The Role of Pedestrian Safety in the Municipal Traffic Safety Planning

When Maintenance Becomes Safety

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Abstract:

This thesis is an investigation of to which extent 18 of the biggest municipalities in Denmark focus on pedestrians in their traffic safety planning, both in terms of pedestrian accidents in general and solo accidents. This is primarily investigated through the study of the 18 municipalities' traffic safety plans, as well as possible pedestrian strategies. However, interviews have likewise been used, since this method makes it possible to ask clarifying questions and acquire knowledge that might not have been possible to get by reading. The definition of a traffic accident does not include solo accidents with pedestrians, why these are not currently included in the official statistics, which the municipalities base their traffic safety plans on. For this reason, there is not much focus on solo accidents with pedestrians, and to a low extent on other pedestrian accidents. It has become clear that pedestrian safety, when talking about solo accidents, to a great extent is a matter of the daily maintenance, therefore we recommend e.g. to include the maintenance department more in the traffic safety plans.

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Preface

The present thesis has been composed by Sara Jensen and Camilla Nielsen, students on MSc04 2021 in the program of *Mobilities and Urban Studies* at Aalborg University, Denmark.

In the present paper, the focus is on the municipal traffic safety planning, with special focus on the inclusion of pedestrians and solo accidents with pedestrians. The aim with this thesis is to reflect on our knowledge and skills provided during our bachelor in Geography as well as our master's degree. Furthermore, the thesis will also illustrate our interest in traffic safety and pedestrians, as well as our wonder over the seemingly missing connection between the two. With this thesis we therefore hope to generate more attention to pedestrian safety and especially solo accidents with pedestrians.

Acknowledgements
We would like to thank our supervisor Harry Lahrmann for the helpful introduction into the interesting world of traffic safety. Your help and advice during the project period has been very appreciated. Furthermore, your constructive criticism and reflections were helpful in the creation of this thesis.

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Likewise we wish to thank the respondents for their time and answers in the interviews both by phone, email and meetings on Microsoft Teams. Your helpfulness is greatly appreciated, and without you, this thesis would not have been the same.

Lastly, we would like to thank our fellow students for interesting and professional discussions regarding mobilities throughout our education.

Reading Guide
Throughout this thesis, the Harvard method has been used as a way of managing the sources. This means that they are referred to as (Surname, Year: Page) in the text.

If the date of publication is unknown, or the source has yet to be published, it will be noted respectively as (*n.d.*), which is an abbreviation of no date, and (*forthcoming*). Furthermore, if the author is unknown, it will be noted (*Anon.*). In the bibliography, the full source of these references can be found. Here the books have been specified by author(s), year, title, edition and publisher. Web pages have been specified by author(s), year, title, URL and date of the last visit, which is noted month/day/year.

In the thesis there will be several figures. To better refer to these, they will be named after the chapter. Hence, the first figure in chapter 3 will be called 3.1, the second will be 3.2 and so forth. This is also the case with the tables. Furthermore, commas (,) are used to divide numbers. This means that commas represent thousands while periods (.) represent decimals.

Camilla Lønne Nielsen

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List of Figures

List of Tables

Contents

Scoping Review and Research Question 1

The present chapter will introduce the topic of this thesis, including the objective for the study. Lastly, a paper overview will be given, which presents the different chapters within the thesis in order to create an overview of the content of the study.

1.1 Scoping Review

> *"Mobility has become an evocative keyword for the twenty-first century and a powerful discourse that creates its own effects and contexts. The concept of mobilities encompasses both the large-scale movements of people, objects, capital and information across the world, as well as the more local processes of daily transportation, movement through public space and the travel of material things within everyday life."*
>
> (Hannam et al., 2006: 1)

As the quote states, mobility is part of every day life in different aspects, from information sharing technologies, to food deliveries across continents and people performing every day activities. Therefore, mobility and transport are a big part of everybody's life, but it is only noticed when friction happens and problems arise. Since mobility is a huge part of everybody's life, it is important that the safety is sufficient, so that people's mobility and safety are not limited.

