Pedestrian Safety Perception in Shared Space Streets

Comparing perceived pedestrian safety to a pedestrian safety index

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TU Delft

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by

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TU Delft

Preface

This thesis concerns perception of pedestrian safety compared to objective safety based on a survey and a pedestrian safety index. It has been written as part of the Bachelor of Science Civil Engineering for the department of Transport and Planning at the Delft University of Technology. I have been researching and writing this study from April to June of 2021.

I would like to thank my supervisors, Yufei Yuan and Jisup Shim, for their guidance and feedback over the course of my research. I would also like to express my gratitude towards my peers, who have provided me with feedback and helped me with my questions. Finally, I would like to thank the participants that have filled in the survey. Without these people, this research would not have been possible.

L.M. (Lisa) Scholtens
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Summary

The perception of safety by pedestrians has been a much researched subject in shared space areas. With the rise of the shared space concept and the improved pedestrian safety by implementing the shared space principles, the question has come up whether this also translates to better pedestrian safety perception.

This study is about the relation between perceived pedestrian safety and quantitative safety with the research question: *How does perceived safety by pedestrians in shared space streets compare to pedestrian safety in reality?* In this study, safety is defined as the likelihood to get physically injured while walking through the street.

The main question was divided into the following sub-questions, considering differences in shared space street design, quantification of safety and design elements that influence pedestrian safety perception. These questions are asked in order to create some insight into general shared space street design and its consequences for pedestrian safety and the perception of it.

Stakeholders in the research were determined to be pedestrians, other traffic, municipalities and local businesses. Pedestrians, other traffic and municipalities have an interest in optimal safety for all traffic and an matching perception. Pedestrians' and other traffic's influence is limited to street use, whereas municipalities have a larger influence by providing permits to developers based on designs and prescribing rules and guidelines. Local businesses only influence urban design by selecting their locations. They do, however, have a large interest, since improved safety and safety perception increases the traffic flow through the streets, which is directly related to a business' success.

A literature study was performed in order to retrieve some background information on the research area and influential factors. From this literature study, it was determined that designs inspired by shared space concept are gaining popularity. The study areas were located in Seoul, South Korea, Auckland, New Zealand and Haren and Amsterdam, the Netherlands. All of these settings have developed street designs that were meant to promote pedestrian priority using the shared space principles that were devised by Hans Monderman. Besides this, all streets also fulfill the same function of urban shopping area.

Investigation into possible influential factors uncovered earlier observations of a relation between safety perception and age, gender, vehicle traffic, lighting levels and street pattern. Also, quantitative safety indicators were determined from the Pedestrian Safety Index that was used for the research. From this, several additional influential factors were determined for the perception of safety by pedestrians.

The influential factors used in the research included demographic characteristics (age, gender and scale of municipality) and street design characteristics (street width, tile/asphalt pattern and colour, landscaping or furnishing, driving speed, tactile guidance markers, separation between traffic and street markings and traffic signs).

The research has been done using a Pedestrian Safety Index, from which the quantitative safety was derived, and a survey, which was held among 112 inhabitants of the Netherlands. The data was then statistically analysed using the one sample sign test and multiple regression. Both tests were executed using a 0.05 significance.

The Pedestrian Safety Index that was used for the quantitative safety is a method with which pedestrian safety in streets can be determined. This is done by scoring street characteristics on its execution and how well this execution meets standard street design requirements. From this, a score on a scale of 0 to 10 is determined. In total, a number of 24 safety indicators were tested with the index to different standards for the specific type of road level.

The survey showed participants pictures of the different streets with a description of the location, type of traffic and driving speed. Then, the participants were asked to rate the level of safety of the street for pedestrians and to give their opinion on the different design variables that function as influential factors.

The survey safety scores were compared to the Pedestrian Safety Index scores by using a one sample sign test. This statistical test determined whether the median of the survey sample was equal to, greater than or less than the Pedestrian Safety Index score. This was done using two-tailed and one-tailed testing with a significance of 0.05.

Also, the shares of the different influential factors in the construction of the survey safety scores were determined by using multiple regression. This test was done with a significance of 0.05 as well.

The results show that in none of the cases, the hypothesis that the Pedestrian Safety Index score is equal to the median of the survey safety scores should be rejected for the hypothesis that the median of the sample is lower than the Pedestrian Safety Index scores.

These findings indicate a more negative perception of safety by pedestrians in shared space streets. The main influential factor in this was determined to be the street width, which had a significant effect in five out of six cases. Also, age had a significant effect in two streets and landscaping, driving speed and separation of traffic influenced safety perception significantly in one street.

The significance of the influential factors being dependent on the specific street, could indicate that the influential factor has a slight influence on the safety perception. Further investigation would be needed in order to confirm this hypothesis.

A discussion point that could be made in the study is the fact that there has been an over-representation in the survey of women and people between 18 and 30 years of age in the respondents group of the survey. Also, measurements were difficult to obtain with COVID-19 restrictions. It is therefore recommended that further research is done with a more representative focus group and using any opportunity to take measurements on site.

Based on the research, it can be concluded that overall safety perception in shared space streets is more negative than quantitative safety would indicate. It is therefore recommended for municipalities to take this into consideration with urban street design. They may, for example, increase street width in order to create more positive safety perception to match it to the objective level of safety.

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1 Introduction

Shared spaces seem to have a reputation of being a safe environment for all traffic. Because of the lower vehicle speeds and open design, the severity of accidents has decreased in places where regular streets and intersections have been substituted for ones designed with elements of shared space (Engwicht, 2005). There is, however, another side to the design of shared space.

In June 2007, a director of public policy, Tom Pey, shared concern for the rise of shared space areas. This had to do with safety concerns the director had for disabled people (Pring, 2019). Pey was not the only person to doubt the safety of the minimalist design of streets and squares. Methorst et al. (2007) have contemplated the possibility that the number of accidents and the severity of them have not been decreased by creating a safer environment, but by a reduction in the number of pedestrians. They stated that perhaps, this was caused by the discomfort pedestrians experienced with the new designs.

The research question is formulated as: *How does perceived safety by pedestrians in shared space streets compare to pedestrian safety in reality?* The definition of safety that is used, is the likelihood to be physically injured while walking through the street. With the research question, the goal is to determine the difference between the perceived safety pedestrians experience when passing through a shared space street, compared to a quantitative safety score based on guidelines and design. This is done with a combination of a literature study and a survey, which are compared to determine the aforementioned differences.

1.1. Sub-questions

In order to determine the way perception of safety is made up, it is of importance to determine influential factors that affect pedestrians. This is done by raising the question how shared spaces are built up and how they differ from each other. In other words, which differences may be found that may influence a pedestrian's perception of safety.

Besides the pedestrian safety perception, also the quantification of safety in shared spaces is an important aspect. With this, objective safety can be determined to compare the safety perception to. Therefore, the main research question may be divided into different sub-questions. These sub-questions are stated as follows:

How do shared space streets differ from each other? By determining variable design characteristics, influential factors for pedestrian safety perception may be determined. Variable design characteristics indicate where shared space streets differ from each other and therefore influence safety perception.

How do different countries design their shared space streets? From this sub-question, differences between the research areas may be determined. These aspects may be used in determining possible influential factors as well.

How can safety be quantified in shared space areas? Quantitative safety is crucial in the determination of objective safety. By using a method of quantification of pedestrian safety, objective pedestrian safety can be determined and compared to subjective pedestrian safety.

What design elements give pedestrians an impression of safety? By determining what design elements influence subjective pedestrian safety, municipalities and urban developers may take these elements into consideration in street design. These elements can be found among the variable design characteristics and demographic characteristics.

The relations between these sub questions are visualised in figure 1.1. The mind map also shows the influential factors that have been derived from the main aspects of the perception of pedestrian safety in shared space streets. These influential factors can be categorized into internal (demographic) and external (design variable) influential factors.

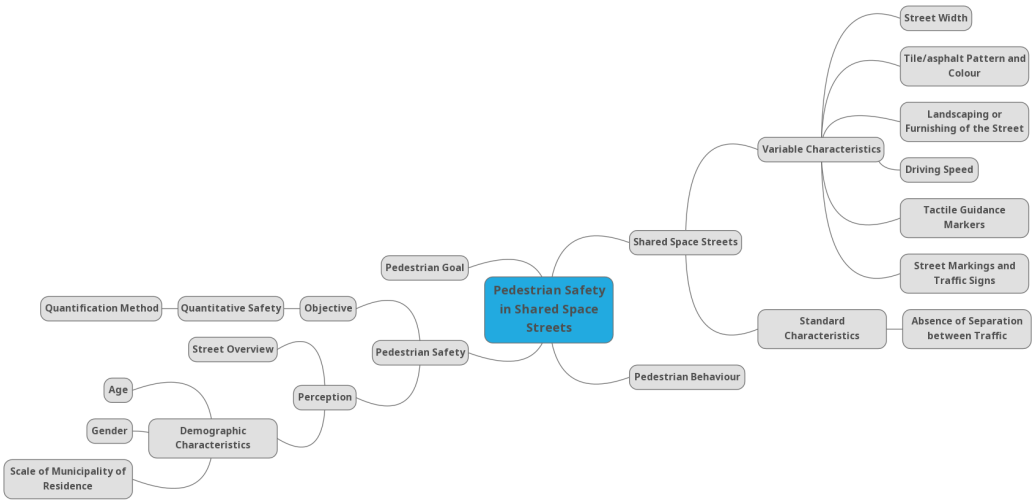


Figure 1.1: Mind map about pedestrian safety perception in shared space streets.

1.2. Influential factors

The determination of the influential factors is based on the quantitative safety method and earlier research. Paragraphs 2.3 and 2.4 give a more detailed description of the determination of the influential factors. An overview of the influential factors can be seen in table 1.1. For each street, the influential factors are determined in tables 1.2 to 1.4. Note that physical separation of traffic is not present in any of the streets, as is prescribed in the shared space principles. There is, however, to some extent separation by means of creating specific zones with street elements. This causes cars to be unable to drive in certain areas in the street.

Table 1.1: Influential factors.

Demographic	Street Design
Age	Street width
Gender	Tile/asphalt colour and pattern
Scale of municipality of residence	Landscaping or furnishing
	Driving speed
	Tactile guidance markers
	Separation of traffic
	Street markings and traffic signs

The research is done in four different settings, of which two are based on earlier international studies and two as baseline cases. These areas are chosen because of the difference in ambiance between the study areas, while the design characteristics are similar to each other. An example for this is the similarity in use of pavement in Seoul as well as Auckland, while the street in Seoul still gives of an impression of priority for motorized traffic.

The first setting is shared space streets in Seoul, South Korea. Here, shared space streets were created from back roads, characterised by a lack of sidewalk, which made pedestrians walk on the asphalt the cars drive on. A study done by Haeryung Lee and Seung-Nam Kim (2019) covered all locations where the Seoul Public Procurement Service (PPS) had implemented the shared street design. In figure 1.2, the type of street can be seen, which was used in the study. The street is quite narrow and the priority seems to lay with the car traffic, which could create a more negative safety perception for pedestrians. Therefore, this is an interesting take on a shared space street with respect to the feeling of safety of pedestrians.

The selected streets that are evaluated in the research are Bukchon-ro 5ga-gil, Jongno-gu and Sanggye-ro 3-gil, Nowon-gu, which are shown in figure 1.2.

Figure 1.2: Bukchon-ro 5ga-gil and Sanggye-ro 3-gil, Seoul (GoogleMaps, 2018a, 2018f).

Table 1.2: Street design variables in the South Korea streets

Design variable	Bukchon-ro 5ga-gil	Sanggye-ro 3-gil
Street width	6.5 m	8 m
Tile/asphalt colour and pattern	Grey tile	Patterned white and red tile
Landscaping or furnishing	No furnishing	No furnishing
Driving speed	30 km/h	30 km/h
Tactile guidance markers	Not present	Not present
Separation of traffic	Not present	Not present
Street markings and traffic signs	Yellow side lines	Not present

The second setting is shared space streets in Auckland, New Zealand. The considered streets are Elliott Street and Jean Batten Place. In 2013 and 2014, Karndacharuk et al. researched pedestrian performance and safety performance in a shared space zone in Auckland. Figure 1.3 shows the streets in New Zealand. There are some obvious similarities between the New Zealand design and that of the one in South Korea, like the lack of a separate sidewalk. However, the overall impressions of the streets are quite different. Where the street in South Korea has a higher priority towards motorized vehicles, the street in New Zealand is more accommodating towards pedestrians.

Figure 1.3: Jean Batten Place and Elliott Street, Auckland (GoogleMaps, 2018b, 2018c).

Table 1.3: Street design variables in the New Zealand streets

Design variable	Elliott Street	Jean Batten Place
Street width	15 m	9 m
Tile/asphalt colour and pattern	Grey tile	Grey tile
Landscaping or furnishing	Bicycle racks and trees	Benches
Driving speed	10 km/h	10 km/h
Tactile guidance markers	Not present	Not present
Separation of traffic	Designated space for cars	Designated space for cars
Street markings and traffic signs	Not present	Speed sign

The final two settings are based in the Netherlands. The Netherlands has been front runner in implementing shared space environments as an alternative to traditional roads and intersections.

The streets used in the study are the Rijksstraatweg in Haren and the Reguliersbreestraat in Amsterdam. These streets are also shown in figure 1.4.

The reason for opting to include the two settings in the Netherlands is for baseline purposes. Because the target group of respondents for the survey is located in the Netherlands, including two extremes (very wide and calm versus very narrow and busy) should give a reasonable insight into the safety perception of the target group in familiar settings.

Figure 1.4: Rijksstraatweg, Haren and Reguliersbreestraat, Amsterdam (GoogleMaps, 2018d, 2018e).

Table 1.4: Street design variables in the Netherlands streets

Design variable	Rijksstraatweg	Reguliersbreestraat
Street width	23 m	12.5 m
Tile/asphalt colour and pattern	Red tiles	Brown tiles with grey tiled line
Landscaping or furnishing	No furnishing	No furnishing
Driving speed	30 km/h	30 km/h
Tactile guidance markers	Not present	Not present
Separation of traffic	Not present	Not present
Street markings and traffic signs	Not present	Not present

1.3. Stakeholders

Pedestrian safety and the perception of it is of interest for multiple stakeholders. These stakeholders may be categorized in the groups pedestrians, other traffic, municipalities and local businesses. To create better insight into the interactions between the stakeholders, it is of importance to determine each party's interests and the degree of influence they are able to exert.

- **Pedestrians**
  The interest of pedestrians lies with their safety and their perception of it. Insight into safety perception may have positive consequences for the comfort of new design of shared space streets. Pedestrians influence the design process by using more attractive streets. Streets which feel less safe are less likely to be used by pedestrians, which make destinations in the street less attractive.

- **Other traffic**
  Other traffic interacts with pedestrians and is directly influenced by pedestrian behaviour. The safety of pedestrians is therefore linked to that of other traffic.
  Like pedestrians, other traffic influences street design by the tendency to use the street over other possible routes.

- **Municipalities**
  Municipalities have a direct say in the development of urban area and streets. They are responsible for ensuring the safety of all traffic and developing a successful street.
  Municipalities have a large influence on street design, as they provide permits to developers and prescribe the rules and guidelines for urban design in the area.

- **Local businesses**
  Local businesses are dependent on the success of a street. A safer street makes for a higher intensity of possible costumers that pass by the businesses. This is especially true for owners of shops and restaurants.
  Local businesses do not have much influence when it comes to urban design. The only option they have is opting to establish their business elsewhere, in other locations where they may find more success.

1.4. Thesis structure

Chapter 2 describes the answering of the sub-questions by means of a literature study. Also, in this literature study hypotheses will be made in relation to the influential factors that have been defined. Next, in chapter 3, the methodology for both the safety quantification and survey setup is explained. The method for the statistical analysis is described in this chapter as well. In chapter 4, the results for both studies are discussed. Chapter 5 contains the discussion, followed by the conclusion in chapter 6.

2

Literature study

In this chapter, sub-questions are answered based on studied literature. This is done to provide some background information that is useful when researching pedestrian safety in shared space streets to a larger extent. Also, hypotheses with regards to the influential factors are formulated.

2.1. Shared space streets

Even though there is no one universal definition of shared space, it may be described as a space in which all traffic participants navigate around each other based on social principles and informal protocol (Hamilton-Baillie, 2008b). Shared space streets are characterized by a lack of separation between different modes of traffic. CROW publication Lopen loont - de voetganger in beleid, ontwerp en beheer states that shared space is a concept in which the interest and responsibility of all traffic modes is prioritized and the space is designed as a residential space (*Lopen loont - de voetganger in beleid, ontwerp en beheer*, 2014).

A lack of separation between traffic modes does not immediately result in a lack of zone indication in a street. A street can be equipped with different functionalities, which indicate accommodation for a specific traffic mode. For example, in the researched street Jean Batten Place in Auckland, New Zealand, benches and light poles are placed in such way that cars have limited space to occupy in the street. The same kind of designs can be found in other types of shared spaces, like intersections or squares.

Shared spaces are viewed as a way to increase the livability of a space. The low speeds and lack of separation between transport modes give the impression of a closer ambiance. This assists the feeling of safety with pedestrians that pass through the space. When pedestrian priority is increased and zones are assigned to pedestrian activity, this enhances the pedestrian experience in the space (Al-Mashaykhi and Hammam, 2020).

The concept of shared space streets originates in the Netherlands with the design of *woonerven*. These access roads were designed to be used for residential streets (Hamilton-Baillie, 2008b). The principles used in the design of these *woonerven* were later implemented in different types of streets.

As mentioned earlier, the street experience is enhanced by the addition of design based on pedestrian activity. However, not all pedestrian activity takes place on the street. Many shared space streets make up shopping areas, in which customers may walk freely between stores. This functionality does not require a specific lay-out in the street design.

2.2. International street design

Not only the Netherlands, but also other countries came to see the allure of shared spaces (Hamilton-Baillie, 2008a). Examples of shared space areas can be found all around the world. This research focuses specifically on Seoul, South Korea, Auckland, New Zealand and the Netherlands.

2.2.1. Seoul, South Korea

In Seoul, South Korea, streets with a width smaller than 13 metres by default have no sidewalk available. These streets are known as *i-myeon-do-ro*, or back roads. In these streets, no safety precautions with relation to collisions with other traffic used to be present, while they make up for over 77 percent of Seoul's total street length (Seoul City Government, 2018). Pedestrians and motorized vehicles shared the same asphalted streets. This caused pedestrian safety perception to be quite low, which is to be expected when the priority in the street is clearly with motorized traffic. However, in 2013, the Seoul city government decided to redesign a number of streets in a project to improve pedestrian priority in order to increase safety for this group (Lee and Kim, 2021).

