when riding cycling	1 completely agree 2 agree 3 neither agree or disagree 4 disagree 5 Completely disagree	Ordinal
Statement 15: I don't feel a lot of stress when cycling		
Statements satisfaction when cycling		
Statement 16: I perceive a lot of enjoyment cycling	1 completely agree 2 agree 3 neither agree or disagree 4 disagree 5 Completely disagree	Ordinal
Statement 17: I feel comfortable when cycling		

Appendix A: The questionnaire of this research

Uitnodiging om mee te doen in een onderzoek voor een bachelor scriptie

Ik heet Niels de Jong en doe de studie technische planologie aan de rijksuniversiteit Groningen. Op dit moment ben ik bezig met mijn bachelor scriptie, en doe ik onderzoek naar hoe veilig mensen zich voelen op de fiets op het platteland. Ik wil u graag uitnodigen om mee te doen in dit onderzoek door een 3 minuten durende enquête in te vullen. Deze enquête is anoniem, alleen u leeftijd, geslacht en woonplaats worden gevraagd voor de analyse. U kunt de enquête invullen door de volgende QR code te scannen

Bij voorbaat dank,

Niels de Jong

Appendix B: Pamphlet

			What is your gender	Agegroups	The supermarket is easy to access by bike	My hobbies/recreational areas are easy to access by bike	There is sufficient separation between cars and bicycle near high traffic density locations	There are sufficient bicycle lanes in and surrounding my village	There are enough junctions that keep the cyclist in mind	There are many cyclist on the road	There are too many parked cars	There are too many cars on the road	Cycling routes are nice to ride trough	There are adequate green areas in the area	Because of aesthetics of the area, I often take the bike	I feel safe when riding my bike	I don't feel a lot of stress when riding my bike	I perceive a lot of enjoyment when riding my bike	I feel comfortable when riding my bike
earman'	What is your	Correlation Coefficient	1,000	-0,087	-0,181	-0,067	0,082	0,050	-0,027	-,228*	-,245*	-0,011	0,052	-0,046	-0,100	0,086	0,030	0,138	-0,008
ho	gender? Male= 1	Sig. (2-tailed)		0,441	0,106	0,552	0,464	0,655	0,809	0,041	0,027	0,925	0,647	0,688	0,377	0,450	0,789	0,222	0,946
	Female= 0	N	81	81	81	81	81	81	81	81	81	81	80	79	80	80	80	80	80
	Agegroups (18-24)=1	Correlation Coefficient	-0,087	1,000	-0,113	-0,107	0,071	0,057	0,056	0,027	-,232*	-,380**	-0,065	-0,145	-,380**	,242*	0,038	-,230*	0,082
	(25-44)=2 (45-64)=3	Sig. (2-tailed)	0,441		0,311	0,340	0,527	0,610	0,615	0,809	0,036	0,000	0,561	0,199	0,000	0,029	0,734	0,039	0,465
	(65-100)=4	N	81	82	82	82	82	82	82	82	82	82	81	80	81	81	81	81	81

Correlation is significant at the 0.05 level (2-tailed).

Correlation is significant at the 0.01 level (2-tailed).

Appendix C: Relationships between socio-demographic data and perceived built environment, perceived safety, and travel cycling satisfaction.