Traffic Safety

Every year the Danish Road Directorate publishes a report concerning the situation of the previous year's traffic accidents divided between the 12 police districts in Denmark (Vejdirektoratet, 2020a). These statistics are based on what is reported to the police, and thereby the police's registrations of the accidents[1]. Therefore, accidents which are not reported to the police are not included in the statistics, which creates some uncertainty towards these statistics. These unreported accidents are defined as *unreported numbers* (Lahrmann et al., 2020).

In a Danish study investigating how to cover the unreported numbers, Møller et al. argue that the unreported numbers *"have been rising in the past years"* (Møller

[1] To read more about how the police make the registrations, see (Vejdirektoratet, 2017).

et al., 2019: 9. Own Translation). According to Møller et al. it is important to reveal the unreported numbers, since they distort the real picture and result in a number of problems:

- The distortion in the statistical data means that the focus of the road administration might be in the wrong place.
- The high amount of unreported numbers for especially vulnerable road users, results in them being overlooked in traffic safety work compared to car accident prevention. This is especially true in the case of solo accidents with pedestrians, where the exact number is unknown.
- The unreported numbers are affecting political decisions and prioritisation in the traffic safety area.
    - It is a problem that all the initiatives regarding traffic safety are based on police registrations, because the high amount of unreported numbers might make it seem like the reduction in traffic accidents is greater than if compared with the numbers in the National Patient Register.

(Møller et al., 2019: 9-10)

Since 1985, the Danish Road Directorate has made statistical analyses of traffic accidents (Vejdirektoratet, 2020b). Yet, the Accident Analysis Group was the first to register injuries in collaboration with Odense Hospital (now Odense University Hospital) in 1971. The purpose of this was to get detailed registrations of traffic accidents[2] (Laursen and Møller, 2011). The Danish Road Safety Commission has since 1988 advocated for the municipalities to start using injury registrations from the emergency rooms:

> *"The initiative to begin this registration and utilize its possibilities is with the owners of the hospitals, in other words the counties and the individual municipalities. The commission recommends that this registration should be carried out as part of the local traffic safety work."*
>
> (Færdselssikkerhedskommissionen, 1988: 81. Own translation)

Today the Danish Road Safety Commission recommends implementing a national data collection technique, which includes both police reported accidents, as well as information from the emergency rooms and the National Patient Register. This change is to some extent self-contradictory, since the Danish Road Safety Commission does not include solo accidents with pedestrians in their plan of action (Færdselssikkerhedskommissionen, 2020a,b).

[2] To read more about how the registration of traffic accidents started, see (Laursen and Møller, 2011) for a short description.

According to Sørensen (2006) it is estimated that the contribution ratio for reported traffic accidents is 100 % for accidents involving casualties, whereas it is 60-90 % for accidents with severe injuries and only 12 % for minor injuries (Sørensen, 2006: 34). This means that the bigger the severity of the accident, the higher the probability is that the accident will be registered, and thereby be a part of the official statistics. Meaning that accidents that only involve vulnerable road users are often excluded in the official accident statistics. This might be because they are able to get the help they need without involving the police, and they might seek their own doctor, or perhaps their injuries do not require further medical assistance. In such cases where the police is not contacted means that these accidents do not become part of the official statistics, but instead they become part of the unreported numbers. These numbers are estimated by *"comparing the official traffic accident statistics with numbers from the National Patient Register, which encompasses all who have been treated in the national emergency rooms and hospitals after a traffic accident"* (Møller et al., 2019: 9. Own Translation).

Another example of under-representation in the official statistics is solo accidents with pedestrians, since pedestrians are only part of the statistics, if the accidents involve at least one motorised vehicle or a bike. The Danish Road Directorate (2021) states that before an accident can be defined as a traffic accident, the following circumstances must be met:

- The accident occurred on a road, square or area, which is used for regular traffic by one or more types of traffic.
- At least one of the involved traffic users was driving.