The project that the Seoul government started in 2013 was called the Pedestrian Priority Zone project. This project was part of a larger plan to enhance pedestrian safety all over South Korea, which was a result of the enactment of the Pedestrian Safety and Convenience Enhancement Act. The implementation and evaluation of the project was published in 2015 by the Korea Transport Institute. This report focused on the infrastructural goals the Seoul government had set for the short-term future. At the time, a decrease in incidents and an increase in pedestrian volume per kilometre of road had been reported (Lim et al., 2015). The street improvements transformed the back roads into shared space streets and therefore made the streets eligible for the research. Also, the project instigated further research into the effects of the changed street design on pedestrian safety and pedestrian safety perception.

Studies have been done to measure the difference in the population's perception of the streets in regards to pedestrian safety. An example is a study done based on the paving design, which concluded that the difference in the paving designs had to significant impact in the safety perception of pedestrians (Lee and Kim, 2019).

2.2.2. Auckland, New Zealand

In 2009, the Auckland City Council published a program that would implement shared space principles into the standard street design. With this, the *CBD streetscapes upgrade programme* was launched. The program was inspired by the theories and principles stated by Hans Monderman, which included the main characteristics of shared space. The characteristics that had been implemented into the program were based on pavement design and use of traffic signs and signals (Council, 2009).

Also, research has been done in Auckland in order to determine the effectiveness of the implementation of shared space principles in street design. One of these studies was a safety performance study done in streets that had been redesigned by the shared space design principles. The study showed a significant decrease in vehicle speeds and volumes as a result of the redesign and recommended similar design methods for other streets (Karndacharuk et al., 2014).

2.2.3. Amsterdam and Haren, the Netherlands

The Netherlands is seen as one of the leading countries in shared space design principles. Still, one of the most widely known shared space concepts is the dutch *woonerf*. In these residential streets, slow speeds are implemented to ensure pedestrian priority and safety. This way, children can play safely outside in their neighbourhood. Once the concept of the *woonerf* was officially implemented, it did not further develop because of a lack of enthusiasm (Hamilton-Baillie, 2008a). However, Hans Monderman did use these principles of street design to state the beginnings of what would become the shared space concept.

Still, shared space areas are quite popular in dutch urban design. Besides the widely known *woonerven*, shared space streets are commonly seen in shopping areas throughout the country.

2.3. Quantitative safety

The absolute safety of streets is difficult to quantify, because of the large number of variables that affect pedestrian safety. Many studies are done based on crash data or fatality rates in streets. However, these methods do not include minor accidents, which do have an impact on the safety perception in a street. Because of this, the perception of safety is likely not determined by the amount of fatal accidents, but the total number of collisions that occur in a street.

Another way of determining objective safety is by basing a safety score on different design characteristics that can be seen in the street based on guidelines and execution of these guidelines. A method of determining a pedestrian safety score based on the aspects stated before was created (Asadi-Shekari et al., 2015). With this index, the pedestrian safety of streets can be quantified based on different characteristics.

The Pedestrian Safety Index Asadi-Shekari et al. created is based on 24 different indicators with each an accompanying standard for different types of roads. This way, the functionality of the street can be taken into consideration when testing the street on the indicators. The indicators are described in further detail in paragraph 3.1.

2.4. Pedestrians in shared space areas

The safety of shared spaces is a polarizing topic. While segregation of transportation modes is an important aspect of traffic safety, some research indicates that traffic casualties are significantly reduced when replacing a regular space with a shared space street. This is mainly due to the enhanced priority of pedestrians and lower driving speeds of motorized traffic, which make collisions less likely to be fatal (Karndacharuk et al., 2013). Research does show that pedestrians perceive safety in shared space environments at least as high as regular streets, though still affected by street design. The study states that pedestrians are affected by street lay-out when considering their safety (Ruiz-Apilánez et al., 2017).

Much research has been done on the safety of pedestrians in shared space streets. However, because quantification of safety is a difficult task, most research is based on pedestrian behaviour and perception.

A study done on pedestrian and driver comfort in shared space environments concluded that both age and gender had a significant share in their perception of the study area (Kaparias et al., 2012). In this research, also vehicle traffic and lighting levels played a role in the perception of safety. Another study showed that street pattern had caused a more positive safety perception among pedestrians (Lee and Kim, 2021).

2.5. Conclusions

From this literature study, several conclusions can be made in regards to the sub-questions stated in chapter 1.

Shared spaces may differ in different design aspects, but even with similar design characteristics, shared space streets may differ in ambiance. The main street design variables that have been determined are taken as influential factors and have also been included in the Pedestrian Safety Index.

It can be seen in the design that different countries implement in their shared space streets are based on the same principles, namely the shared space principles stated by Monderman. This includes the absence of separation between traffic and a homogenised design of the street. However, other major design aspects like street width or type of paving is not determined by these principles. This further design is then determined by cultural aspects that are common in the environment. The differences between those aspects may cause a difference in the degree of safety and the safety perception among pedestrians.

Finally, the literature study shows that pedestrians are influenced by street lay-out and other traffic and street patterns had affected the pedestrian safety perception. It is therefore hypothesised that street design characteristics affect pedestrian safety perception. Also, demographic characteristics like age and gender are shown to play a part in pedestrian safety perception in earlier research.

3

Methodology

In this chapter, the methodology behind the research is explained. In the first paragraph, the safety index for quantification of pedestrian safety in streets is elaborated on. Next, the setup of the survey and the accompanying data processing is described. The survey is meant to gather data on safety perception of pedestrians. Finally, the processing of data acquired from the survey is described.

3.1. Pedestrian safety index

The Pedestrian Safety Index is based on 24 different indicators for different types of roads. An overview of applicable characteristics for the streets and their standards can be seen in table 3.1. Because the streets function as shopping areas, the specific indicators for access roads are used. For access roads, 20 indicators are available.

Table 3.1: Safety index indicators (Asadi-Shekari et al., 2015)

	Indicator	**Standard**
1	Slower traffic speed	< 25 km/h
2	Buffer and barriers	Width is 0.15 m and height is 0.10 m
3	Fewer traffic lane	2 lanes
4	Landscape and tree	Vertical clearance is 2.4 m at least 7.6 m from intersection
5	Footpath pavement	Stable, anti kid smooth and continuous, width is 1.2 m
6	Marking (crosswalk)	Width is 3 to 5 m, spacing accordingly
7	Corner island	Crossing at 90 degrees, unattractive center island
8	Sidewalk on both sides	Sidewalk should be on both sides of the street
9	Advance stop bar	Present at crossings
10	Driveway	Not wider than garage, at least 3.6 m
11	Lighting	Enough based on pedestrian scale
12	Signing	Cross signs provided
13	Bollard	Removable, lockable, accessible and highly visible
14	Slope	< 2%
15	Curb ramp	Protected from parked vehicles, standard dimensions
16	Tactile pavement (guiding)	Colored and standard dimensions
17	Tactile pavement (warning)	Adjoined by smooth surface, on ramps and crosswalks
18	Ramp	Below 8.3%, width is 1.2 m with handrail
19	Grade	<5%
20	Signal	Standard dimensions and distances, accessible.

Because the pedestrian safety index is not designed specifically for shared space streets, some indicators are not applicable to the research areas. There is no sidewalk, as the whole street width is designed with pedestrian priority in mind. This results in an absence of crossings in the streets and the whole street being considered as *sidewalk*. The absence of these indicators will be taken into account when calculating the scores by removing the coefficients from the total, which makes that the scores are based solely on the indicators that are applicable to the areas.

The safety score is based on several variables. First of all, the number of guidelines and the depth in which they evaluate an indicator. Also the safety indicator SI is of importance and can be determined based on the execution of those guidelines. 20 different guidelines have been used, taken from different countries around the world in order to create a representative index (Asadi-Shekari et al., 2015).

The possible scores that guidelines may receive based on the depth in which they evaluate an indicator are 0 (not mentioned), 1 (incomplete), 2 (semi complete) or 3 (complete). Several indicators are not applicable to shared space streets. These indicators are not included in the calculation of the degree of safety. This is taken into account in indicator coefficient c, which is determined by equation 3.1.

$$c_i = \sum_{j=1}^{3} D_j N_(ij) \tag{3.1}$$

To consider the special characteristics of shared space streets, the indicators that are being scored and their corresponding indicator coefficients are shown in table 3.2. In this table, the availability of information on the street dimensions is also considered.

Table 3.2: Applicable indicators for shared space streets Asadi-Shekari et al., 2015

	Indicator	**Standard**	**c**
1	Slower traffic speed	< 25 km/h	37
2	Fewer traffic lane	2 lanes	17
3	Landscape and tree	Vertical clearance is 2.4 m at least	38
4	Footpath pavement	Stable, anti kid smooth and continuous	32
5	Sidewalk on both sides	Sidewalk should be available on both sides of the street	39
6	Driveway	Not wider than garage, at least 3.6 m	23
7	Lighting	Enough based on pedestrian scale	31
8	Slope	<2%	34
9	Tactile pavement (guiding)	Colored and standard dimensions	7
10	Ramp	Below 8.3%, width is 1.2 m with handrail	15
11	Grade	<5%	25

The coefficient is then multiplied by its safety index score SI, which can be determined based on the calculations from table 3.3. SI has a value between 0 and 1, based on the implementation of the indicator in the street. For example,

$$SI_1 = 0$$

when vehicle speeds are over 30 km/h, but when speeds are under 30 km/h

$$SI_1 = 1$$

(Asadi-Shekari et al., 2015).

The final values are summed up and the total is divided by the total number of points that can be achieved. This results in the following equations 3.2 and 3.3 :

$$PSI = \sum_{i=1}^{n} c_i SI_i \tag{3.2}$$

Table 3.3: Calculations for the SI-scores (Asadi-Shekari et al., 2015)

	Indicator	**SI score**
1	Slower traffic speed	$SI = \begin{cases} 1, & \text{when} v \leq 25 \\ 0, & \text{when} v > 25 \end{cases}$
2	Fewer traffic lane	$SI = \begin{cases} 0, & \text{when No. lanes} > 2 \\ 0.5, & \text{when No. lanes} = 2 \\ 1, & \text{when No. lanes} = 1 \end{cases}$
3	Landscape and tree	$SI = (\frac{\text{length of street with vertical clearance standard condition}}{\text{length of street}} + 1)/2$
4	Footpath pavement	$SI = \frac{\text{area of standard pavement}}{\text{length of street} * \text{width}}$
5	Sidewalk on both sides	$SI = \frac{\text{fraction of sidewalk on one side} + \text{fraction of sidewalk on opposite side}}{2}$
6	Driveway	$SI = \frac{\text{number of standard driveways}}{\text{total number of driveways}}$
7	Lighting	$SI = \begin{cases} 1, & \text{when} P \geq 1 \\ P, & \text{when} P < 1 \end{cases}$ $P = \frac{\text{length of street with lighting}}{\text{distance between light poles}} * \frac{9}{\text{length of street}}$
8	Slope	$SI = \frac{\text{area of sidewalk with standard slope}}{\text{length of street} * \text{width}}$
9	Tactile pavement (guiding)	$SI = \begin{cases} 1, & \text{when} P \geq 1 \\ P, & \text{when} P < 1 \end{cases}$ $P = \frac{\text{length of standard guiding tactile pavement}}{\text{length of guiding tactile pavement necessary}}$
10	Ramp	$SI = \begin{cases} 1, & \text{when} P \geq 1 \\ P, & \text{when} P < 1 \end{cases}$ $P = \frac{\text{No. standard ramps}}{\text{No. ramps}}$
11	Grade	$SI = \frac{\text{area of sidewalk with standard grade}}{\text{length of street} * \text{width}}$

$$PSI\% = \frac{PSI}{\sum c_i} * 100\% \tag{3.3}$$

The Pedestrian Safety Index percentage can be expressed as a value between 0 and 10, which is compared to the scores given on the survey by participants.

3.2. Survey setup

To determine the perceived safety in the research areas, a survey is set up. In this survey, participants are asked to give the streets mentioned in chapter 1 a score on safety on a Likert scale. A short explanation of the scoring was asked for as well. An example from the survey can be seen in figure 3.1.

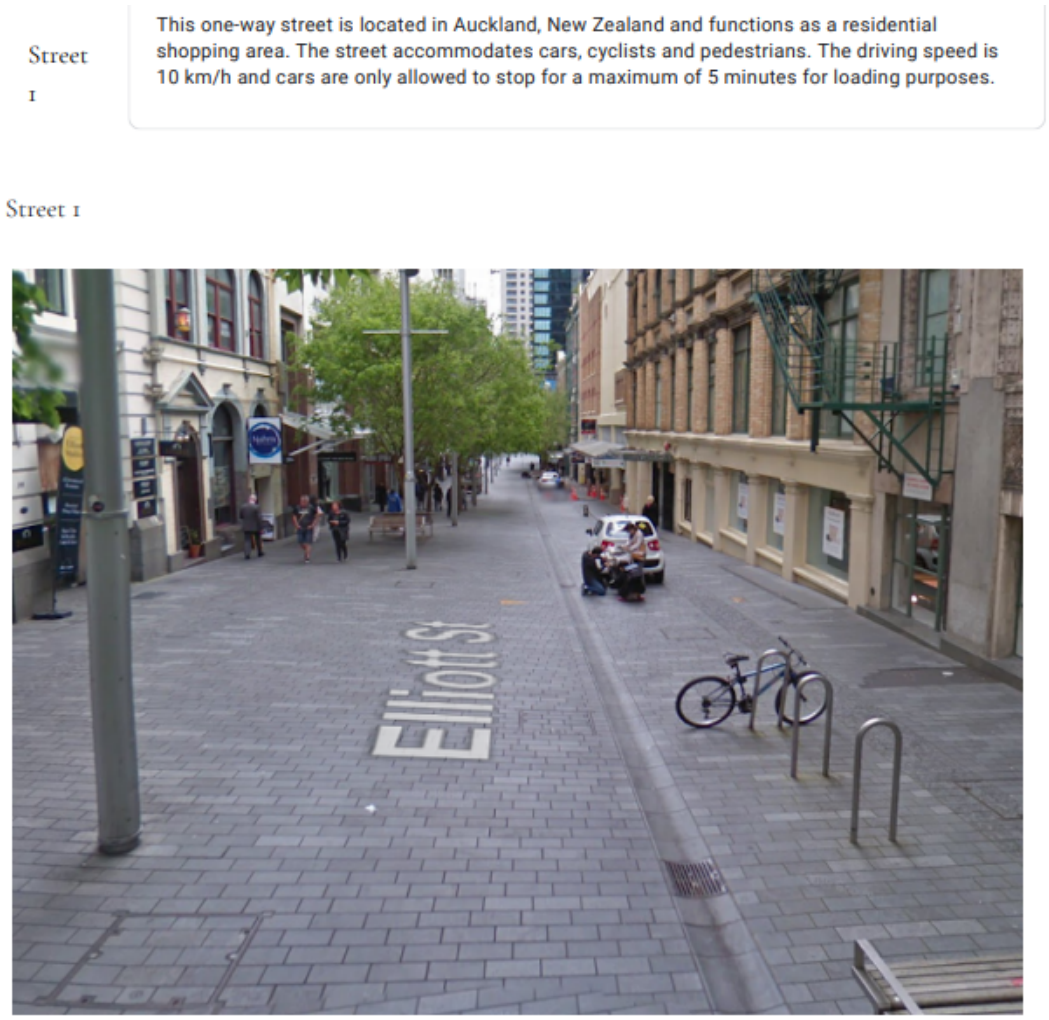


Figure 3.1: Survey figure and description example

The first part of the survey consists of general questions about demographic characteristics. Participants are asked about their age, gender and municipality of residence. These questions can be used to identify age-, gender-, or location-specific preferences in street design.

Secondly, the streets are shown one by one with the same three questions:

- *How would you rate the safety level of this street?*
- *How do you perceive these different aspects of the street?*

The first question is answered by means of a sliding bar from 1 (very unsafe) to 10 (very safe). The explanation is answered with a multiple choice question where the options are based on the indicators from the pedestrian safety index and are as follows:

- Street width
- Tile/asphalt pattern and colour
- Landscaping or furnishing of the street
- Driving speed
- Tactile guidance markers
- Separation between traffic
- Street markings and traffic signs

For each of the indicators, the participant may rate them as *too little/slow*, *sufficient*, *too much/fast* or *no opinion*. With these questions, the influential factors are asked for with each participant. The demographic influential factors (age, gender and scale of municipality) are provided in the first part of the survey. The street design influential factors (street width, tile/asphalt colour and pattern, landscaping/furnishing, driving speed, tactile guidance markers, separation of traffic en street markings/traffic signs) are asked about in the second part when providing the safety scores.

The survey is setup in Google Forms and spread with two different methods. Firstly, a personal network was used to distribute the survey among friends, family and acquaintances. The second method of distribution was by using SurveySwap, an online platform where participants can be recruited by answering others' surveys. In order to achieve a representative focus group, a minimum of 100 participants is aimed for.

The survey is included in Appendix A.

3.3. Statistical processing

Statistical processing is done in order to determine the significance of the different influential factors and to test the hypotheses that have been stated in paragraph 2.5.

3.3.1. One sample sign test

The comparison between the Pedestrian Safety Index and the survey safety scores is done by a one sample sign test. In this test, the hypothesis is tested that the median of a sample is equal to a certain value. The value used in this study is equal to the Pedestrian Safety Index score. The test is done with two sets of data, the survey safety scores and the Pedestrian Safety Index score.

With the one sample sign test, the following hypotheses can be tested:

- H0: The median of the sample is **equal to** the Pedestrian Safety Index score
- H1: The median of the sample is **not equal to** the Pedestrian Safety Index score
- H2: The median of the sample is **greater than** the Pedestrian Safety Index score
- H3: The median of the sample is **less than** the Pedestrian Safety Index score

If H0 is rejected for H1, it can then be determined whether it can be rejected for either H2 or H3 as well. If H0 can be rejected for H2, it can be concluded that subjective pedestrian safety is more negative than the Pedestrian Safety Index scores would suggest. On the other hand, if H0 can be rejected for H3, subjective pedestrian safety is determined to be more positive than the Pedestrian Safety Index score would suggest.