		The supermarket is easy to access by bike	My hobbies/recreational areas are easy to access by bike	There is sufficient separation between cars and bicycle near high traffic density locations	There are sufficient bicycle lanes in and surrounding my village	There are enough junctions that keep the cyclist in mind	There are many cyclist on the road	There are too many parked cars	There are too many cars on the road	Cycling routes are nice to ride trough	There are adequate green areas in the area	Because of aesthetics of the area, I often cycle	I feel safe when cycling	I don't feel a lot of stress when cycling
The supermarket is easy to access by bike	Pearson Correlation	1	,383**	-0,033	-0,012	-0,011	0,183	,248*	0,086	0,110	,220*	,292**	0,052	0,060
	Sig. (2-tailed)		0,000	0,771	0,915	0,923	0,101	0,025	0,441	0,329	0,050	0,008	0,642	0,592
	N	82	82	82	82	82	82	82	82	81	80	81	81	81
My hobbies/recreational areas are easy to	Pearson Correlation	,383**	1	0,020	0,066	-0,053	,224*	,276*	0,061	-0,051	0,067	,394**	0,061	0,177
	Sig. (2-tailed)	0,000		0,858	0,555	0,637	0,043	0,012	0,585	0,654	0,556	0,000	0,591	0,114
	N	82	82	82	82	82	82	82	82	81	80	81	81	81
There is sufficient separation between cars and	Pearson Correlation	-0,033	0,020	1	,367**	,650**	-,252*	-0,211	0,020	0,207	0,135	0,072	,412**	0,104
	Sig. (2-tailed)	0,771	0,858		0,001	0,000	0,023	0,057	0,862	0,063	0,233	0,521	0,000	0,355
	N	82	82	82	82	82	82	82	82	81	80	81	81	81
There are sufficient bicycle lanes in and	Pearson Correlation	-0,012	0,066	,367**	1	,363**	-0,068	-0,206	-0,105	,326**	0,178	0,022	0,156	0,205
	Sig. (2-tailed)	0,915	0,555	0,001		0,001	0,542	0,063	0,348	0,003	0,113	0,844	0,165	0,066
	N	82	82	82	82	82	82	82	82	81	80	81	81	81
There are enough junctions that keep the cyclist	Pearson Correlation	-0,011	-0,053	,650**	,363**	1	-,241*	-0,154	-0,008	,267*	0,082	-0,053	,253*	0,077
	Sig. (2-tailed)	0,923	0,637	0,000	0,001		0,029	0,168	0,945	0,016	0,468	0,636	0,023	0,494
	N	82	82	82	82	82	82	82	82	81	80	81	81	81
There are many cyclist on the road	Pearson Correlation	0,183	,224*	-,252*	-0,068	-,241*	1	,427**	0,132	0,100	0,011	0,183	0,069	0,058
	Sig. (2-tailed)	0,101	0,043	0,023	0,542	0,029		0,000	0,239	0,375	0,922	0,102	0,543	0,610
	N	82	82	82	82	82	83	82	82	81	80	81	81	81
There are too many parked cars	Pearson Correlation	,248*	,276*	-0,211	-0,206	-0,154	,427**	1	,422**	-0,174	-0,065	0,166	-0,167	-0,096
	Sig. (2-tailed)	0,025	0,012	0,057	0,063	0,168	0,000		0,000	0,121	0,566	0,138	0,135	0,395
	N	82	82	82	82	82	82	82	82	81	80	81	81	81
There are too many cars on the road	Pearson Correlation	0,086	0,061	0,020	-0,105	-0,008	0,132	,422**	1	0,069	-0,049	,228*	-0,197	-0,172
	Sig. (2-tailed)	0,441	0,585	0,862	0,348	0,945	0,239	0,000		0,543	0,667	0,041	0,078	0,124
	N	82	82	82	82	82	82	82	82	81	80	81	81	81
Cycling routes are nice to ride trough	Pearson Correlation	0,110	-0,051	0,207	,326**	,267*	0,100	-0,174	0,069	1	0,193	0,023	0,141	-0,051
	Sig. (2-tailed)	0,329	0,654	0,063	0,003	0,016	0,375	0,121	0,543		0,088	0,843	0,213	0,655
	N	81	81	81	81	81	81	81	81	81	79	80	80	80
There are adequate green areas in the area	Pearson Correlation	,220*	0,067	0,135	0,178	0,082	0,011	-0,065	-0,049	0,193	1	0,172	0,181	0,123
	Sig. (2-tailed)	0,050	0,556	0,233	0,113	0,468	0,922	0,566	0,667	0,088		0,126	0,108	0,277
	N	80	80	80	80	80	80	80	80	79	80	80	80	80
Because of aesthetics of the area, I often cycle	Pearson Correlation	,292**	,394**	0,072	0,022	-0,053	0,183	0,166	,228*	0,023	0,172	1	0,055	0,163
	Sig. (2-tailed)	0,008	0,000	0,521	0,844	0,636	0,102	0,138	0,041	0,843	0,126		0,623	0,147
	N	81	81	81	81	81	81	81	81	80	80	81	81	81
I feel safe when cycling	Pearson Correlation	0,052	0,061	,412**	0,156	,253*	0,069	-0,167	-0,197	0,141	0,181	0,055	1	,329**
	Sig. (2-tailed)	0,642	0,591	0,000	0,165	0,023	0,543	0,135	0,078	0,213	0,108	0,623		0,003
	N	81	81	81	81	81	81	81	81	80	80	81	81	81
I don't feel a lot of stress when cycling	Pearson Correlation	0,060	0,177	0,104	0,205	0,077	0,058	-0,096	-0,172	-0,051	0,123	0,163	,329**	1
	Sig. (2-tailed)	0,592	0,114	0,355	0,066	0,494	0,610	0,395	0,124	0,655	0,277	0,147	0,003	
	N	81	81	81	81	81	81	81	81	80	80	81	81	81