(Vejdirektoratet, 2021: Own translation)

This agrees with the European Union's definition of traffic accidents: *"Any accident involving at least one road vehicle in motion on a public road or private road to which the public has right of access, resulting in at least one injured or killed person"* (European Union, 2010). In practice this means that solo accidents with pedestrians, e.g. falling in public space, does not count as a traffic accident, since no vehicles are involved. In Denmark, solo accidents with pedestrians have not been part of the official definition since 1967 (Lahrmann et al., 2020: 8). In the Danish spelling dictionary, a pedestrian is defined as a *"walking person in traffic"* (Det Danske Sprog- og Litteraturselskab, n.d.: Own translation), and yet pedestrian falls are not included in the definition of a traffic accident. Therefore, one might wonder why solo accidents with pedestrians are left out of the official traffic accident statistics, when walking is defined as taking part in traffic.

The exclusion of pedestrian falls in the official statistics is according to Lahrmann et al. (2020) problematic. Furthermore, they argue that there is an underexposed traffic safety issue that the traffic board directors and other authorities may not be aware of or pay much attention to:

> *"Since fall accidents with pedestrians in public are not defined as traffic accidents, it would be better for a traffic board direction to build a round-about, which will prevent car accidents instead of fixing or preventing uneven and slippery sidewalks."*
>
> (Lahrmann et al., 2020: 8. Own translation)

This mindset regarding solo accidents among pedestrians as a part of the official traffic accident statistics is shared by Methorst et al. (2017), who argue that pedestrian falls should be added to the definition of traffic accidents. They further argue, that it is a necessity in order to improve the public health policies, because *"the exclusion of PFs [pedestrian falls] from transport research is likely to lead to biased conclusions about the link between road safety and the design of our road transport system"* (Methorst et al., 2017: 11). This complies with the earlier mentioned problems, which Møller et al. (2019) mention in their study concerning unreported numbers.

The International Transport Forum (2012) also argues that walking is a neglected mode of transportation, which is seldom included in government statistics, and therefore it is overlooked in the planning process. This is in spite of walking being a part of all trips, and the fact that almost everyone is a pedestrian at some point during the day (International Transport Forum, 2012; Methorst, 2021).

In a Danish study, it was investigated how data from self-registration can provide better data concerning traffic accidents (Lahrmann et al., 2020). In the study they found out that self-registration can provide a better picture of the real situation of accidents in Denmark and thereby cover some of the unreported numbers. Furthermore, they estimated that almost 85,000 accidents are unreported in the official statistics, and that 20,000 of these accidents involve pedestrians falls on a public road:

> *"This is clearly an underexposed traffic safety issue in Denmark, which the road administrations and other authorities should address in their preventive work, just as a clear recommendation must be to include these accidents in the official definition of a traffic accident."*
>
> (ibid.: 12. Own translation)

When planning the Danish road network, it is the respective road administrations that are responsible for the traffic safety on the different roads. This means that e.g.

the municipalities administrate the municipal roads, and the Danish Road Directorate administrates the national roads. Therefore, the municipality administrates the majority of the Danish roads, where multiple road users move compared to the national roads. This is due to the fact that the national roads primarily cover motorways and expressways, where bikes and pedestrians are not allowed (Danmarks Statistik, n.d.[c]; Dansk Vejforening, 2017; Trafik-, Bygge- og Boligstyrelsen, n.d.).

The Aging Population

Traffic accidents are never a pleasant experience and can result in long-term injuries, and this is especially true for the elderly. Elderly mostly move by foot, and being a vulnerable road user the risk rises (Health in Aging Foundation, 2021; Oxley et al., 2018).