The survey scores below the Pedestrian Safety Index score are assigned a 0 and the scores with a value above the PSI score are assigned a 1. This process can also be described by equation 3.4

$$B = \sum_{i=1}^{n} \psi_i B = \begin{cases} 1 & \text{when} X_i - \theta_0 > 0 \\ 0 & \text{when} X_i - \theta_0 < 0 \end{cases} \tag{3.4}$$

Then, the obtained frequencies are determined by *B*, with *B* being the frequency above the hypothesised value and *n* - *B* the frequency below the hypothesis. From these values, the Test Statistic can be determined by taking the minimum value between the two.

The Test Statistic can be tested by means of binomial distribution B(n,0.5). Here, the lower boundary for $p < 0.025$ can be set in order to achieve a two-tailed 5% significance. If the Test Statistic is below this critical value, H0 is to be rejected for H1 and if the Test Statistic is above the critical value, fail to reject H0 for H1.

To test for H2 and H3, the same test is used. The difference is that in these cases a one-tailed 5% significance is achieved. The same binomial distribution is used, but the lower boundary can be set at $p < 0.05$. H0 is rejected for H2 if *B* is greater than the critical value and H0 is rejected for H3 if *n* - *B* is greater than the critical value.

3.3.2. Multiple regression

Multiple regression is used to determine the dependency of a dependent variable on multiple independent variables. It is an analysis based on linear regression, except with multiple variables. With this method, the relative share of influence of the independent variables can be determined by fitting a linear equation through the data (Yale University", n.d.). Also, the analysis provides for each street an R Square value, which provides insight in the percentage of variation in the sample that can be explained through the independent variables.

The surveys are processed by first exporting the numerical data to Microsoft Excel. Here, the data is prepared in order to import it into IBM SPSS Statistics by assigning numerical values to the different multiple choice options from the survey. In this program, statistical analysis can be performed on the received data. An overview of the data entered in the columns can be found in table 3.4.

Table 3.4: Safety index indicators

Column	Data
1	Age
2	Gender
3	Scale of municipality
4	Safety score street 1
5	Safety score street 2
6	Safety score street 3
7	Safety score street 4
8	Safety score street 5
9	Safety score street 6
10 - 15	Score street width 1 - 6
16 - 21	Score tile and asphalt 1 - 6
22 - 27	Score landscaping and furnishing 1 - 6
28 - 33	Score driving speed 1 - 6
34 - 39	Score tactile guidance markers 1 - 6
40 - 45	Score separation 1 - 6
46 - 51	Score markings and signs 1 - 6

Survey ID and age are entered as whole numbers as ordinal variable, gender, a nominal variable, is entered as 0 (male) or 1 (female). Scale of municipality, an ordinal variable, is determined by the selected municipality in the survey. The categories used in the statistical analysis are based on the municipality ranking (CBS, 2020). The possible categories are 1 (very urban), 2 (quite urban), 3 (averagely urban), 4 (quite rural) and 5 (very rural). Safety scores are entered as an ordinal value between

1 and 10. The evaluations of the different design variables are given as ordinal values 0 (no opinion), 1 (too little/slow), 2 (sufficient) and 3 (too much/fast).

With the IBM SPSS software, a statistical analysis is executed. This is done to determine possible correlations between the given scoring and the demographic characteristics of participants by means of multiple regression. With this method, several assumptions are done (Laerd Statistics, n.d.):

- The dependent variable (in this case the safety score) is measured on a continuous scale.
- There are two or more independent that are either continuous or categorical
- There is independence of observations
- There is a linear relationship between the dependent and independent variables separately and as a whole
- The data shows that all data-points have equal variance
- The data shows that independent variables are highly correlated to each other
- There are no significant outliers
- The residuals are approximately normally distributed

Based on these assumptions, multiple regression analysis is able to explain the variance of the model and the contributing share of each of the design variables. With these shares known, the safety scores can be predicted.

3.4. Summary

In short, the research consists of three parts. The first part is the calculation of objective pedestrian safety scores using an existing Pedestrian Safety Index. This safety score is based on individual scores on eleven safety indicators: traffic speed, traffic lanes, landscaping, footpath pavement, sidewalk, driveways, lighting, slope, tactile pavement, ramps and grade.

The second part is a survey that is conducted among a minimum of 100 residents of the Netherlands. In this survey, participants are asked to rate the level of safety of six different streets and motivate their scores by means of a multiple choice question about the different design influential factors.

Finally, the third part consists of statistical analysis using a one sample sign test, in which the medians of the survey safety scores are compared to the Pedestrian Safety Index scores, and multiple regression, which determines the shares of the different design influential factors.

4

Results

In this chapter, the results of the research is discussed and analysed. First, the calculation of the Pedestrian Safety Index scores is described. After this, in paragraph 4.2, the results of the survey and relevant statistics are given. Finally, the hypotheses are tested using the statistical analysis described in paragraph 4.3.

4.1. Pedestrian Safety Index

The calculation of the Pedestrian Safety Index is done using known measurements and observations done with Google Earth and Google Maps. Design aspects that cannot be measured, like the grade, are not taken into consideration within the calculation.

To illustrate the calculation of the Pedestrian Safety Index score, Bukchon-ro 5ga-gil will be taken as an example. The calculation of the score of this street can be seen in table 4.1 and equation 4.1, resulting in equation 4.2. The coefficients can be found in paragraph 3.1, table 3.2.

$$Score = \frac{\sum_{i=1}^{11} c_i * SI_i}{\sum_{i=1}^{11} c_i} \tag{4.1}$$

$$Score = \frac{37*0+17*1+38*1+32*1+39*1+23*0.5+31*0.25+34*0.54+7*0}{37+17+38+32+39+23+31+34+7} * 10 = 6.34 \tag{4.2}$$

Figure 4.1 shows the method of determining the SI score for driveways. This is done by counting and looking at all driveways in the street. The figure shows the analysis of example street Bukchon-ro 5ga-gil. As can be seen, four driveways can be found in the street. Visual analysis determines that two out of four driveways (driveways b and d) do not meet the standard for driveways, because they are wider than a standard garage (3.5 metres).

(a) (b) (c) (d)

Figure 4.1: Driveways in Bukchon-ro 5ga-gil. Two driveways do not suffice, because they are wider than a garage (wider than one car) (GoogleMaps, 2018a).

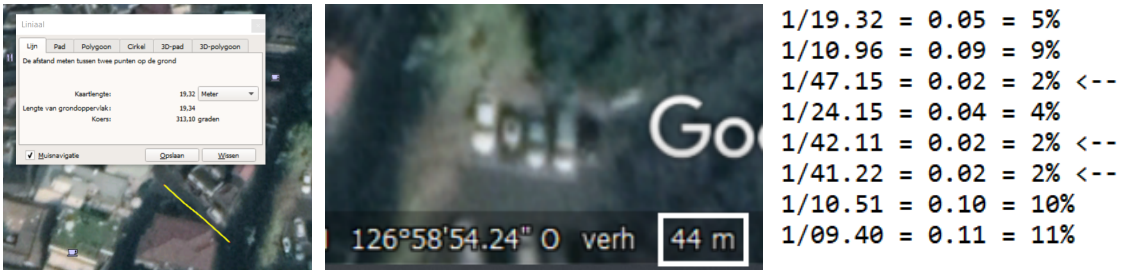
Figure 4.2 shows the score calculation for the distance between light poles. In Google Maps, the locations of the light poles is determined in reference to the surrounding buildings. Then, the distance

between the light poles is measured using the measuring tool. This provided the distance between the light poles in the street. It is assumed that the streets are illuminated over the whole length.

(a) (b) (c)

Figure 4.2: Determining distance between light poles (GoogleMaps, 2018a)

Finally, figure 4.3 shows the calculation of the length of the street in which standard slope can be found. This was done by measuring the distance in which the height difference was equal to one metre. Figure a shows the method of measuring the distance between a height difference of one metre and figure b shows the tool from Google Earth in the white box on the bottom right, in which the height from sea level could be seen. Figure c shows the calculation that was done to determine the slope of the measured part and therefore which parts of the street meets the requirements for standard slope (less than or equal to 2%). These parts are indicated with arrows. The total of these lengths could then be summed up in order to determine the length of the street that met the slope requirements.



(a) (b) (c)

Figure 4.3: Calculation of length of street with standard slope using Google Earth (Earth, 2020)

This scoring results in the Pedestrian Safety Index scores shown in table 4.3. An insight that can be stated about the scoring is the fact that the shared space design contributes to most scores of 1.00, like the amount of pavement, the number of traffic lanes and the driving speed. This seems to indicate that introducing these shared space principles into street design inherently increases pedestrian safety in the street.

From the scores in table 4.3 it can be concluded that the New Zealand streets are much safer than the streets from South Korea and the Netherlands, whose scores are more similar to each other. The score interpretations are that Elliott Street and Jean Batten Place are considered of the highest quality, Bukchon-ro 5ga-gi, Rijksstraatweg and Reguliersbreestraat are considered of high quality and Sanggye-ro 3-gil is considered of average quality (Asadi-Shekari et al., 2015).

Table 4.1: Calculations for the SI-scores of Bukchon-ro 5ga-gil.

	Indicator	**SI score**
1	Slower traffic speed	$v = 30 \geq 25$, so $SI = 0$
2	Fewer traffic lane	No. lanes $= 1$, so $SI = 1$
3	Landscape and tree	No obstacles are present in the vertical space of the street, so $SI = 1$
4	Footpath pavement	The whole street is covered in the same type of pavement, so $SI = 1$
5	Sidewalk on both sides	The whole street is considered as sidewalk, so $SI = 1$
6	Driveway	4 driveways are present in the street, of which 2 are standard (see figure 4.1), so $SI = \frac{2}{4} = 0.5$
7	Lighting	The whole street with a length of 240 metres is lit with distances between lighting poles being 36.42 m (see figure 4.2), so $SI = \frac{240}{36.42} * \frac{9}{240} = 0.25$
8	Slope	The whole street with a length of 240 metres has a standard slope in 130.48 metres (see figure 4.3), so $SI = \frac{130.48 * 6.5}{240 * 6.5} = 0.54$
9	Tactile pavement (guiding)	No tactile pavement is present, while there should be (Asadi-Shekari et al., 2015), so $SI = 0$
10	Ramp	No ramps are present, so $SI = n.a.$
11	Grade	Cannot be measured, so $SI = n.a.$

Table 4.2: SI scores for the different streets.

SI	E. St.	J.B. Place	B. 5ga-gil	S. 3-gil	R.S. Weg	R.B. St.
1	1.00	1.00	0.00	0.00	0.00	0.00
2	0.50	1.00	1.00	1.00	1.00	0.50
3	1.00	1.00	1.00	1.00	1.00	1.00
4	1.00	1.00	1.00	0.00	1.00	1.00
5	1.00	1.00	1.00	1.00	1.00	1.00
6	n.a.	n.a.	0.50	0.00	n.a.	n.a.
7	0.56	1.00	0.25	0.76	0.56	0.28
8	1.00	1.00	0.54	1.00	0.00	0.93
9	0.00	0.00	0.00	0.00	1.00	0.00
10	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
11	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table 4.3: Pedestrian Safety Index scores.

Street	Pedestrian Safety Index Score
Elliott Street	8.76
Jean Batten Place	9.70
Bukchon-ro 5ga-gil	6.34
Sanggye-ro 3-gil	5.87
Rijksstraatweg	7.85
Reguliersbreestraat	6.71

4.2. Survey

When closing the survey, 112 responses were recorded. In figures 4.4 and 4.5, the figures show that in both the age distribution and the gender distribution a large representation of respondents between 18 and 30 years of age and of women can be observed. This over-representation will have influenced the data obtained from the survey and makes determining differences between age groups and genders more difficult.

The complete outcome from the survey can be seen in appendix C.

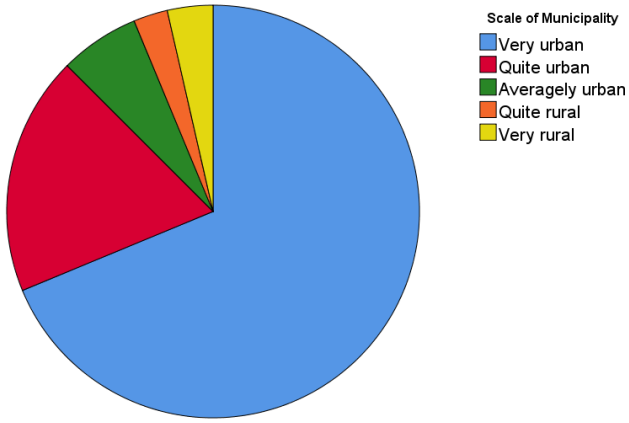
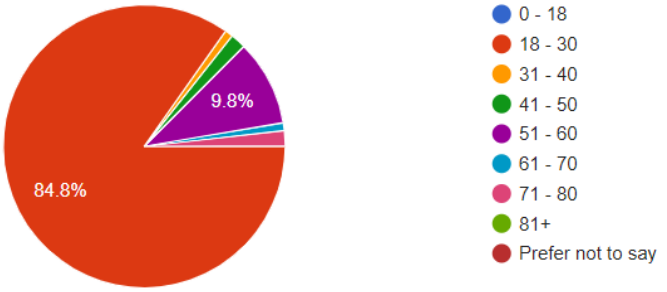
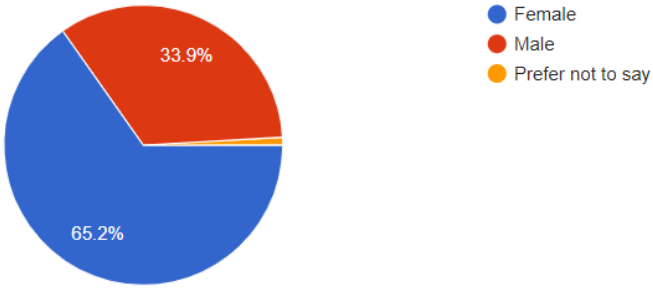


Figure 4.4: Scale of municipality of survey respondents



(a)



(b)

Figure 4.5: Age and gender distribution in the survey respondents

4.3. Statistical Analysis

The statistical analysis is made up of two parts, the one sample sign test and the multiple regression. First, the one sample sign test will be discussed and the hypothesis will be tested. Next, the linear regression will be described in which the attributing factors to the pedestrian safety perception will be observed.

4.3.1. One sample sign test

The one sample sign test was executed using the *pandas* package in python. The full code can be found in Appendix D.

First, the B-value for all streets was calculated using a loop, adding 1 to each street's score when a survey score was greater than the hypothesised Pedestrian Safety Index score. The B-value is the observed frequency of survey scores above the Pedestrian Safety Index scores.

Then the test statistic was determined by taking the minimum value between B and $n - B$. This value represents the number of respondents that have given the street a lower score than the Pedestrian Safety Index score.

Figure 4.6 shows the corresponding binomial distribution with $n = 112$ and $p = 0.5$. When taking a 5% significance with a two-tailed test, a lower boundary can be determined from which the null hypothesis is to be rejected. With the presented binomial distribution, this value lies at 48 with P(X=48) = 0.02414. In short, if the test statistic is less than 48, hypothesis H0 is rejected.

The results of the one sample sign test can be found in table 4.4.

When looking at a one-tail test with a significance of 5%, the lower boundary is equal to 51 with P(X=51) = 0.0483. It can be seen in table 4.4 that in all cases, B is less than the critical value of 51 and $n - B$ is over the critical value for all cases. This means that in all cases, H0 can be rejected for H3. This means that the medians of the survey scores are less than the Pedestrian Safety Index scores, indicating a more negative subjective safety perception than the objective safety.

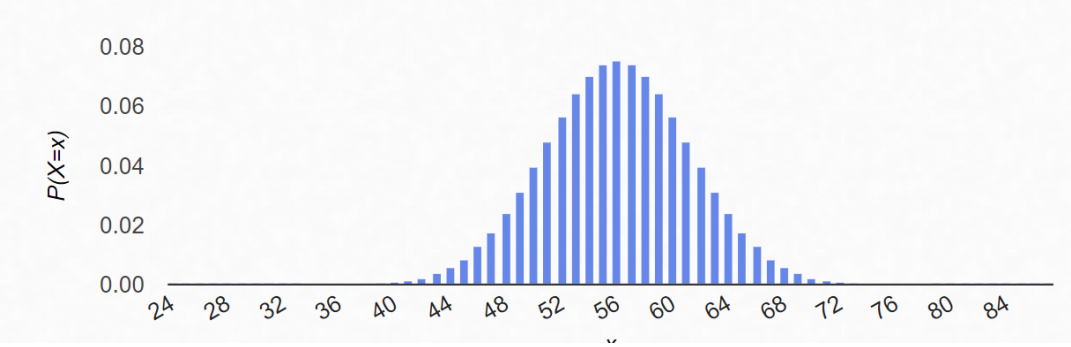


Figure 4.6: Binomial distribution B(112,0.5) corresponding to the sample size

Table 4.4: Calculation of one sample sign test.

Street	B	n - B	Test statistic	Conclusion
Elliott Street	26	86	26	Reject H0
Jean Batten Place	12	100	12	Reject H0
Bukchon-ro 5ga-gil	16	96	16	Reject H0
Sanggye-ro 3-gil	36	76	36	Reject H0
Rijksstraatweg	42	70	42	Reject H0
Reguliersbreestraat	15	97	15	Reject H0

4.3.2. Multiple regression

The multiple regression was executed using IBM SPSS for each of the streets. The full results can be found in appendix E. First, the model test results gave an indication of the share of the variance that could be explained by the independent variables. An overview of these values for each street can be found in table 4.5.

Table 4.5: Values retrieved from multiple regression

Street	R	R Square	Adjusted R Square	Std. Error
Elliott Street	0.421	0.177	0.092	2.008
Jean Batten Place	0.646	0.418	0.357	1.850
Bukchon-ro 5ga-gil	0.493	0.243	0.166	1.710
Sanggye-ro 3-gil	0.460	0.211	0.131	1.778
Rijksstraatweg	0.345	0.119	0.030	1.745
Reguliersbreestraat	0.643	0.402	0.342	1.658

It can be seen in table 4.5 that the percentage of variance that can be explained by the variables is between 3% and 35.7%. This is expected, since most regression models about human behaviour have R Square values below 50% (Frost, n.d.).

Table 4.6 shows the significance of the values that have been found for each of the streets with each independent variable.