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix D: Relationships between perceived built environment and perceived safety

			The supermarket is easy to access by bike	My hobbies/recreational areas are easy to access by bike	There is sufficient separation between cars and bicycle near high traffic density locations	There are sufficient bicycle lanes in and surrounding my village	There are enough junctions that keep the cyclist in mind	There are many cyclist on the road	There are too many parked cars	There are too many cars on the road	Cycling routes are nice to ride trough	There are adequate green areas in the area	Because of aesthetics of the area, I often cycke	I perceive a lot of enjoyment when cycling	I feel comfortable when cycling
Spearman's rho	The supermarket is easy to access by bike	Correlation Coefficient	1,000	,459**	0,054	0,028	-0,029	0,190	,219*	-0,023	0,123	,278*	,231*	0,094	,222*
		Sig. (2-tailed)		0,000	0,629	0,800	0,794	0,087	0,048	0,841	0,275	0,012	0,038	0,406	0,046
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	My hobbies/recreational areas are easy to	Correlation Coefficient	,459**	1,000	0,069	0,088	0,020	,226*	,226*	0,024	0,077	0,209	,299**	,263*	0,202
		Sig. (2-tailed)	0,000		0,541	0,433	0,858	0,041	0,041	0,833	0,495	0,063	0,007	0,018	0,071
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There is sufficient separation between cars and	Correlation Coefficient	0,054	0,069	1,000	,408**	,664**	-0,180	-0,198	0,044	0,158	0,088	0,047	0,099	0,084
		Sig. (2-tailed)	0,629	0,541		0,000	0,000	0,105	0,074	0,695	0,160	0,440	0,676	0,380	0,454
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There are sufficient bicycle lanes in and	Correlation Coefficient	0,028	0,088	,408**	1,000	,384**	-0,079	-0,176	-0,173	0,200	0,161	0,032	0,197	0,153
		Sig. (2-tailed)	0,800	0,433	0,000		0,000	0,478	0,113	0,119	0,073	0,153	0,779	0,079	0,173
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There are enough junctions that keep the cyclist	Correlation Coefficient	-0,029	0,020	,664**	,384**	1,000	-0,201	-0,140	-0,003	,238*	0,079	-0,034	0,040	0,065
		Sig. (2-tailed)	0,794	0,858	0,000	0,000		0,071	0,208	0,976	0,033	0,484	0,766	0,722	0,563
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There are many cyclist on the road	Correlation Coefficient	0,190	,226*	-0,180	-0,079	-0,201	1,000	,429**	,240*	,233*	0,170	0,148	0,077	0,156
		Sig. (2-tailed)	0,087	0,041	0,105	0,478	0,071		0,000	0,030	0,036	0,132	0,189	0,493	0,163
		N	82	82	82	82	82	83	82	82	81	80	81	81	81
	There are too many parked cars	Correlation Coefficient	,219*	,226*	-0,198	-0,176	-0,140	,429**	1,000	,403**	-0,147	-0,022	0,107	0,037	-0,114
		Sig. (2-tailed)	0,048	0,041	0,074	0,113	0,208	0,000		0,000	0,189	0,850	0,340	0,744	0,310
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There are too many cars on the road	Correlation Coefficient	-0,023	0,024	0,044	-0,173	-0,003	,240*	,403**	1,000	0,090	-0,108	0,182	0,161	-0,114
		Sig. (2-tailed)	0,841	0,833	0,695	0,119	0,976	0,030	0,000		0,422	0,338	0,104	0,152	0,309
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	Cycling routes are nice to ride trough	Correlation Coefficient	0,123	0,077	0,158	0,200	,238*	,233*	-0,147	0,090	1,000	,389**	0,173	0,157	,273*
		Sig. (2-tailed)	0,275	0,495	0,160	0,073	0,033	0,036	0,189	0,422		0,000	0,126	0,165	0,014
		N	81	81	81	81	81	81	81	81	81	79	80	80	80
	There are adequate green areas in the area	Correlation Coefficient	,278*	0,209	0,088	0,161	0,079	0,170	-0,022	-0,108	,389**	1,000	0,175	0,177	,254*
		Sig. (2-tailed)	0,012	0,063	0,440	0,153	0,484	0,132	0,850	0,338	0,000		0,121	0,115	0,023
		N	80	80	80	80	80	80	80	80	79	80	80	80	80
	Because of aesthetics of the area, I often cycle	Correlation Coefficient	,231*	,299**	0,047	0,032	-0,034	0,148	0,107	0,182	0,173	0,175	1,000	,393**	,311**
		Sig. (2-tailed)	0,038	0,007	0,676	0,779	0,766	0,189	0,340	0,104	0,126	0,121		0,000	0,005
		N	81	81	81	81	81	81	81	81	80	80	81	81	81
	I perceive a lot of enjoyment when cycling	Correlation Coefficient	0,094	,263*	0,099	0,197	0,040	0,077	0,037	0,161	0,157	0,177	,393**	1,000	,484**
		Sig. (2-tailed)	0,406	0,018	0,380	0,079	0,722	0,493	0,744	0,152	0,165	0,115	0,000		0,000
		N	81	81	81	81	81	81	81	81	80	80	81	81	81
	I feel comfortable when cycling	Correlation Coefficient	,222*	0,202	0,084	0,153	0,065	0,156	-0,114	-0,114	,273*	,254*	,311**	,484**	1,000
		Sig. (2-tailed)	0,046	0,071	0,454	0,173	0,563	0,163	0,310	0,309	0,014	0,023	0,005	0,000	
		N	81	81	81	81	81	81	81	81	80	80	81	81	81