Despite the neglect of studies of pedestrian falls in public, there already exist several studies regarding falls in general, as well as the prevention hereof (Kelsey et al., 2010; Li et al., 2006; Schepers et al., 2017; WHO, 2007). A study shows that falls occur more often outdoor than indoor across most age groups (Li et al., 2006). Furthermore, some studies do not distinguish between falls that happen outside in public or outside in e.g. a garden. Additionally, some studies do not distinguish between indoor and outdoor falls. This is problematic since *"failure to separate indoor and outdoor falls can make it difficult to assess the magnitudes of associations between various risk factors and falls; in fact, associations may be completely missed when all falls are combined"* (Kelsey et al., 2010: 2135). Moreover, studies show that people who are physically active have a higher risk at falling outdoors (Kelsey et al., 2010; Li et al., 2006). According to Li et al. (2006), 73 % of the outdoor falls were caused by environmental factors, which includes uneven surfaces, slipping on objects, or tripping. Additionally, most of these falls occurred on curbs, sidewalks and streets (Li et al., 2006).

It is noteworthy that pedestrian falls are neglected to such extent, when falling while walking is a serious health problem (Oxley et al., 2018; Schepers et al., 2017; WHO, 2018). Globally, WHO (2018) estimates that 646,000 people die from falls each year, making falls the second most common cause for unintentional or accidental deaths worldwide. Whereas a study from 2017 shows that *"in the Netherlands more elderly people are fatally injured from a pedestrian fall in public space than from pedestrian-vehicle collisions"* (Methorst et al., 2017: 11). Falling can induce anxiety for it happening again, especially among elderly. This could prevent them from participating in physical exercise and enjoying the health benefits which walking provides, both physically and mentally (Feypell et al., n.d.; Methorst et al., 2017; Schepers et al., 2017).

> *"Our ageing population means that without the introduction of new public health and road safety policies severe injuries from PFs [pedestrian falls] are likely to increase."*
>
> (Methorst et al., 2017: 12)

Due to the aging population, this problem will only increase in the future, since *"falls exponentially increase with age-related biological change"* (WHO, 2007: 3). This means that as the population ages, the number of severe and fatal injuries following a fall will increase.

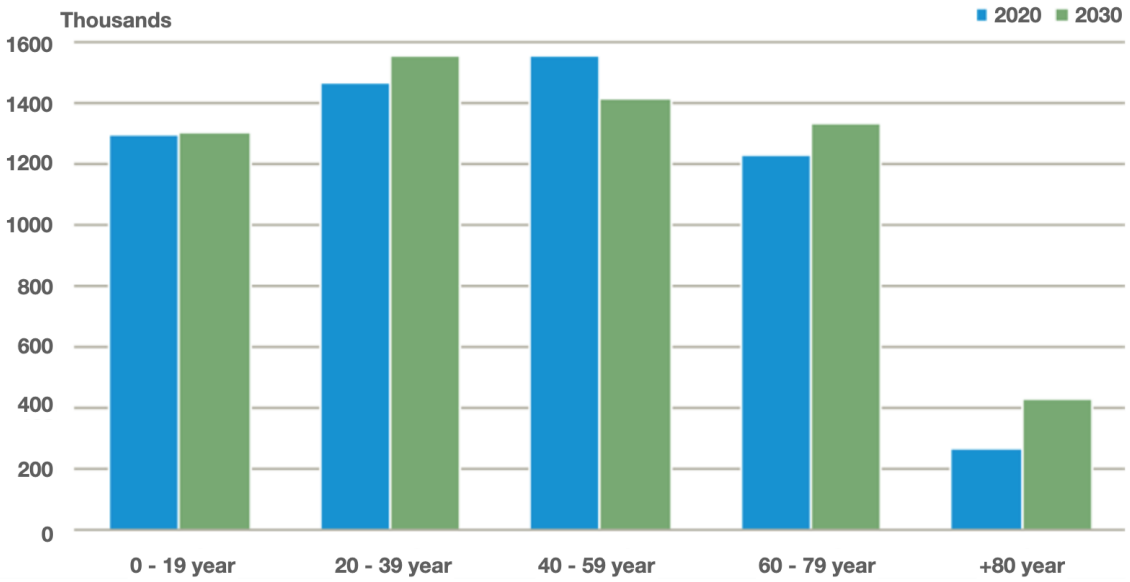

Figure 1.1 Projection of the Danish population 2020-2030 (Danmarks Statistik, n.d.[a]: 5. Own translation).