Significant values can be seen for almost all streets for street width. Furthermore, age shows significance in two streets and landscaping, driving speed and separation of traffic show a significant value in one street.

Interesting is that, as seen in table 4.6, gender does not show a significant influence on pedestrian safety perception and neither does scale of municipality. This contradicts the statement that was done in paragraph 2.5. This could partially be explained by the over-representation observed in paragraph 4.2.

Table 4.6: Significance values for the multiple regression analysis. Significant values are indicated as **value***.

Variable	Sig. E. Str.	Sig. J.B. Place	Sig. B. 5ga-gil	Sig. S. 3-gil	R.S. Weg	R.B. St.
Age	0.684	0.134	**0.023***	0.653	0.538	**0.007***
Gender	0.292	0.216	0.979	0.330	0.327	0.657
Scale of Municipality	0.646	0.158	0.867	0.233	0.263	0.237
Street width	**0.016***	**0.000***	**0.033***	**0.008***	0.174	**0.000***
Tile and pattern	0.210	0.371	0.330	0.546	0.640	0.429
Landscape	0.589	0.486	0.903	0.872	0.207	**0.016***
Driving speed	0.713	0.473	0.667	**0.013***	0.281	0.288
Tactile markers	0.596	0.397	0.135	0.858	0.683	0.571
Separation traffic	0.075	0.498	**0.002***	0.662	0.216	0.073
Signs and markings	0.773	0.903	0.402	0.139	0.689	0.670

4.4. Summary

The Pedestrian Safety Index scores were calculated for each street, which resulted in scores ranging from 4.42 to 8.51. In this, some safety indicators could not be taken into account because of a lack of data.

The survey closed with 112 responses recorded. In this, there is an over-representation of women and people between the ages of 18 and 30 years old.

The one sample sign test resulted in a rejection of H0 for H3 with a significance level of 0.05 in all six cases.

The multiple regression analysis concluded a significant share from street width for five out of six cases, from age for two out of six cases and for landscape, driving speed and separation between traffic for one out of six cases.

Overall, it can be stated that pedestrians have a more negative perception of safety in shared space streets and that the main contributor to this is street width. Besides this influential factor, age, landscaping, driving speed and separation of traffic show in some cases a significant contribution in the pedestrian safety perception.

5

Discussion

The results show that in none of the six cases, the Pedestrian Safety Index appeared a good indicator for the perceived pedestrian safety among respondents. In these results it can also be noticed that in all cases, the median was below the pedestrian safety index.

As mentioned in paragraph 3.3, this means that pedestrians overall have a more negative perception of streets and feel more in danger than they would be when comparing it to the objective quantification of pedestrian safety. This could be because of limitations of the Pedestrian Safety Index or because of the ambiance that the different streets give off. It should also be noted that subjective safety spectrum does not reach a value of 0. This makes a more negative perception even more exceptional.

Paragraph 1.3, about stakeholders, states that the safety perception influences the use of streets of pedestrians. However, since all streets show the same negative perception, this would not have an influence unless pedestrians decide to use other forms of transportation or not to go out as often as they would with a higher safety perception.

The lower safety perception, as mentioned in paragraph 2.4, also influences pedestrian behaviour. This could then change the experience for other traffic and the clientele of local businesses.

Municipalities may use the results of the analysis to adjust the design process by comparing the designs with a higher safety rating with their own designs. This way, the safety perception could be brought to a point where pedestrians have a realistic perception of their safety while walking down a street.

A limitation of the Pedestrian Safety Index that could explain the difference between the survey scores and the Index scores is the fact that the PSI does not take into account the type of traffic that passes trough the street. This speculation is based on the significance of the influential factor *Separation of traffic* in the Reguliersbreestraat. This street has the most types of traffic with cyclists, cars and trams and it can be seen in the results that this street has quite a low significance score for separation of traffic.

Also, the demographic groups that are represented in the survey are limited. As seen in figure 4.3, there is an over-representation of women and people between the ages of 18 and 30 years old. It is therefore recommended to perform a similar study with a more representative focus group.

Finally, it would have been ideal if the measurements for the Pedestrian Safety Index could be done physically on site. Because of COVID-19 restrictions, this was not possible for any of the streets covered in the study and the information had to be retrieved from the internet. Though the internet covers much information, it is not as accurate as doing physical measurements.

6

Conclusion

The main research question was formulated as: *How does perceived safety by pedestrians in shared space streets compare to pedestrian safety in reality?* Here, pedestrian safety was defined as likelihood to get physically injured while walking down the street.

The research question has been answered by comparing a Pedestrian Safety Index scores to perceived safety scores of the same streets obtained from a survey.

In the literature that has been studied in the first phase of the research, several street design variables have been discovered to be influential factors in the safety score, so it was concluded that these aspects should also have an effect on the perception of safety among pedestrians. These influential factors consisted of demographic and street design characteristics.

The design and execution of these variables were then defined in the different settings that were used in the survey. In order to be able to identify the differences between the streets, while all streets fulfill the same function as a shared space street as an urban shopping area.

The research was executed by means of calculation of Pedestrian Safety Index scores and a survey. Then, the results from these methods were tested using statistical methods.

The Pedestrian Safety Index scores were determined using measurements and observations from Google Maps and Google Earth. With this, different safety indicators were scored based on predetermined standards and these scores were combined into the Pedestrian Safety Index scores, which later were compared to the medians of the survey scores.

The survey asked participants to rate the level of safety in the different streets and then to motivate this rating by means of a multiple choice question asking about their opinion on the execution of the different influential factors in the streets.

The scores were compared using a one sample sign test, starting with a two-tailed test with a significance of 0.05 and then, going deeper into the differences between the scores, with a one-tailed test with a significance of 0.05. Also, the effects of the influential factors was determined using multiple regression.

The results show that perceived safety by pedestrians in shared space streets is less than the pedestrian safety in reality based on the survey and Pedestrian Safety Index. They also show that the main design aspect that influences the safety perception is the street width, but it raises the question whether traffic modes that use the street is an aspect that should be integrated into the calculation of quantitative safety.

Municipalities may choose to use these results to improve street design create an environment in which perceived safety matches the quantitative safety. An example is to create wider streets while maintaining the other design variables. This would improve pedestrian safety perception, while keeping the objective safety equal to the previous situation.

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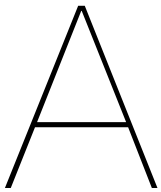


Survey in Google Forms

Pedestrian Safety Perception in Shared Space Streets

Dear participant,

Thank you for participating in this study on pedestrian safety perception. This study takes place in the context of my Bachelor's thesis. This research focusses on comparing the perception of pedestrians' safety to objective safety scores.

You will be asked to score 6 streets on physical safety (likeliness to get injured) on a scale of 1 (very unsafe) to 10 (very safe). Also, an explanation of your scoring is asked based on multiple choice answers. For each figure, a description is given of the traffic that passes through the streets. The survey will take approximately 3 minutes.

Participation in this survey is not mandatory and completely anonymous. The collected data are exclusively used for this study and will not be published. If you do not want to participate after all, you may stop the survey at any moment.

If you have any questions about the study, please contact me via the following emailaddress:
l.m.scholtens@student.tudelft.nl

* Required

1. What is your age? *

Mark only one oval.

- ◯ 0 - 18
- ◯ 18 - 30
- ◯ 31 - 40
- ◯ 41 - 50
- ◯ 51 - 60
- ◯ 61 - 70
- ◯ 71 - 80
- ◯ 81+
- ◯ Prefer not to say

2. What is your gender? *

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Prefer not to say
- ◯ Other: _____

3. What is your municipality of residence? *

Mark only one oval.

- Aa en Hunze
- Aalsmeer
- Aalten
- Achtkarspelen
- Alblasserdam
- Albrandswaard
- Alkmaar
- Almelo
- Almere
- Alphen aan den Rijn
- Alphen-Chaam
- Altena
- Ameland
- Amersfoort
- Amstelveen
- Amsterdam
- Apeldoorn
- Arnhem
- Assen
- Asten
- Baarle-Nassau
- Baarn
- Barendrecht
- Barneveld
- Beek
- Beekdaelen
- Beemster
- Beesel
- Berg en Dal
- Bergeijk
- Bergen (L.)
- Bergen (NH.)

- Zundert
- Zutphen
- Zwartewaterland
- Zwijndrecht
- Zwolle

Street 1

This one-way street is located in Auckland, New Zealand and functions as a residential shopping area. The street accommodates cars, cyclists and pedestrians. The driving speed is 10 km/h and cars are only allowed to stop for a maximum of 5 minutes for loading purposes.

Street 1

4. How would you rate the level of safety? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Very unsafe											Very safe

5. How do you perceive these different design aspects in the street?

Mark only one oval per row.

	Too little/slow	Sufficient	Too much/fast	No opinion
Street width				
Tile/asphalt pattern and colour				
Landscaping or furnishing of the street				
Driving speed				
Tactile guidance markers				
Separation of traffic				
Street markings and traffic signs				

Street 2

This one-way street is located in Auckland, New Zealand and functions as a residential shopping area. The street accommodates cars, cyclists and pedestrians. The driving speed is 10 km/h and cars are only allowed to stop for a maximum of 5 minutes for loading purposes.

Street 2

6. How would you rate the level of safety? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very safe

7. How do you perceive these different design aspects in the street?

Mark only one oval per row.

	Too little/slow	Sufficient	Too much/fast	No opinion
Street width	◯	◯	◯	◯
Tile/asphalt pattern and colour	◯	◯	◯	◯
Landscaping or furnishing of the street	◯	◯	◯	◯
Driving speed	◯	◯	◯	◯
Tactile guidance markers	◯	◯	◯	◯
Separation of traffic	◯	◯	◯	◯
Street markings and traffic signs	◯	◯	◯	◯

Street 3

This two-way street is located in Seoul, Korea and functions as a residential shopping area. The street accommodates cars and pedestrians. The driving speed is 30 km/h and cars are not allowed to park in the street, but they are allowed to stop for loading.

Street 3

8. How would you rate the level of safety? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very safe

9. How do you perceive these different design aspects in the street?

Mark only one oval per row.

	Too little/slow	Sufficient	Too much/fast	No opinion
Street width	◯	◯	◯	◯
Tile/asphalt pattern and colour	◯	◯	◯	◯
Landscaping or furnishing of the street	◯	◯	◯	◯
Driving speed	◯	◯	◯	◯
Tactile guidance markers	◯	◯	◯	◯
Separation of traffic	◯	◯	◯	◯
Street markings and traffic signs	◯	◯	◯	◯

Street 4

This two-way street is located in Seoul, Korea and functions as a residential shopping area. The street accommodates cars and pedestrians. The driving speed is 30 km/h and cars are not allowed to park in the street, but they are allowed to stop for loading.

Street 4

10. How would you rate the level of safety? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very safe

11. How do you perceive these different design aspects in the street?

Mark only one oval per row.

	Too little/slow	Sufficient	Too much/fast	No opinion
Street width	◯	◯	◯	◯
Tile/asphalt pattern and colour	◯	◯	◯	◯
Landscaping or furnishing of the street	◯	◯	◯	◯
Driving speed	◯	◯	◯	◯
Tactile guidance markers	◯	◯	◯	◯
Separation of traffic	◯	◯	◯	◯
Street markings and traffic signs	◯	◯	◯	◯

Street 5

This two-way street is located in Haren, the Netherlands and functions as a residential shopping area. The street accommodates cars, cyclists and pedestrians. The driving speed is 30 km/h and cars are not allowed to park on the street, but they are allowed to stop for loading.

Street 5

12. How would you rate the level of safety? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very safe

13. How do you perceive these different design aspects in the street?

Mark only one oval per row.

	Too little/slow	Sufficient	Too much/fast	No opinion
Street width	◯	◯	◯	◯
Tile/asphalt pattern and colour	◯	◯	◯	◯
Landscaping or furnishing of the street	◯	◯	◯	◯
Driving speed	◯	◯	◯	◯
Tactile guidance markers	◯	◯	◯	◯
Separation of traffic	◯	◯	◯	◯
Street markings and traffic signs	◯	◯	◯	◯

Street 6

This two-way street is located in Amsterdam, the Netherlands and functions as a residential shopping area. The street accommodates cars, cyclists and pedestrians. The driving speed is 30 km/h and cars are not allowed to park on the street, but they are allowed to stop for loading.

Street 6

14. How would you rate the level of safety? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very safe

15. How do you perceive these different design aspects in the street?

Mark only one oval per row.

	Too little/slow	Sufficient	Too much/fast	No opinion
Street width				
Tile/asphalt pattern and colour				
Landscaping or furnishing of the street				
Driving speed				
Tactile guidance markers				
Separation of traffic				
Street markings and traffic signs				

B

Python code: Calculation SI scores

In [1]:

```
import numpy as np
def SI_score(v, lanes, H, L, W, ASP, SDW, DW, LL, DL, ASS, LGP, LGPN):
    SI = []
    #1
    if v <= 25:
        SI.append(1)
    else:
        SI.append(0)

    #2
    if lanes > 2:
        SI.append(0)
    elif lanes == 2:
        SI.append(0.5)
    else:
        SI.append(1)

    #3
    SI.append((H / L + 1) / 2) #H = length of vertical clearance in standard conditions

    #4
    SI.append(ASP / (L * W)) #ASP = area of standard pavement

    #5
    SI.append(1.00)

    #6
    SI.append(SDW / DW)  #SDW = standard driveways, DW = driveways

    #7
    if (LL / DL * 9 / L) >= 1:
        SI.append(1)
    else:
        SI.append(LL / DL * 9 / L) #LL = length with lighting, DL = distance between po

    #8
    SI.append(ASS / (L * W))  #ASS = area of sidewalk with standard slope

    #9
    if (LGP / LGPN) >= 1:
        SI.append(1)
    else:
        SI.append(LGP / LGPN) #LGP = length of standard guiding tactile pavement, LGPN
    return SI
```

In [2]:

```
#Street 1: Elliott Street
v = 10
lanes = 2
H = 200
L = 200
W = 15
ASP = L * W
SDW = 1
DW = 1
LL = 200
DL = 16
ASS = 200 * W
LGP = 0
LGPN = 1
score = SI_score(v, lanes, H, L, W, ASP, SDW, DW, LL, DL, ASS, LGP, LGPN)
print(score)
c = [37, 17, 38, 32, 39, 0, 31, 34, 7]

PSI = 0
for i in range(len(c)):
    PSI += score[i] * c[i]

grade = PSI / np.sum(c) * 10
print(grade)


```

```
[1, 0.5, 1.0, 1.0, 1.0, 1.0, 0.5625, 1.0, 0.0]
8.763297872340425
```

In [3]:

```
#Street 2: Jean Batten Place
v = 10
lanes = 1
H = 60
L = 60
W = 9
ASP = W * L
SDW = 1
DW = 1
LL = 60
DL = 8
ASS = 60 * W
LGP = 0
LGPN = 1
score = SI_score(v, lanes, H, L, W, ASP, SDW, DW, LL, DL, ASS, LGP, LGPN)
print(score)
c = [37, 17, 38, 32, 39, 0, 31, 34, 7]

PSI = 0
for i in range(len(c)):
    PSI += score[i] * c[i]

grade = PSI / np.sum(c) * 10
print(grade)
```

```
[1, 1, 1.0, 1.0, 1.0, 1.0, 1, 1.0, 0.0]
9.702127659574467
```

In [4]:

```
# Street 3: Bukchon-ro 5ga-gil
v = 30
lanes = 1
H = 240
L = 240
W = 6.5
ASP = W * L
SDW = 2
DW = 4
LL = 240
DL = 36.42
ASS = 130.48 * W
LGP = 0
LGPN = 1
score = SI_score(v, lanes, H, L, W, ASP, SDW, DW, LL, DL, ASS, LGP, LGPN)
print(score)
c = [37, 17, 38, 32, 39, 23, 31, 34, 7]

PSI = 0
for i in range(len(c)):
    PSI += score[i] * c[i]

grade = PSI / np.sum(c) * 10
print(grade)
```

```
[0, 1, 1.0, 1.0, 1.0, 0.5, 0.24711696869851732, 0.5436666666666666, 0.0]
6.342840802182973
```

In [5]:

```
#Street 4: Sanggye-ro 3-gil
v = 30
lanes = 1
H = 150
L = 150
W = 8
ASP = 0
SDW = 0
DW = 2
LL = L
DL = 11.87
ASS = 150 * W
LGP = 0
LGPN = 1
score = SI_score(v, lanes, H, L, W, ASP, SDW, DW, LL, DL, ASS, LGP, LGPN)
print(score)
c = [37, 17, 38, 32, 39, 23, 31, 34, 7]

PSI = 0
for i in range(len(c)):
    PSI += score[i] * c[i]

grade = PSI / np.sum(c) * 10
print(grade)
```

```
[0, 1, 1.0, 0.0, 1.0, 0.0, 0.7582139848357204, 1.0, 0.0]
5.872272617438269
```

In [6]:

```
#Street 5: Rijksstraatweg
v = 30
lanes = 1
H = 60
L = 60
W = 23
ASP = W * L
SDW = 0
DW = 1
LL = 60
DL = 16
ASS = 60 * W
LGP = 1      #No tactile guidance markers needed, street meets requirement
LGPN = 1
score = SI_score(v, lanes, H, L, W, ASP, SDW, DW, LL, DL, ASS, LGP, LGPN)
print(score)
c = [37, 17, 38, 32, 39, 0, 31, 34, 7]

PSI = 0
for i in range(len(c)):
    PSI += score[i] * c[i]

grade = PSI / np.sum(c) * 10
print(grade)
```

```
[0, 1, 1.0, 1.0, 1.0, 0.0, 0.5625, 1.0, 1]
7.848404255319149
```

In [7]:

```
#Street 6: Reguliersbreestraat
v = 30
lanes = 2
H = 160
L = 160
W = 12.5
ASP = L * W
SDW = 1
DW = 1
LL = 160
DL = 32.5
ASS = 148.38 * W
LGP = 0
LGPN = 1
score = SI_score(v, lanes, H, L, W, ASP, SDW, DW, LL, DL, ASS, LGP, LGPN)
print(score)
c = [37, 17, 38, 32, 39, 0, 31, 34, 7]

PSI = 0
for i in range(len(c)):
    PSI += score[i] * c[i]

grade = PSI / np.sum(c) * 10
print(grade)
```

```
[0, 0.5, 1.0, 1.0, 1.0, 1.0, 0.27692307692307694, 0.927375, 0.0]
6.7070368248772505
```

C

Results from the survey

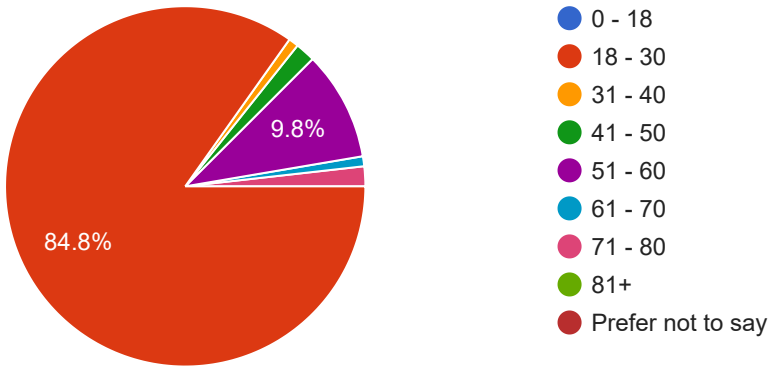
Pedestrian Safety Perception in Shared Space Streets

112 responses

Publish analytics

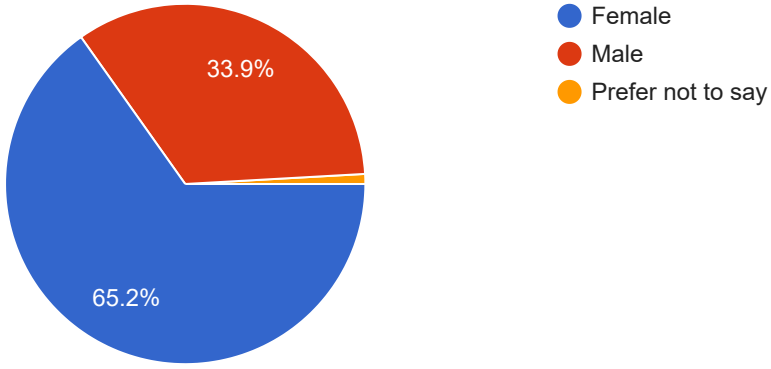
What is your age?