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix E: Relationships between perceive built environment and satisfaction when cycling

		I feel safe when cycling	I don't feel a lot of stress when cycling	I perceive a lot of enjoyment when cycling	I feel comfortable when cycling
I feel safe when cycling	Pearson Correlation	1	,329**	0,110	,342**
	Sig. (2-tailed)		0,003	0,328	0,002
	N	81	81	81	81
I don't feel a lot of stress when cycling	Pearson Correlation	,329**	1	,286**	,277*
	Sig. (2-tailed)	0,003		0,010	0,012
	N	81	81	81	81
I perceive a lot of enjoyment when cycling	Pearson Correlation	0,110	,286**	1	,516**
	Sig. (2-tailed)	0,328	0,010		0,000
	N	81	81	81	81
I feel comfortable when cycling	Pearson Correlation	,342**	,277*	,516**	1
	Sig. (2-tailed)	0,002	0,012	0,000	
	N	81	81	81	81

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix F: Relationships between perceived safety and satisfaction when cycling

			The supermarket is easy to access by bike	My hobbies/recreational areas are easy to access by bike	There is sufficient separation between cars and bicycle near high traffic density locations	There are sufficient bicycle lanes in and surrounding my village	There are enough junctions that keep the cyclist in mind	There are many cyclist on the road	There are too many parked cars	There are too many cars on the road	Cycling routes are nice to ride trough	There are adequate green areas in the area	Because of aesthetics of the area, I often cycle	Mean_Perceived_Safety	Mean_Satisfaction
Spearman's rho	The supermarket is easy to access by bike	Correlation Coefficient	1,000	,459**	0,054	0,028	-0,029	0,190	,219*	-0,023	0,123	,278*	,231*	0,195	0,185
		Sig. (2-tailed)		0,000	0,629	0,800	0,794	0,087	0,048	0,841	0,275	0,012	0,038	0,082	0,098
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	My hobbies/recreational areas are easy to	Correlation Coefficient	,459**	1,000	0,069	0,088	0,020	,226*	,226*	0,024	0,077	0,209	,299**	0,196	,305**
		Sig. (2-tailed)	0,000		0,541	0,433	0,858	0,041	0,041	0,833	0,495	0,063	0,007	0,080	0,006
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There is sufficient separation between cars and	Correlation Coefficient	0,054	0,069	1,000	,408**	,664**	-0,180	-0,198	0,044	0,158	0,088	0,047	,331**	0,135
		Sig. (2-tailed)	0,629	0,541		0,000	0,000	0,105	0,074	0,695	0,160	0,440	0,676	0,003	0,228
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There are sufficient bicycle lanes in and	Correlation Coefficient	0,028	0,088	,408**	1,000	,384**	-0,079	-0,176	-0,173	0,200	0,161	0,032	0,212	,223*
		Sig. (2-tailed)	0,800	0,433	0,000		0,000	0,478	0,113	0,119	0,073	0,153	0,779	0,058	0,046