112 responses



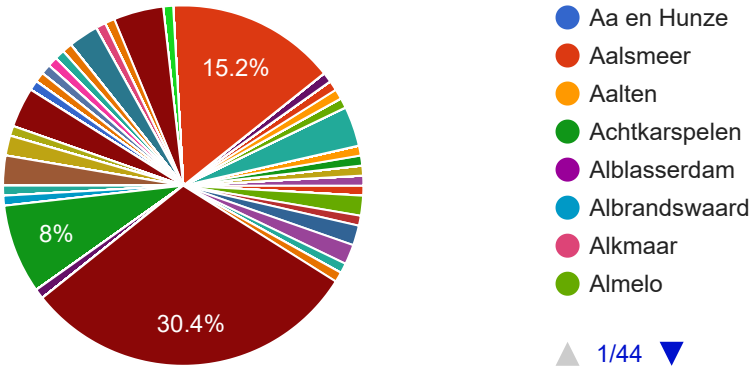
What is your gender?

112 responses



What is your municipality of residence?

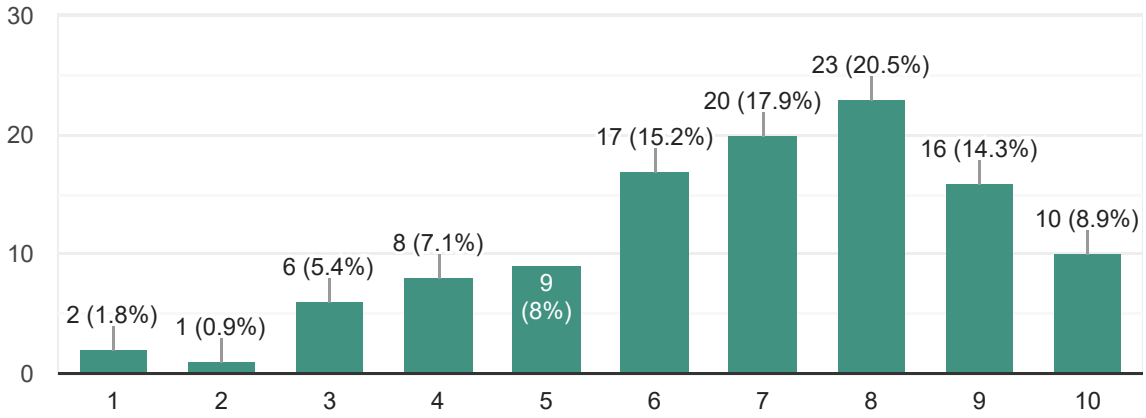
112 responses



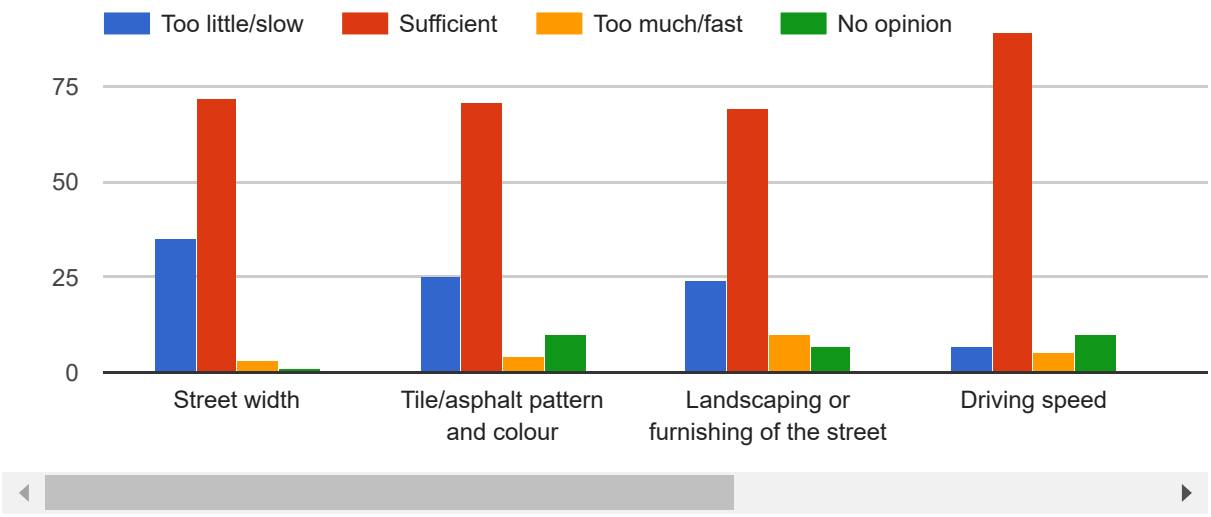
Street 1

How would you rate the level of safety?

112 responses



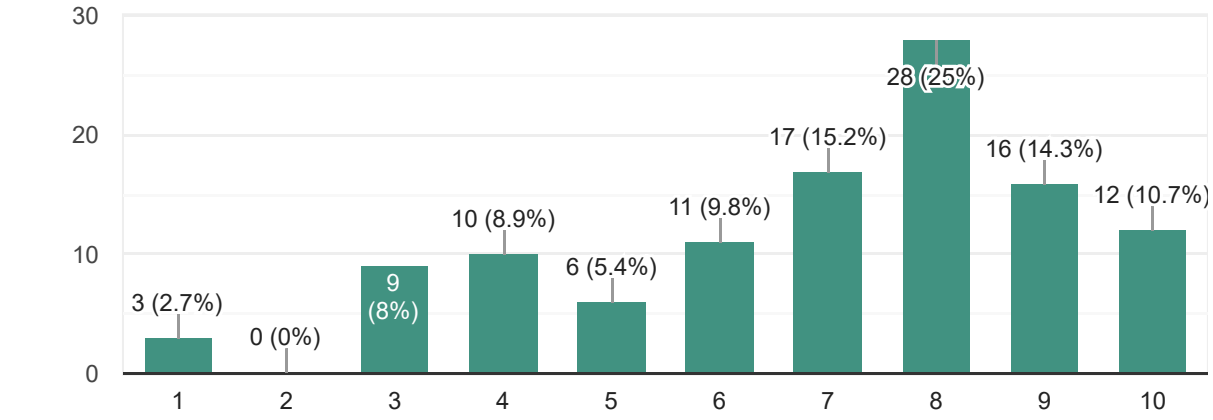
How do you perceive these different design aspects in the street?



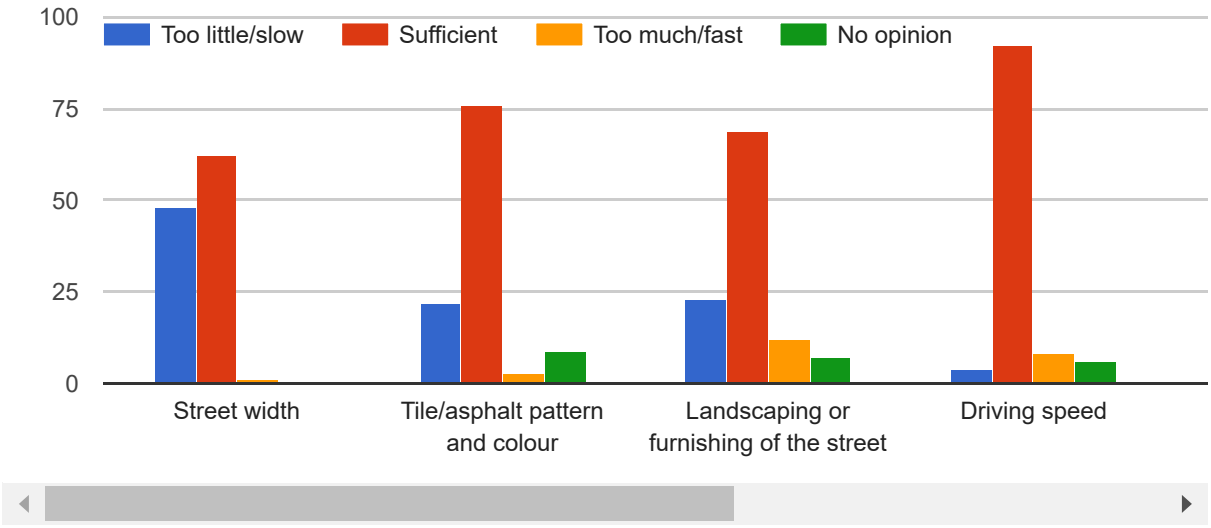
Street 2

How would you rate the level of safety?

112 responses



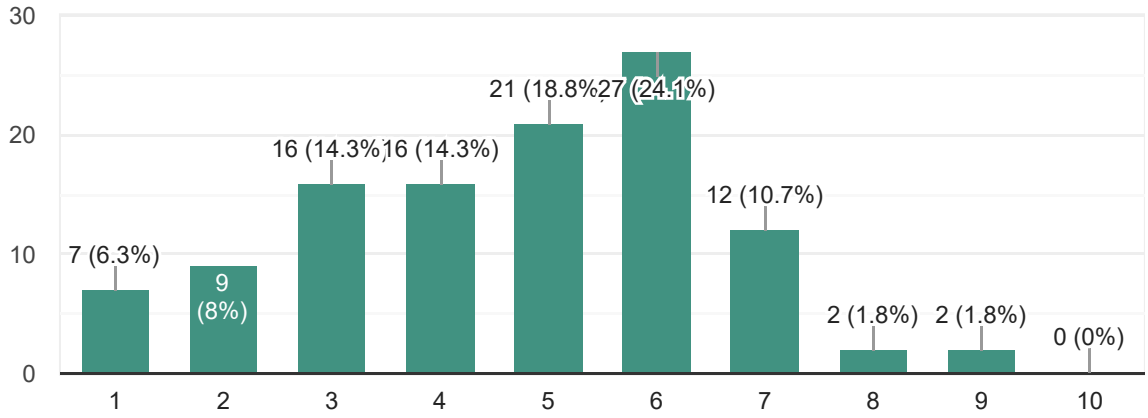
How do you perceive these different design aspects in the street?



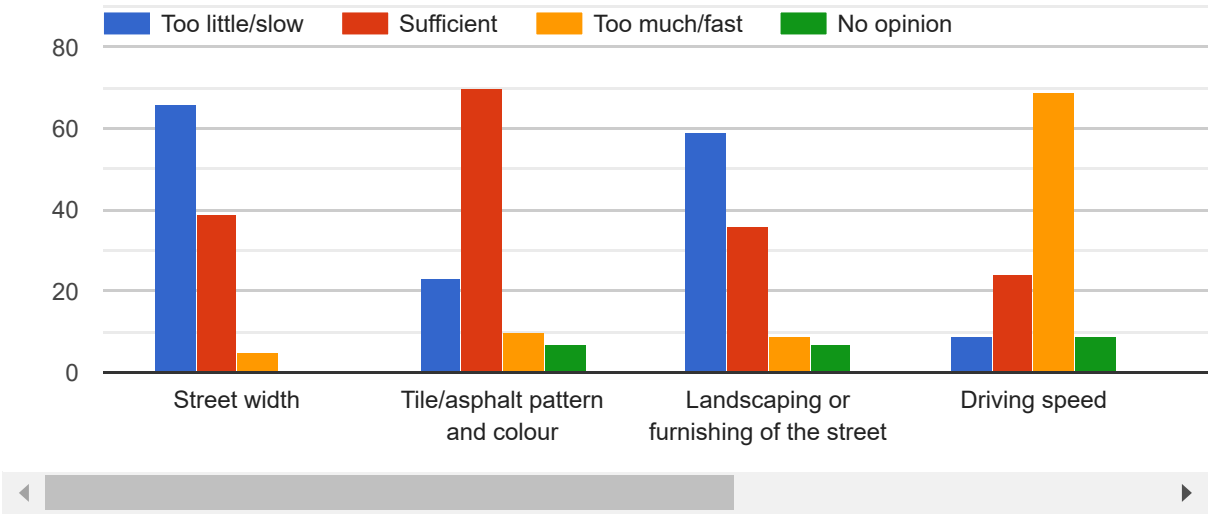
Street 3

How would you rate the level of safety?

112 responses



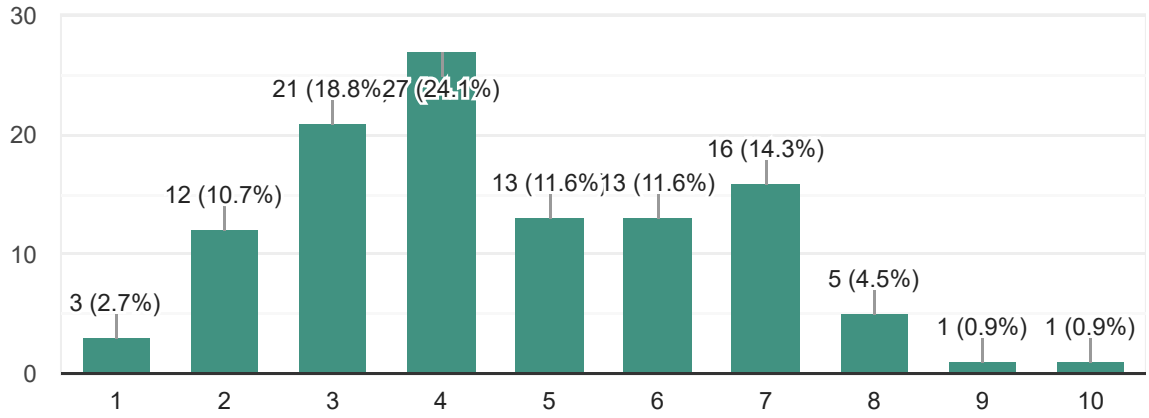
How do you perceive these different design aspects in the street?



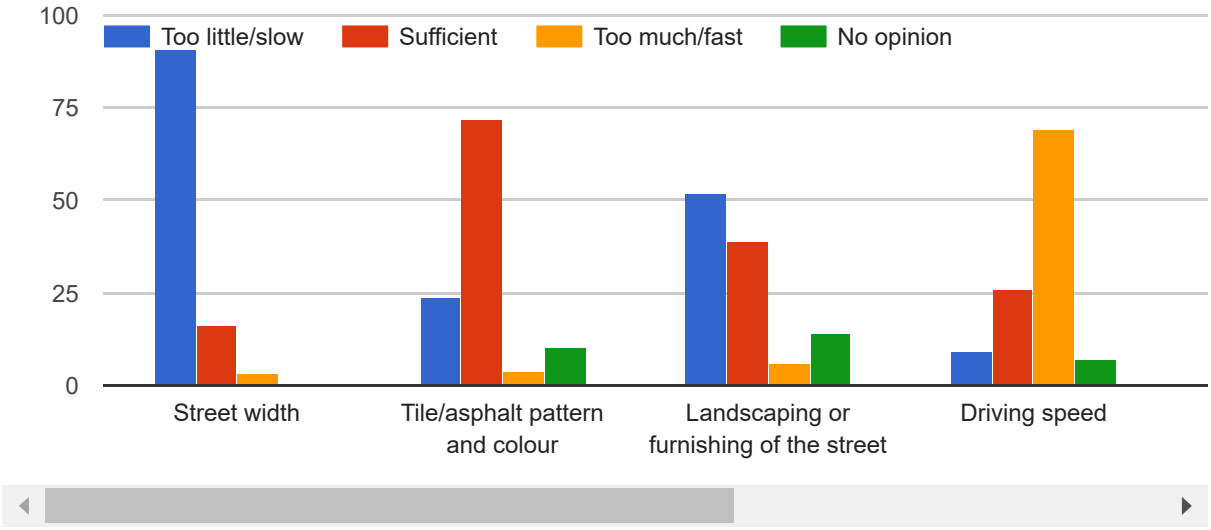
Street 4

How would you rate the level of safety?