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There are enough junctions that keep the cyclist	Correlation Coefficient	-0,029	0,020	,664**	,384**	1,000	-0,201	-0,140	-0,003	,238*	0,079	-0,034	,219*	0,095
		Sig. (2-tailed)	0,794	0,858	0,000	0,000		0,071	0,208	0,976	0,033	0,484	0,766	0,049	0,398
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There are many cyclist on the road	Correlation Coefficient	0,190	,226*	-0,180	-0,079	-0,201	1,000	,429**	,240*	,233*	0,170	0,148	0,123	0,127
		Sig. (2-tailed)	0,087	0,041	0,105	0,478	0,071		0,000	0,030	0,036	0,132	0,189	0,275	0,259
		N	82	82	82	82	82	83	82	82	81	80	81	81	81
	There are too many parked cars	Correlation Coefficient	,219*	,226*	-0,198	-0,176	-0,140	,429**	1,000	,403**	-0,147	-0,022	0,107	-0,123	0,001
		Sig. (2-tailed)	0,048	0,041	0,074	0,113	0,208	0,000		0,000	0,189	0,850	0,340	0,273	0,992
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	There are too many cars on the road	Correlation Coefficient	-0,023	0,024	0,044	-0,173	-0,003	,240*	,403**	1,000	0,090	-0,108	0,182	-0,192	0,038
		Sig. (2-tailed)	0,841	0,833	0,695	0,119	0,976	0,030	0,000		0,422	0,338	0,104	0,085	0,738
		N	82	82	82	82	82	82	82	82	81	80	81	81	81
	Cycling routes are nice to ride trough	Correlation Coefficient	0,123	0,077	0,158	0,200	,238*	,233*	-0,147	0,090	1,000	,389**	0,173	0,065	,250*
		Sig. (2-tailed)	0,275	0,495	0,160	0,073	0,033	0,036	0,189	0,422		0,000	0,126	0,570	0,026
		N	81	81	81	81	81	81	81	81	81	79	80	80	80
	There are adequate green areas in the area	Correlation Coefficient	,278*	0,209	0,088	0,161	0,079	0,170	-0,022	-0,108	,389**	1,000	0,175	,245*	,257*
		Sig. (2-tailed)	0,012	0,063	0,440	0,153	0,484	0,132	0,850	0,338	0,000		0,121	0,029	0,022
		N	80	80	80	80	80	80	80	80	79	80	80	80	80
	Because of aesthetics of the area, I often cycle	Correlation Coefficient	,231*	,299**	0,047	0,032	-0,034	0,148	0,107	0,182	0,173	0,175	1,000	0,186	,397**
		Sig. (2-tailed)	0,038	0,007	0,676	0,779	0,766	0,189	0,340	0,104	0,126	0,121		0,096	0,000
		N	81	81	81	81	81	81	81	81	80	80	81	81	81
	Mean_Perceived_Safety	Correlation Coefficient	0,195	0,196	,331**	0,212	,219*	0,123	-0,123	-0,192	0,065	,245*	0,186	1,000	,520**
		Sig. (2-tailed)	0,082	0,080	0,003	0,058	0,049	0,275	0,273	0,085	0,570	0,029	0,096		0,000
		N	81	81	81	81	81	81	81	81	80	80	81	81	81
	Mean_Satisfaction	Correlation Coefficient	0,185	,305**	0,135	,223*	0,095	0,127	0,001	0,038	,250*	,257*	,397**	,520**	1,000
		Sig. (2-tailed)	0,098	0,006	0,228	0,046	0,398	0,259	0,992	0,738	0,026	0,022	0,000	0,000	
		N	81	81	81	81	81	81	81	81	80	80	81	81	81

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix G: Relationships between perceived built environment and the average means