112 responses



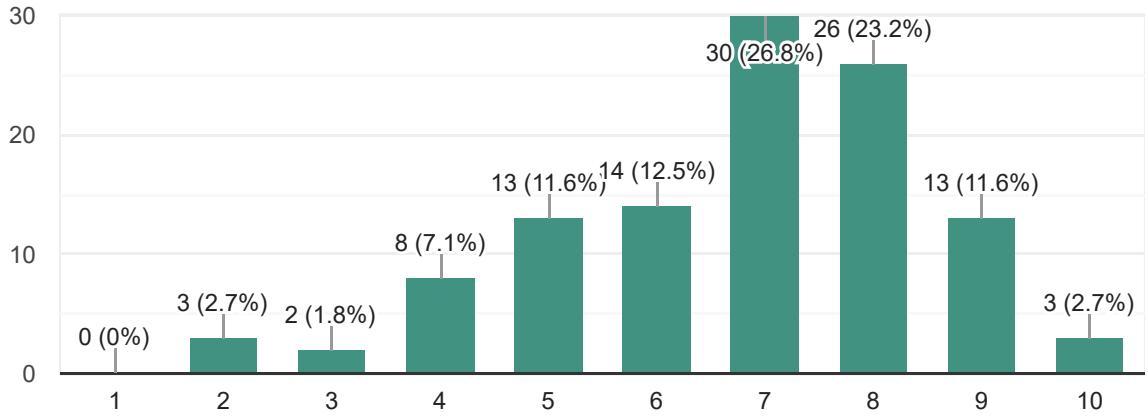
How do you perceive these different design aspects in the street?



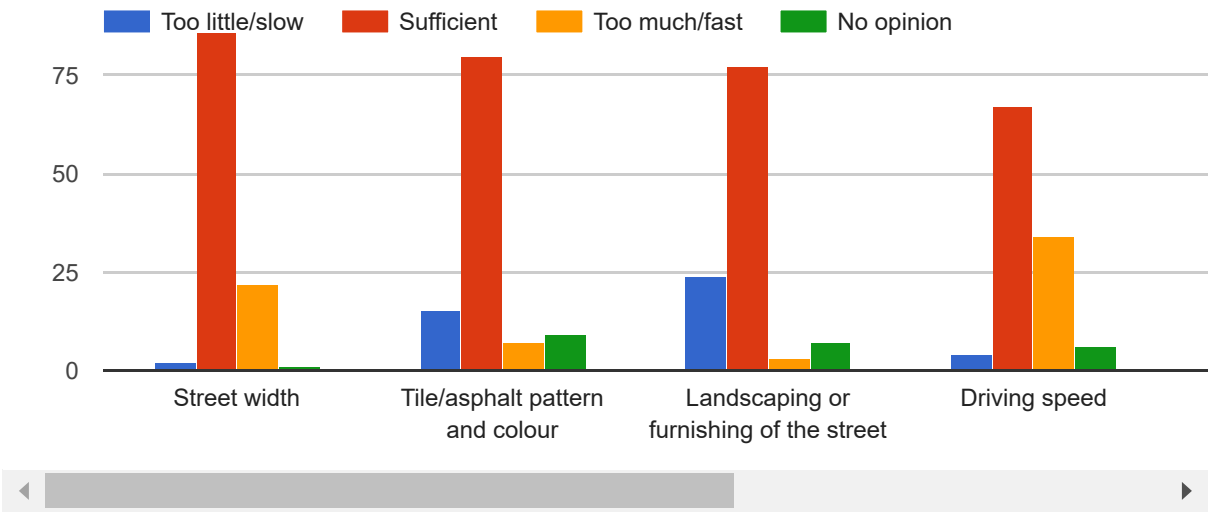
Street 5

How would you rate the level of safety?

112 responses



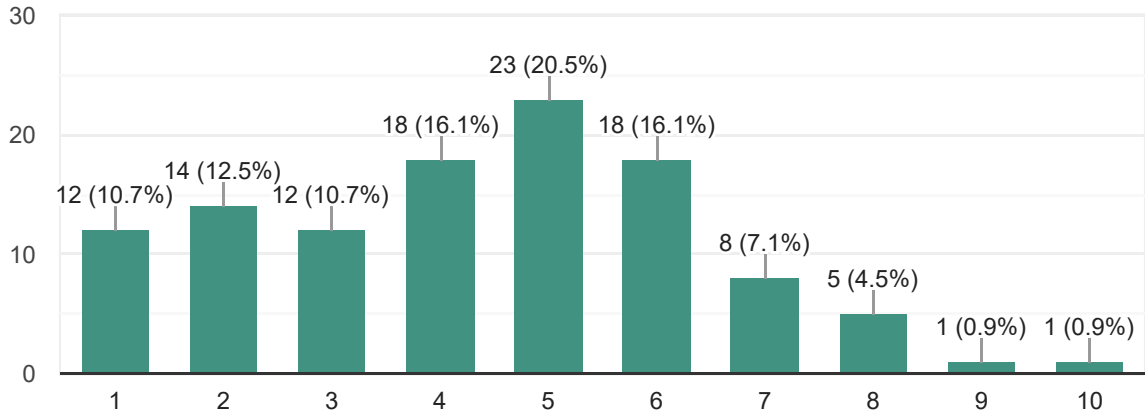
How do you perceive these different design aspects in the street?



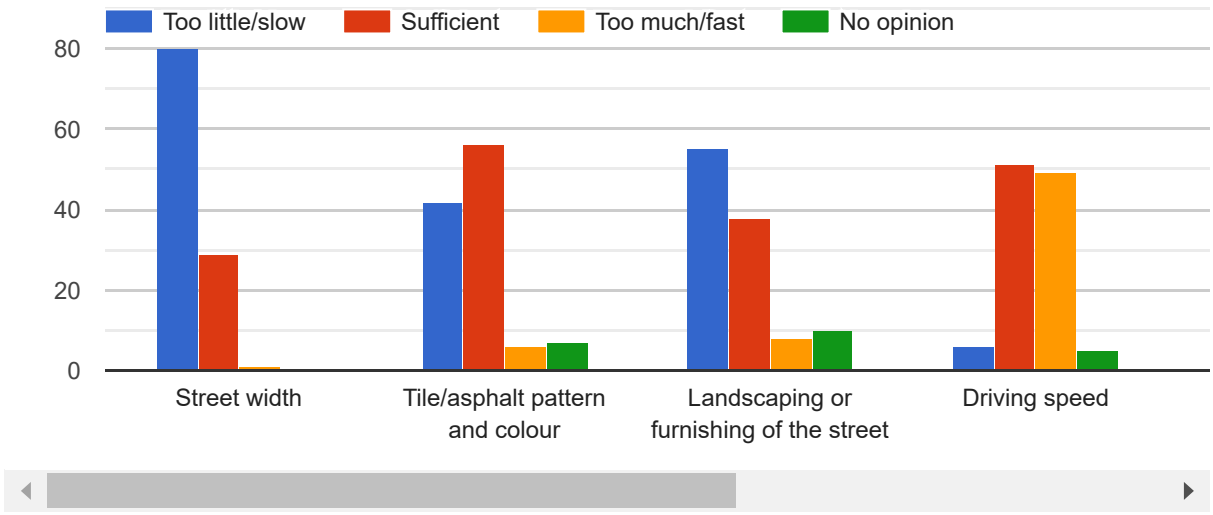
Street 6

How would you rate the level of safety?

112 responses



How do you perceive these different design aspects in the street?



D

Python code: One sample sign test

In [1]:

```
%matplotlib inline
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

In [2]:

```
data = pd.read_csv('BEP.csv', sep=';', index_col=None)
```

In [3]:

```
elliott = 0
jb = 0
bukchon = 0
sanggye = 0
rijksstraatweg = 0
reguliersbreestraat = 0

for i in range(len(data)):
    if data['Safety 1'][i] > 8.76:
        elliott += 1
    if data['Safety 2'][i] > 9.70:
        jb += 1
    if data['Safety 3'][i] > 6.34:
        bukchon += 1
    if data['Safety 4'][i] > 5.87:
        sanggye += 1
    if data['Safety 5'][i] > 7.85:
        rijksstraatweg += 1
    if data['Safety 6'][i] > 6.71:
        reguliersbreestraat += 1
print(elliott, 112 - elliott)
print(jb, 112 - jb)
print(bukchon, 112 - bukchon)
print(sanggye, 112 - sanggye)
print(rijksstraatweg, 112 - rijksstraatweg)
print(reguliersbreestraat, 112 - reguliersbreestraat)
TS = [49, 28, 43, 49, 42, 33]
```

```
26 86
12 100
16 96
36 76
42 70
15 97
```

E

Output multiple regression analysis

Regression Elliott Street

Descriptive Statistics

	Mean	Std. Deviation	N
Safety	6,84	2,106	107
Age	,40	1,106	107
Gender	,68	,488	107
Scale of Municipality	1,52	,945	107
Street width	1,67	,563	107
Tile and pattern	1,64	,692	107
Landscape	1,75	,688	107
Driving speed	1,78	,691	107
Tactile guidance markers	1,21	,710	107
Separation between traffic	1,39	,683	107
Traffic signs and markings	1,32	,681	107

Correlations

		Safety	Age	Gender	Scale of Municipality
Pearson Correlation	Safety	1,000	-,065	-,077	-,015
	Age	-,065	1,000	-,216	,068
	Gender	-,077	-,216	1,000	-,270
	Scale of Municipality	-,015	,068	-,270	1,000
	Street width	,330	-,135	,030	-,048
	Tile and pattern	,245	-,152	,101	-,066
	Landscape	,141	,122	,124	,002
	Driving speed	,066	-,029	,122	-,021
	Tactile guidance markers	,154	,026	,027	,077
	Separation between traffic	,260	,026	-,075	,146
	Traffic signs and markings	,141	,092	-,119	,120
Sig. (1-tailed)	Safety	.	,251	,215	,440
	Age	,251	.	,013	,244
	Gender	,215	,013	.	,002
	Scale of Municipality	,440	,244	,002	.
	Street width	,000	,082	,379	,313
	Tile and pattern	,006	,059	,151	,249

Correlations

		Street width	Tile and pattern	Landscape
Pearson Correlation	Safety	,330	,245	,141
	Age	-,135	-,152	,122
	Gender	,030	,101	,124
	Scale of Municipality	-,048	-,066	,002
	Street width	1,000	,321	,150
	Tile and pattern	,321	1,000	,320
	Landscape	,150	,320	1,000
	Driving speed	,173	,222	,197
	Tactile guidance markers	,312	,154	,319
	Separation between traffic	,239	,166	,253
	Traffic signs and markings	,175	,168	,213
Sig. (1-tailed)	Safety	,000	,006	,073
	Age	,082	,059	,105
	Gender	,379	,151	,101
	Scale of Municipality	,313	,249	,492
	Street width	.	,000	,061
	Tile and pattern	,000	.	,000

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
Pearson Correlation	Safety	,066	,154	,260
	Age	-,029	,026	,026
	Gender	,122	,027	-,075
	Scale of Municipality	-,021	,077	,146
	Street width	,173	,312	,239
	Tile and pattern	,222	,154	,166
	Landscape	,197	,319	,253
	Driving speed	1,000	,210	,188
	Tactile guidance markers	,210	1,000	,590
	Separation between traffic	,188	,590	1,000
	Traffic signs and markings	-,007	,468	,540
Sig. (1-tailed)	Safety	,250	,056	,003
	Age	,383	,395	,393
	Gender	,104	,391	,221
	Scale of Municipality	,416	,215	,066
	Street width	,037	,001	,007
	Tile and pattern	,011	,057	,044

Correlations

		Traffic signs and markings
Pearson Correlation	Safety	,141
	Age	,092
	Gender	-,119
	Scale of Municipality	,120
	Street width	,175
	Tile and pattern	,168
	Landscape	,213
	Driving speed	-,007
	Tactile guidance markers	,468
	Separation between traffic	,540
	Traffic signs and markings	1,000
Sig. (1-tailed)	Safety	,074
	Age	,173
	Gender	,111
	Scale of Municipality	,109
	Street width	,035
	Tile and pattern	,042

Correlations

		Safety	Age	Gender	Scale of Municipality
	Landscape	,073	,105	,101	,492
	Driving speed	,250	,383	,104	,416
	Tactile guidance markers	,056	,395	,391	,215
	Separation between traffic	,003	,393	,221	,066
	Traffic signs and markings	,074	,173	,111	,109
N	Safety	107	107	107	107
	Age	107	107	107	107
	Gender	107	107	107	107
	Scale of Municipality	107	107	107	107
	Street width	107	107	107	107
	Tile and pattern	107	107	107	107
	Landscape	107	107	107	107
	Driving speed	107	107	107	107
	Tactile guidance markers	107	107	107	107
	Separation between traffic	107	107	107	107
	Traffic signs and markings	107	107	107	107

Correlations

		Street width	Tile and pattern	Landscape
	Landscape	,061	,000	.
	Driving speed	,037	,011	,021
	Tactile guidance markers	,001	,057	,000
	Separation between traffic	,007	,044	,004
	Traffic signs and markings	,035	,042	,014
N	Safety	107	107	107
	Age	107	107	107
	Gender	107	107	107
	Scale of Municipality	107	107	107
	Street width	107	107	107
	Tile and pattern	107	107	107
	Landscape	107	107	107
	Driving speed	107	107	107
	Tactile guidance markers	107	107	107
	Separation between traffic	107	107	107
	Traffic signs and markings	107	107	107

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
	Landscape	,021	,000	,004
	Driving speed	.	,015	,026
	Tactile guidance markers	,015	.	,000
	Separation between traffic	,026	,000	.
	Traffic signs and markings	,469	,000	,000
N	Safety	107	107	107
	Age	107	107	107
	Gender	107	107	107
	Scale of Municipality	107	107	107
	Street width	107	107	107
	Tile and pattern	107	107	107
	Landscape	107	107	107
	Driving speed	107	107	107
	Tactile guidance markers	107	107	107
	Separation between traffic	107	107	107
	Traffic signs and markings	107	107	107

Correlations

		Traffic signs and markings
	Landscape	,014
	Driving speed	,469
	Tactile guidance markers	,000
	Separation between traffic	,000
	Traffic signs and markings	.
N	Safety	107
	Age	107
	Gender	107
	Scale of Municipality	107
	Street width	107
	Tile and pattern	107
	Landscape	107
	Driving speed	107
	Tactile guidance markers	107
	Separation between traffic	107
	Traffic signs and markings	107

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Traffic signs and markings, Driving speed, Age, Scale of Municipality, Street width, Landscape, Gender, Tile and pattern, Tactile guidance markers, Separation between traffic[b]	.	Enter

a. Dependent Variable: Safety

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,421[a]	,177	,092	2,008

a. Predictors: (Constant), Traffic signs and markings, Driving speed, Age, Scale of Municipality, Street width, Landscape, Gender, Tile and pattern, Tactile guidance markers, Separation between traffic

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	83,345	10	8,334	2,068	,035[b]
	Residual	386,955	96	4,031		
	Total	470,299	106			

a. Dependent Variable: Safety

b. Predictors: (Constant), Traffic signs and markings, Driving speed, Age, Scale of Municipality, Street width, Landscape, Gender, Tile and pattern, Tactile guidance markers, Separation between traffic

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t
		B	Std. Error	Beta	
1	(Constant)	4,386	,982		4,466
	Age	-,077	,188	-,040	-,408
	Gender	-,462	,436	-,107	-1,059
	Scale of Municipality	-,100	,217	-,045	-,461
	Street width	,947	,386	,253	2,454
	Tile and pattern	,406	,321	,133	1,262
	Landscape	,175	,323	,057	,542
	Driving speed	-,112	,303	-,037	-,370
	Tactile guidance markers	-,196	,367	-,066	-,532
	Separation between traffic	,699	,388	,227	1,801
	Traffic signs and markings	-,104	,360	-,034	-,289

Coefficients[a]

Model		Sig.	95,0% Confidence Interval for B	
			Lower Bound	Upper Bound
1	(Constant)	,000	2,436	6,335
	Age	,684	-,450	,297
	Gender	,292	-1,327	,404
	Scale of Municipality	,646	-,531	,331
	Street width	,016	,181	1,712
	Tile and pattern	,210	-,232	1,043
	Landscape	,589	-,465	,815
	Driving speed	,713	-,714	,490
	Tactile guidance markers	,596	-,925	,534
	Separation between traffic	,075	-,071	1,468
	Traffic signs and markings	,773	-,818	,610

a. Dependent Variable: Safety

Regression Jean Batten Place

Descriptive Statistics

	Mean	Std. Deviation	N
Safety	6,92	2,307	107
Age	,46	1,160	107
Gender	,65	,497	107
Scale of Municipality	1,54	1,003	107
Street width	1,58	,533	107
Tile and pattern	1,64	,692	107
Landscape	1,75	,754	107
Driving speed	1,91	,607	107
Tactile guidance markers	1,39	,711	107
Separation between traffic	1,39	,595	107
Traffic signs and markings	1,60	,657	107

Correlations

		Safety	Age	Gender	Scale of Municipality
Pearson Correlation	Safety	1,000	,191	-,215	,130
	Age	,191	1,000	-,246	,004
	Gender	-,215	-,246	1,000	-,283
	Scale of Municipality	,130	,004	-,283	1,000
	Street width	,585	,070	-,091	-,046
	Tile and pattern	,164	-,107	,042	-,080
	Landscape	,058	,069	-,109	-,079
	Driving speed	,008	,035	-,046	-,071
	Tactile guidance markers	,297	,146	-,013	,003
	Separation between traffic	,285	,052	-,111	,020
	Traffic signs and markings	,214	,108	-,112	,090
Sig. (1-tailed)	Safety	.	,024	,013	,091
	Age	,024	.	,005	,485
	Gender	,013	,005	.	,002
	Scale of Municipality	,091	,485	,002	.
	Street width	,000	,236	,175	,319
	Tile and pattern	,046	,135	,336	,207
	Landscape	,276	,241	,131	,208
	Driving speed	,468	,362	,321	,234
	Tactile guidance markers	,001	,067	,448	,487
	Separation between traffic	,001	,299	,128	,421
	Traffic signs and markings	,013	,135	,126	,177
N	Safety	107	107	107	107
	Age	107	107	107	107
	Gender	107	107	107	107
	Scale of Municipality	107	107	107	107
	Street width	107	107	107	107
	Tile and pattern	107	107	107	107
	Landscape	107	107	107	107
	Driving speed	107	107	107	107
	Tactile guidance markers	107	107	107	107
	Separation between traffic	107	107	107	107
	Traffic signs and markings	107	107	107	107

Correlations

		Street width	Tile and pattern	Landscape
Pearson Correlation	Safety	,585	,164	,058
	Age	,070	-,107	,069
	Gender	-,091	,042	-,109
	Scale of Municipality	-,046	-,080	-,079
	Street width	1,000	,220	,109
	Tile and pattern	,220	1,000	,220
	Landscape	,109	,220	1,000
	Driving speed	,023	,143	,092
	Tactile guidance markers	,316	,217	,275
	Separation between traffic	,317	,076	,202
	Traffic signs and markings	,267	,152	,174
Sig. (1-tailed)	Safety	,000	,046	,276
	Age	,236	,135	,241
	Gender	,175	,336	,131
	Scale of Municipality	,319	,207	,208
	Street width	.	,011	,131
	Tile and pattern	,011	.	,011
	Landscape	,131	,011	.
	Driving speed	,406	,071	,172
	Tactile guidance markers	,000	,012	,002
	Separation between traffic	,000	,219	,018
	Traffic signs and markings	,003	,059	,036
N	Safety	107	107	107
	Age	107	107	107
	Gender	107	107	107
	Scale of Municipality	107	107	107
	Street width	107	107	107
	Tile and pattern	107	107	107
	Landscape	107	107	107
	Driving speed	107	107	107
	Tactile guidance markers	107	107	107
	Separation between traffic	107	107	107
	Traffic signs and markings	107	107	107

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
Pearson Correlation	Safety	,008	,297	,285
	Age	,035	,146	,052
	Gender	-,046	-,013	-,111
	Scale of Municipality	-,071	,003	,020
	Street width	,023	,316	,317
	Tile and pattern	,143	,217	,076
	Landscape	,092	,275	,202
	Driving speed	1,000	,348	,312
	Tactile guidance markers	,348	1,000	,614
	Separation between traffic	,312	,614	1,000
	Traffic signs and markings	,307	,321	,528
Sig. (1-tailed)	Safety	,468	,001	,001
	Age	,362	,067	,299
	Gender	,321	,448	,128
	Scale of Municipality	,234	,487	,421
	Street width	,406	,000	,000
	Tile and pattern	,071	,012	,219
	Landscape	,172	,002	,018
	Driving speed	.	,000	,001
	Tactile guidance markers	,000	.	,000
	Separation between traffic	,001	,000	.
	Traffic signs and markings	,001	,000	,000
N	Safety	107	107	107
	Age	107	107	107
	Gender	107	107	107
	Scale of Municipality	107	107	107
	Street width	107	107	107
	Tile and pattern	107	107	107
	Landscape	107	107	107
	Driving speed	107	107	107
	Tactile guidance markers	107	107	107
	Separation between traffic	107	107	107
	Traffic signs and markings	107	107	107

Correlations

		Traffic signs and markings
Pearson Correlation	Safety	,214
	Age	,108
	Gender	-,112
	Scale of Municipality	,090
	Street width	,267
	Tile and pattern	,152
	Landscape	,174
	Driving speed	,307
	Tactile guidance markers	,321
	Separation between traffic	,528
	Traffic signs and markings	1,000
Sig. (1-tailed)	Safety	,013
	Age	,135
	Gender	,126
	Scale of Municipality	,177
	Street width	,003
	Tile and pattern	,059
	Landscape	,036
	Driving speed	,001
	Tactile guidance markers	,000
	Separation between traffic	,000
	Traffic signs and markings	.
N	Safety	107
	Age	107
	Gender	107
	Scale of Municipality	107
	Street width	107
	Tile and pattern	107
	Landscape	107
	Driving speed	107
	Tactile guidance markers	107
	Separation between traffic	107
	Traffic signs and markings	107

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Traffic signs and markings, Scale of Municipality, Age, Landscape, Street width, Driving speed, Tile and pattern, Gender, Tactile guidance markers, Separation between traffic[b]	.	Enter

a. Dependent Variable: Safety

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,646[a]	,418	,357	1,850

a. Predictors: (Constant), Traffic signs and markings, Scale of Municipality, Age, Landscape, Street width, Driving speed, Tile and pattern, Gender, Tactile guidance markers, Separation between traffic

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	235,799	10	23,580	6,892	,000[b]
	Residual	328,444	96	3,421		
	Total	564,243	106			

a. Dependent Variable: Safety

b. Predictors: (Constant), Traffic signs and markings, Scale of Municipality, Age, Landscape, Street width, Driving speed, Tile and pattern, Gender, Tactile guidance markers, Separation between traffic

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	t
1	(Constant)	2,784	1,086		2,563
	Age	,251	,166	,126	1,513
	Gender	-,498	,400	-,107	-1,244
	Scale of Municipality	,274	,192	,119	1,424
	Street width	2,220	,376	,512	5,895
	Tile and pattern	,254	,283	,076	,898
	Landscape	-,179	,256	-,059	-,699
	Driving speed	-,239	,332	-,063	-,721
	Tactile guidance markers	,301	,353	,093	,851
	Separation between traffic	,299	,440	,077	,680
	Traffic signs and markings	-,041	,339	-,012	-,122

Coefficients[a]

Model		Sig.	95,0% Confidence Interval for B	
			Lower Bound	Upper Bound
1	(Constant)	,012	,628	4,940
	Age	,134	-,078	,580
	Gender	,216	-1,292	,296
	Scale of Municipality	,158	-,108	,656
	Street width	,000	1,472	2,967
	Tile and pattern	,371	-,307	,816
	Landscape	,486	-,688	,330
	Driving speed	,473	-,898	,420
	Tactile guidance markers	,397	-,400	1,001
	Separation between traffic	,498	-,574	1,173
	Traffic signs and markings	,903	-,715	,632

a. Dependent Variable: Safety

Regression Bukchon-ro 5ga-gil

Descriptive Statistics

	Mean	Std. Deviation	N
Safety	4,65	1,873	109
Age	,39	1,097	109
Gender	,67	,492	109
Scale of Municipality	1,53	,996	109
Street width	1,43	,599	109
Tile and pattern	1,74	,725	109
Landscape	1,41	,748	109
Driving speed	2,36	,967	109
Tactile guidance markers	1,18	,722	109
Separation between traffic	1,29	,613	109
Traffic signs and markings	1,17	,606	109

Correlations

		Safety	Age	Gender	Scale of Municipality
Pearson Correlation	Safety	1,000	,153	-,076	-,024
	Age	,153	1,000	-,254	,009
	Gender	-,076	-,254	1,000	-,281
	Scale of Municipality	-,024	,009	-,281	1,000
	Street width	,267	-,078	,016	-,249
	Tile and pattern	,186	-,046	,097	-,065
	Landscape	,097	-,121	,097	,013
	Driving speed	,039	,145	,076	,002
	Tactile guidance markers	,164	,001	-,036	,082
	Separation between traffic	,364	-,091	-,044	,075
	Traffic signs and markings	,250	-,007	-,147	,014
Sig. (1-tailed)	Safety	.	,056	,216	,403
	Age	,056	.	,004	,461
	Gender	,216	,004	.	,002
	Scale of Municipality	,403	,461	,002	.
	Street width	,002	,210	,433	,005
	Tile and pattern	,027	,317	,157	,250
	Landscape	,158	,104	,157	,446
	Driving speed	,344	,066	,217	,490
	Tactile guidance markers	,044	,495	,354	,199

Correlations

		Street width	Tile and pattern	Landscape
Pearson Correlation	Safety	,267	,186	,097
	Age	-,078	-,046	-,121
	Gender	,016	,097	,097
	Scale of Municipality	-,249	-,065	,013
	Street width	1,000	,279	,157
	Tile and pattern	,279	1,000	,283
	Landscape	,157	,283	1,000
	Driving speed	,051	,172	,063
	Tactile guidance markers	,179	,232	,218
	Separation between traffic	,156	,213	,218
	Traffic signs and markings	,225	,040	,085
Sig. (1-tailed)	Safety	,002	,027	,158
	Age	,210	,317	,104
	Gender	,433	,157	,157
	Scale of Municipality	,005	,250	,446
	Street width	.	,002	,051
	Tile and pattern	,002	.	,001
	Landscape	,051	,001	.
	Driving speed	,300	,037	,259
	Tactile guidance markers	,031	,008	,011

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
Pearson Correlation	Safety	,039	,164	,364
	Age	,145	,001	-,091
	Gender	,076	-,036	-,044
	Scale of Municipality	,002	,082	,075
	Street width	,051	,179	,156
	Tile and pattern	,172	,232	,213
	Landscape	,063	,218	,218
	Driving speed	1,000	,144	,055
	Tactile guidance markers	,144	1,000	,609
	Separation between traffic	,055	,609	1,000
	Traffic signs and markings	,256	,476	,509
Sig. (1-tailed)	Safety	,344	,044	,000
	Age	,066	,495	,173
	Gender	,217	,354	,325
	Scale of Municipality	,490	,199	,218
	Street width	,300	,031	,052
	Tile and pattern	,037	,008	,013
	Landscape	,259	,011	,011
	Driving speed	.	,068	,284
	Tactile guidance markers	,068	.	,000

Correlations

		Traffic signs and markings
Pearson Correlation	Safety	,250
	Age	-,007
	Gender	-,147
	Scale of Municipality	,014
	Street width	,225
	Tile and pattern	,040
	Landscape	,085
	Driving speed	,256
	Tactile guidance markers	,476
	Separation between traffic	,509
	Traffic signs and markings	1,000
Sig. (1-tailed)	Safety	,004
	Age	,472
	Gender	,064
	Scale of Municipality	,444
	Street width	,009
	Tile and pattern	,341
	Landscape	,190
	Driving speed	,004
	Tactile guidance markers	,000

Correlations

		Safety	Age	Gender	Scale of Municipality
	Separation between traffic	,000	,173	,325	,218
	Traffic signs and markings	,004	,472	,064	,444
N	Safety	109	109	109	109
	Age	109	109	109	109
	Gender	109	109	109	109
	Scale of Municipality	109	109	109	109
	Street width	109	109	109	109
	Tile and pattern	109	109	109	109
	Landscape	109	109	109	109
	Driving speed	109	109	109	109
	Tactile guidance markers	109	109	109	109
	Separation between traffic	109	109	109	109
	Traffic signs and markings	109	109	109	109

Correlations

		Street width	Tile and pattern	Landscape
	Separation between traffic	,052	,013	,011
	Traffic signs and markings	,009	,341	,190
N	Safety	109	109	109
	Age	109	109	109
	Gender	109	109	109
	Scale of Municipality	109	109	109
	Street width	109	109	109
	Tile and pattern	109	109	109
	Landscape	109	109	109
	Driving speed	109	109	109
	Tactile guidance markers	109	109	109
	Separation between traffic	109	109	109
	Traffic signs and markings	109	109	109

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
	Separation between traffic	,284	,000	.
	Traffic signs and markings	,004	,000	,000
N	Safety	109	109	109
	Age	109	109	109
	Gender	109	109	109
	Scale of Municipality	109	109	109
	Street width	109	109	109
	Tile and pattern	109	109	109
	Landscape	109	109	109
	Driving speed	109	109	109
	Tactile guidance markers	109	109	109
	Separation between traffic	109	109	109
	Traffic signs and markings	109	109	109

Correlations

		Traffic signs and markings
	Separation between traffic	,000
	Traffic signs and markings	.
N	Safety	109
	Age	109
	Gender	109
	Scale of Municipality	109
	Street width	109
	Tile and pattern	109
	Landscape	109
	Driving speed	109
	Tactile guidance markers	109
	Separation between traffic	109
	Traffic signs and markings	109

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Traffic signs and markings, Age, Scale of Municipality, Tile and pattern, Landscape, Driving speed, Street width, Gender, Tactile guidance markers, Separation between traffic[b]	.	Enter

a. Dependent Variable: Safety

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,493[a]	,243	,166	1,710

a. Predictors: (Constant), Traffic signs and markings, Age, Scale of Municipality, Tile and pattern, Landscape, Driving speed, Street width, Gender, Tactile guidance markers, Separation between ...

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92,027	10	9,203	3,145	,002[b]
	Residual	286,725	98	2,926		
	Total	378,752	108			

a. Dependent Variable: Safety

b. Predictors: (Constant), Traffic signs and markings, Age, Scale of Municipality, Tile and pattern, Landscape, Driving speed, Street width, Gender, Tactile guidance markers, Separation between ...

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	t
1	(Constant)	1,895	,831		2,282
	Age	,370	,161	,217	2,305
	Gender	-,010	,374	-,003	-,026
	Scale of Municipality	,030	,181	,016	,168
	Street width	,660	,306	,211	2,157
	Tile and pattern	,249	,255	,097	,978
	Landscape	,029	,236	,012	,122
	Driving speed	-,080	,185	-,041	-,431
	Tactile guidance markers	-,456	,303	-,176	-1,503
	Separation between traffic	1,182	,367	,387	3,225
	Traffic signs and markings	,296	,352	,096	,841

Coefficients[a]

Model		Sig.	95,0% Confidence Interval for B	
			Lower Bound	Upper Bound
1	(Constant)	,025	,247	3,544
	Age	,023	,051	,689
	Gender	,979	-,752	,733
	Scale of Municipality	,867	-,329	,389
	Street width	,033	,053	1,268
	Tile and pattern	,330	-,257	,755
	Landscape	,903	-,440	,498
	Driving speed	,667	-,447	,287
	Tactile guidance markers	,136	-1,058	,146
	Separation between traffic	,002	,455	1,910
	Traffic signs and markings	,402	-,402	,994

a. Dependent Variable: Safety

Regression Sanggye-ro 3-gil

Descriptive Statistics

	Mean	Std. Deviation	N
Safety	4,57	1,907	109
Age	,39	1,063	109
Gender	,68	,488	109
Scale of Municipality	1,50	,968	109
Street width	1,19	,481	109
Tile and pattern	1,61	,707	109
Landscape	1,31	,766	109
Driving speed	2,41	,915	109
Tactile guidance markers	1,36	,739	109
Separation between traffic	1,17	,586	109
Traffic signs and markings	1,33	,695	109

Correlations

		Safety	Age	Gender	Scale of Municipality
Pearson Correlation	Safety	1,000	-,011	-,071	-,137
	Age	-,011	1,000	-,217	-,096
	Gender	-,071	-,217	1,000	-,261
	Scale of Municipality	-,137	-,096	-,261	1,000
	Street width	,344	-,186	,148	-,231
	Tile and pattern	,086	-,247	,139	-,085
	Landscape	,125	-,141	,023	,123
	Driving speed	-,263	,069	,113	-,039
	Tactile guidance markers	,084	-,169	,013	,095
	Separation between traffic	,081	-,091	,025	-,001
	Traffic signs and markings	,178	-,191	-,012	,067
Sig. (1-tailed)	Safety	.	,454	,233	,078
	Age	,454	.	,012	,160
	Gender	,233	,012	.	,003
	Scale of Municipality	,078	,160	,003	.
	Street width	,000	,026	,063	,008
	Tile and pattern	,188	,005	,074	,189
	Landscape	,098	,072	,407	,102
	Driving speed	,003	,238	,121	,345
	Tactile guidance markers	,192	,039	,445	,164

Correlations

		Street width	Tile and pattern	Landscape
Pearson Correlation	Safety	,344	,086	,125
	Age	-,186	-,247	-,141
	Gender	,148	,139	,023
	Scale of Municipality	-,231	-,085	,123
	Street width	1,000	,280	,363
	Tile and pattern	,280	1,000	,434
	Landscape	,363	,434	1,000
	Driving speed	-,098	-,075	-,053
	Tactile guidance markers	,195	,343	,242
	Separation between traffic	,379	,405	,545
	Traffic signs and markings	,307	,437	,379
Sig. (1-tailed)	Safety	,000	,188	,098
	Age	,026	,005	,072
	Gender	,063	,074	,407
	Scale of Municipality	,008	,189	,102
	Street width	.	,002	,000
	Tile and pattern	,002	.	,000
	Landscape	,000	,000	.
	Driving speed	,155	,219	,291
	Tactile guidance markers	,021	,000	,006

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
Pearson Correlation	Safety	-,263	,084	,081
	Age	,069	-,169	-,091
	Gender	,113	,013	,025
	Scale of Municipality	-,039	,095	-,001
	Street width	-,098	,195	,379
	Tile and pattern	-,075	,343	,405
	Landscape	-,053	,242	,545
	Driving speed	1,000	,026	,183
	Tactile guidance markers	,026	1,000	,376
	Separation between traffic	,183	,376	1,000
	Traffic signs and markings	,104	,435	,502
Sig. (1-tailed)	Safety	,003	,192	,201
	Age	,238	,039	,174
	Gender	,121	,445	,397
	Scale of Municipality	,345	,164	,494
	Street width	,155	,021	,000
	Tile and pattern	,219	,000	,000
	Landscape	,291	,006	,000
	Driving speed	.	,394	,029
	Tactile guidance markers	,394	.	,000

Correlations

		Traffic signs and markings
Pearson Correlation	Safety	,178
	Age	-,191
	Gender	-,012
	Scale of Municipality	,067
	Street width	,307
	Tile and pattern	,437
	Landscape	,379
	Driving speed	,104
	Tactile guidance markers	,435
	Separation between traffic	,502
	Traffic signs and markings	1,000
Sig. (1-tailed)	Safety	,032
	Age	,024
	Gender	,451
	Scale of Municipality	,246
	Street width	,001
	Tile and pattern	,000
	Landscape	,000
	Driving speed	,141
	Tactile guidance markers	,000

Correlations

		Safety	Age	Gender	Scale of Municipality
	Separation between traffic	,201	,174	,397	,494
	Traffic signs and markings	,032	,024	,451	,246
N	Safety	109	109	109	109
	Age	109	109	109	109
	Gender	109	109	109	109
	Scale of Municipality	109	109	109	109
	Street width	109	109	109	109
	Tile and pattern	109	109	109	109
	Landscape	109	109	109	109
	Driving speed	109	109	109	109
	Tactile guidance markers	109	109	109	109
	Separation between traffic	109	109	109	109
	Traffic signs and markings	109	109	109	109

Correlations

		Street width	Tile and pattern	Landscape
	Separation between traffic	,000	,000	,000
	Traffic signs and markings	,001	,000	,000
N	Safety	109	109	109
	Age	109	109	109
	Gender	109	109	109
	Scale of Municipality	109	109	109
	Street width	109	109	109
	Tile and pattern	109	109	109
	Landscape	109	109	109
	Driving speed	109	109	109
	Tactile guidance markers	109	109	109
	Separation between traffic	109	109	109
	Traffic signs and markings	109	109	109

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
	Separation between traffic	,029	,000	.
	Traffic signs and markings	,141	,000	,000
N	Safety	109	109	109
	Age	109	109	109
	Gender	109	109	109
	Scale of Municipality	109	109	109
	Street width	109	109	109
	Tile and pattern	109	109	109
	Landscape	109	109	109
	Driving speed	109	109	109
	Tactile guidance markers	109	109	109
	Separation between traffic	109	109	109
	Traffic signs and markings	109	109	109

Correlations

		Traffic signs and markings
	Separation between traffic	,000
	Traffic signs and markings	.
N	Safety	109
	Age	109
	Gender	109
	Scale of Municipality	109
	Street width	109
	Tile and pattern	109
	Landscape	109
	Driving speed	109
	Tactile guidance markers	109
	Separation between traffic	109
	Traffic signs and markings	109

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Traffic signs and markings, Gender, Driving speed, Scale of Municipality, Age, Landscape, Tactile guidance markers, Street width, Tile and pattern, Separation between traffic[b]	.	Enter

a. Dependent Variable: Safety

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,460[a]	,211	,131	1,778

a. Predictors: (Constant), Traffic signs and markings, Gender, Driving speed, Scale of Municipality, Age, Landscape, Tactile guidance markers, Street width, Tile and pattern, Separation between traffic

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	83,057	10	8,306	2,628	,007[b]
	Residual	309,677	98	3,160		
	Total	392,734	108			

a. Dependent Variable: Safety

b. Predictors: (Constant), Traffic signs and markings, Gender, Driving speed, Scale of Municipality, Age, Landscape, Tactile guidance markers, Street width, Tile and pattern, Separation between traffic

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	t
1	(Constant)	4,748	,928		5,116
	Age	,079	,175	,044	,452
	Gender	-,374	,382	-,096	-,978
	Scale of Municipality	-,239	,199	-,121	-1,200
	Street width	1,154	,427	,291	2,705
	Tile and pattern	-,183	,303	-,068	-,605
	Landscape	,047	,291	,019	,161
	Driving speed	-,508	,201	-,244	-2,526
	Tactile guidance markers	,048	,268	,019	,179
	Separation between traffic	-,178	,405	-,055	-,439
	Traffic signs and markings	,471	,316	,172	1,492

Coefficients[a]

Model		Sig.	95,0% Confidence Interval for B	
			Lower Bound	Upper Bound
1	(Constant)	,000	2,906	6,590
	Age	,653	-,269	,427
	Gender	,330	-1,132	,385
	Scale of Municipality	,233	-,634	,156
	Street width	,008	,308	2,001
	Tile and pattern	,546	-,784	,417
	Landscape	,872	-,531	,625
	Driving speed	,013	-,908	-,109
	Tactile guidance markers	,858	-,483	,579
	Separation between traffic	,662	-,982	,626
	Traffic signs and markings	,139	-,156	1,099

a. Dependent Variable: Safety

Regression Rijkstraatweg

Descriptive Statistics

	Mean	Std. Deviation	N
Safety	6,75	1,772	110
Age	,47	1,171	110
Gender	,67	,490	110
Scale of Municipality	1,55	,992	110
Street width	2,15	,522	110
Tile and pattern	1,75	,710	110
Landscape	1,66	,654	110
Driving speed	2,14	,760	110
Tactile guidance markers	1,31	,660	110
Separation between traffic	1,41	,610	110
Traffic signs and markings	1,34	,595	110

Correlations

		Safety	Age	Gender	Scale of Municipality
Pearson Correlation	Safety	1,000	-,072	-,093	-,043
	Age	-,072	1,000	-,239	,013
	Gender	-,093	-,239	1,000	-,290
	Scale of Municipality	-,043	,013	-,290	1,000
	Street width	-,070	-,023	,008	-,031
	Tile and pattern	,096	-,019	-,057	,056
	Landscape	,221	,030	-,089	,059
	Driving speed	-,132	,205	,145	-,027
	Tactile guidance markers	,152	,082	-,081	,062
	Separation between traffic	,204	-,158	-,039	,158
	Traffic signs and markings	,114	-,151	-,154	,153
Sig. (1-tailed)	Safety	.	,228	,166	,327
	Age	,228	.	,006	,447
	Gender	,166	,006	.	,001
	Scale of Municipality	,327	,447	,001	.
	Street width	,233	,404	,465	,375
	Tile and pattern	,160	,420	,277	,282
	Landscape	,010	,378	,178	,270
	Driving speed	,085	,016	,065	,392
	Tactile guidance markers	,057	,197	,199	,259

Correlations

		Street width	Tile and pattern	Landscape
Pearson Correlation	Safety	-,070	,096	,221
	Age	-,023	-,019	,030
	Gender	,008	-,057	-,089
	Scale of Municipality	-,031	,056	,059
	Street width	1,000	,398	,279
	Tile and pattern	,398	1,000	,546
	Landscape	,279	,546	1,000
	Driving speed	,111	,116	-,018
	Tactile guidance markers	,108	,228	,392
	Separation between traffic	,071	,158	,394
	Traffic signs and markings	,077	,357	,317
Sig. (1-tailed)	Safety	,233	,160	,010
	Age	,404	,420	,378
	Gender	,465	,277	,178
	Scale of Municipality	,375	,282	,270
	Street width	.	,000	,002
	Tile and pattern	,000	.	,000
	Landscape	,002	,000	.
	Driving speed	,123	,114	,427
	Tactile guidance markers	,131	,008	,000

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
Pearson Correlation	Safety	-,132	,152	,204
	Age	,205	,082	-,158
	Gender	,145	-,081	-,039
	Scale of Municipality	-,027	,062	,158
	Street width	,111	,108	,071
	Tile and pattern	,116	,228	,158
	Landscape	-,018	,392	,394
	Driving speed	1,000	,098	,116
	Tactile guidance markers	,098	1,000	,526
	Separation between traffic	,116	,526	1,000
	Traffic signs and markings	,101	,551	,502
Sig. (1-tailed)	Safety	,085	,057	,016
	Age	,016	,197	,050
	Gender	,065	,199	,343
	Scale of Municipality	,392	,259	,049
	Street width	,123	,131	,231
	Tile and pattern	,114	,008	,050
	Landscape	,427	,000	,000
	Driving speed	.	,154	,114
	Tactile guidance markers	,154	.	,000

Correlations

		Traffic signs and markings
Pearson Correlation	Safety	,114
	Age	-,151
	Gender	-,154
	Scale of Municipality	,153
	Street width	,077
	Tile and pattern	,357
	Landscape	,317
	Driving speed	,101
	Tactile guidance markers	,551
	Separation between traffic	,502
	Traffic signs and markings	1,000
Sig. (1-tailed)	Safety	,118
	Age	,057
	Gender	,054
	Scale of Municipality	,056
	Street width	,211
	Tile and pattern	,000
	Landscape	,000
	Driving speed	,148
	Tactile guidance markers	,000

Correlations

		Safety	Age	Gender	Scale of Municipality
	Separation between traffic	,016	,050	,343	,049
	Traffic signs and markings	,118	,057	,054	,056
N	Safety	110	110	110	110
	Age	110	110	110	110
	Gender	110	110	110	110
	Scale of Municipality	110	110	110	110
	Street width	110	110	110	110
	Tile and pattern	110	110	110	110
	Landscape	110	110	110	110
	Driving speed	110	110	110	110
	Tactile guidance markers	110	110	110	110
	Separation between traffic	110	110	110	110
	Traffic signs and markings	110	110	110	110

Correlations

		Street width	Tile and pattern	Landscape
	Separation between traffic	,231	,050	,000
	Traffic signs and markings	,211	,000	,000
N	Safety	110	110	110
	Age	110	110	110
	Gender	110	110	110
	Scale of Municipality	110	110	110
	Street width	110	110	110
	Tile and pattern	110	110	110
	Landscape	110	110	110
	Driving speed	110	110	110
	Tactile guidance markers	110	110	110
	Separation between traffic	110	110	110
	Traffic signs and markings	110	110	110

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
	Separation between traffic	,114	,000	.
	Traffic signs and markings	,148	,000	,000
N	Safety	110	110	110
	Age	110	110	110
	Gender	110	110	110
	Scale of Municipality	110	110	110
	Street width	110	110	110
	Tile and pattern	110	110	110
	Landscape	110	110	110
	Driving speed	110	110	110
	Tactile guidance markers	110	110	110
	Separation between traffic	110	110	110
	Traffic signs and markings	110	110	110

Correlations

		Traffic signs and markings
	Separation between traffic	,000
	Traffic signs and markings	.
N	Safety	110
	Age	110
	Gender	110
	Scale of Municipality	110
	Street width	110
	Tile and pattern	110
	Landscape	110
	Driving speed	110
	Tactile guidance markers	110
	Separation between traffic	110
	Traffic signs and markings	110

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Traffic signs and markings, Street width, Driving speed, Scale of Municipality, Age, Landscape, Gender, Separation between traffic, Tile and pattern, Tactile guidance markers[b]	.	Enter

a. Dependent Variable: Safety

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,345[a]	,119	,030	1,745

a. Predictors: (Constant), Traffic signs and markings, Street width, Driving speed, Scale of Municipality, Age, Landscape, Gender, Separation between traffic, Tile and pattern, Tactile guidance markers

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40,813	10	4,081	1,340	,220[b]
	Residual	301,559	99	3,046		
	Total	342,373	109			

a. Dependent Variable: Safety

b. Predictors: (Constant), Traffic signs and markings, Street width, Driving speed, Scale of Municipality, Age, Landscape, Gender, Separation between traffic, Tile and pattern, Tactile guidance markers

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	t
1	(Constant)	7,368	,977		7,545
	Age	-,101	,164	-,067	-,618
	Gender	-,378	,384	-,105	-,985
	Scale of Municipality	-,201	,179	-,113	-1,125
	Street width	-,485	,355	-,143	-1,369
	Tile and pattern	,147	,314	,059	,469
	Landscape	,436	,343	,161	1,271
	Driving speed	-,261	,240	-,112	-1,084
	Tactile guidance markers	,140	,341	,052	,410
	Separation between traffic	,454	,365	,156	1,245
	Traffic signs and markings	-,155	,386	-,052	-,402

Coefficients[a]

Model		Sig.	95,0% Confidence Interval for B	
			Lower Bound	Upper Bound
1	(Constant)	,000	5,430	9,306
	Age	,538	-,427	,224
	Gender	,327	-1,139	,383
	Scale of Municipality	,263	-,557	,154
	Street width	,174	-1,189	,218
	Tile and pattern	,640	-,476	,770
	Landscape	,207	-,245	1,117
	Driving speed	,281	-,738	,216
	Tactile guidance markers	,683	-,537	,817
	Separation between traffic	,216	-,270	1,178
	Traffic signs and markings	,689	-,922	,611

a. Dependent Variable: Safety

Regression Reguliersbreestraat

Descriptive Statistics

	Mean	Std. Deviation	N
Safety	4,37	2,045	111
Age	,42	1,083	111
Gender	,68	,489	111
Scale of Municipality	1,51	,962	111
Street width	1,27	,485	111
Tile and pattern	1,54	,711	111
Landscape	1,39	,765	111
Driving speed	2,28	,800	111
Tactile guidance markers	1,22	,609	111
Separation between traffic	1,25	,495	111
Traffic signs and markings	1,16	,548	111

Correlations

		Safety	Age	Gender	Scale of Municipality
Pearson Correlation	Safety	1,000	,097	-,034	,046
	Age	,097	1,000	-,202	-,080
	Gender	-,034	-,202	1,000	-,261
	Scale of Municipality	,046	-,080	-,261	1,000
	Street width	,540	-,133	-,087	-,086
	Tile and pattern	,068	-,253	,012	-,024
	Landscape	,204	-,167	,144	,048
	Driving speed	-,103	,051	,024	-,058
	Tactile guidance markers	,198	-,071	,115	,073
	Separation between traffic	,347	-,167	,116	,012
	Traffic signs and markings	,230	-,163	,096	,082
Sig. (1-tailed)	Safety	.	,156	,363	,316
	Age	,156	.	,017	,203
	Gender	,363	,017	.	,003
	Scale of Municipality	,316	,203	,003	.
	Street width	,000	,082	,182	,185
	Tile and pattern	,240	,004	,450	,401
	Landscape	,016	,040	,065	,307
	Driving speed	,142	,297	,399	,272
	Tactile guidance markers	,019	,229	,114	,225

Correlations

		Street width	Tile and pattern	Landscape
Pearson Correlation	Safety	,540	,068	,204
	Age	-,133	-,253	-,167
	Gender	-,087	,012	,144
	Scale of Municipality	-,086	-,024	,048
	Street width	1,000	,179	,083
	Tile and pattern	,179	1,000	,414
	Landscape	,083	,414	1,000
	Driving speed	-,056	,020	,059
	Tactile guidance markers	,293	,316	,228
	Separation between traffic	,433	,152	,052
	Traffic signs and markings	,312	,379	,326
Sig. (1-tailed)	Safety	,000	,240	,016
	Age	,082	,004	,040
	Gender	,182	,450	,065
	Scale of Municipality	,185	,401	,307
	Street width	.	,030	,194
	Tile and pattern	,030	.	,000
	Landscape	,194	,000	.
	Driving speed	,281	,418	,268
	Tactile guidance markers	,001	,000	,008

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
Pearson Correlation	Safety	-,103	,198	,347
	Age	,051	-,071	-,167
	Gender	,024	,115	,116
	Scale of Municipality	-,058	,073	,012
	Street width	-,056	,293	,433
	Tile and pattern	,020	,316	,152
	Landscape	,059	,228	,052
	Driving speed	1,000	-,050	-,065
	Tactile guidance markers	-,050	1,000	,330
	Separation between traffic	-,065	,330	1,000
	Traffic signs and markings	-,042	,683	,283
Sig. (1-tailed)	Safety	,142	,019	,000
	Age	,297	,229	,040
	Gender	,399	,114	,113
	Scale of Municipality	,272	,225	,451
	Street width	,281	,001	,000
	Tile and pattern	,418	,000	,056
	Landscape	,268	,008	,295
	Driving speed	.	,300	,250
	Tactile guidance markers	,300	.	,000

Correlations

		Traffic signs and markings
Pearson Correlation	Safety	,230
	Age	-,163
	Gender	,096
	Scale of Municipality	,082
	Street width	,312
	Tile and pattern	,379
	Landscape	,326
	Driving speed	-,042
	Tactile guidance markers	,683
	Separation between traffic	,283
	Traffic signs and markings	1,000
Sig. (1-tailed)	Safety	,008
	Age	,044
	Gender	,158
	Scale of Municipality	,196
	Street width	,000
	Tile and pattern	,000
	Landscape	,000
	Driving speed	,331
	Tactile guidance markers	,000

Correlations

		Safety	Age	Gender	Scale of Municipality
	Separation between traffic	,000	,040	,113	,451
	Traffic signs and markings	,008	,044	,158	,196
N	Safety	111	111	111	111
	Age	111	111	111	111
	Gender	111	111	111	111
	Scale of Municipality	111	111	111	111
	Street width	111	111	111	111
	Tile and pattern	111	111	111	111
	Landscape	111	111	111	111
	Driving speed	111	111	111	111
	Tactile guidance markers	111	111	111	111
	Separation between traffic	111	111	111	111
	Traffic signs and markings	111	111	111	111

Correlations

		Street width	Tile and pattern	Landscape
	Separation between traffic	,000	,056	,295
	Traffic signs and markings	,000	,000	,000
N	Safety	111	111	111
	Age	111	111	111
	Gender	111	111	111
	Scale of Municipality	111	111	111
	Street width	111	111	111
	Tile and pattern	111	111	111
	Landscape	111	111	111
	Driving speed	111	111	111
	Tactile guidance markers	111	111	111
	Separation between traffic	111	111	111
	Traffic signs and markings	111	111	111

Correlations

		Driving speed	Tactile guidance markers	Separation between traffic
	Separation between traffic	,250	,000	.
	Traffic signs and markings	,331	,000	,001
N	Safety	111	111	111
	Age	111	111	111
	Gender	111	111	111
	Scale of Municipality	111	111	111
	Street width	111	111	111
	Tile and pattern	111	111	111
	Landscape	111	111	111
	Driving speed	111	111	111
	Tactile guidance markers	111	111	111
	Separation between traffic	111	111	111
	Traffic signs and markings	111	111	111

Correlations

		Traffic signs and markings
	Separation between traffic	,001
	Traffic signs and markings	.
N	Safety	111
	Age	111
	Gender	111
	Scale of Municipality	111
	Street width	111
	Tile and pattern	111
	Landscape	111
	Driving speed	111
	Tactile guidance markers	111
	Separation between traffic	111
	Traffic signs and markings	111

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Traffic signs and markings, Driving speed, Scale of Municipality, Age, Separation between traffic, Landscape, Gender, Street width, Tile and pattern, Tactile guidance markers[b]	.	Enter

a. Dependent Variable: Safety

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,634[a]	,402	,342	1,658

a. Predictors: (Constant), Traffic signs and markings, Driving speed, Scale of Municipality, Age, Separation between traffic, Landscape, Gender, Street width, Tile and pattern, Tactile guidance ...

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	184,922	10	18,492	6,726	,000[b]
	Residual	274,934	100	2,749		
	Total	459,856	110			

a. Dependent Variable: Safety

b. Predictors: (Constant), Traffic signs and markings, Driving speed, Scale of Municipality, Age, Separation between traffic, Landscape, Gender, Street width, Tile and pattern, Tactile guidance ...

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t
		B	Std. Error	Beta	
1	(Constant)	,255	,908		,281
	Age	,439	,159	,233	2,760
	Gender	,162	,364	,039	,445
	Scale of Municipality	,212	,178	,100	1,190
	Street width	2,133	,385	,506	5,534
	Tile and pattern	-,210	,265	-,073	-,794
	Landscape	,577	,236	,216	2,443
	Driving speed	-,213	,200	-,083	-1,068
	Tactile guidance markers	-,209	,368	-,062	-,568
	Separation between traffic	,673	,372	,163	1,809
	Traffic signs and markings	,179	,419	,048	,428

Coefficients[a]

Model		Sig.	95,0% Confidence Interval for B	
			Lower Bound	Upper Bound
1	(Constant)	,779	-1,547	2,057
	Age	,007	,123	,755
	Gender	,657	-,560	,884
	Scale of Municipality	,237	-,141	,565
	Street width	,000	1,368	2,898
	Tile and pattern	,429	-,735	,315
	Landscape	,016	,109	1,046
	Driving speed	,288	-,609	,183
	Tactile guidance markers	,571	-,940	,521
	Separation between traffic	,073	-,065	1,411
	Traffic signs and markings	,670	-,652	1,011

a. Dependent Variable: Safety