As illustrated on fig. 1.1 the population in Denmark above 60 years will increase within the next 10 years. The age group 60-70 years suggests an increase of around 100,000 people, while it will be an increase of nearly 200,000 people for the age group +80 years. With increasing age, there is a higher risk of serious injuries when falling, which will put stress on e.g. health care services (Methorst et al., 2017; Oxley et al., 2018). With an increase of elderly people and, according to Methorst (2021), an increasing number of vehicles in traffic, the vulnerable road users will be at higher risk (Methorst, 2021).

Benefits of Walking

Despite the risk that especially elderly people face when walking, there are still numerous advantages:

- Walking provides exercise, which reduces the risk of different diseases both physically and mentally (Arthritis Foundation, n.d.; Kingham and Ussher,

2007; Methorst, 2021; Methorst et al., 2017).

- Walking is a sustainable mode of transportation (Københavns Kommune, 2012a; Methorst, 2021).
- Walking does not require any formal education or training (State of Victoria, 2020).
- Walking instead of driving a car decreases congestion and carbon emissions (Bendtsen, 1994; Methorst, 2021).
- Walking does not require any special equipment (State of Victoria, 2020).
- Pedestrians add to an attractive environment (Anon., 2019; Methorst, 2021).
- Walking offers accessibility, because it is cheap, easy and flexible (Københavns Kommune, 2012a, 2019; Methorst, 2021).

These, however, are just some of the advantages of walking[3]. Walking is also a relatively safe mode of transport, since pedestrians in general pose the least danger toward other road users, yet the pedestrians are still at risk as vulnerable road users (Methorst, 2021). Furthermore, Laursen (1994) argues that some pedestrians are badly trained as road users. Especially children and elderly can have problems following the traffic rules and the rhythm of the traffic (Laursen, 1994). This might be due to the fact, that there is no formal training for pedestrians as known for e.g. car drivers. Methorst (2021) furthermore argues that, *"when a pedestrian walks in public space, s/he functions within the transport system, which can be seen as part of a greater spatial system, and as part of a social, normative and cultural system"* (Methorst, 2021: 83).

The Municipality of Copenhagen agrees with Methorst (2021) in pedestrians being more than just people walking from A to B:

> *"To walk is easy, healthy and free and if we move by foot through the city, our bodies are directly connected to the physical environment, and bodily contact provides both knowledge, attachment and ownership."*
>
> (Københavns Kommune, 2019: 18: Own translation)

According to Mulley et al. (2017), there is a connection between physical exercise, morbidity, and mortality. Therefore, public health researchers have investigated the built environment, and how this can improve and enhance health by promoting physical activity.

Not only do researchers take an interest in how walking can contribute to a more livable city. The Danish municipalities of Copenhagen's and Aarhus have created pedestrian strategies, in which they set some visions for how they can make their

[3] For a more comprehensive list of advantages see e.g. (Methorst, 2021).

inhabitants walk more as part of making the cities more livable and sustainable (Aarhus Kommune, 2020; Københavns Kommune, 2012a).

This corresponds with the mobility pyramid designed by JAJA Architects, which, as known from the food pyramid, it is recommended to use more from the bottom than from the top. Figure 1.2 therefore illustrates which transport mode one should use the most and the least. And since walking does not emit any pollutants, it is beneficial for the environment, and it provides less pollution than e.g. driving a car.

Furthermore, Copenhagen's Municipality has estimated that *"society earns 7,62 DKK every time 1 km has been walked in Copenhagen. The profit is primarily due to saved health expenses"* (Københavns Kommune, 2019: 21. Own translation). By comparison, it costs society 5,28 DKK for every kilometer driven by a car in Copenhagen (ibid.: 21). For this reason it would be better from a financial point of view for the municipalities to focus on planning more for the pedestrians than for the car users.

Figure 1.2 Mobility pyramid (Brömmelstroet, 2021: Designed by JAJA Architects).

Challenges in Planning

According to Laursen (1994) road technicians are often 'strangers' towards pedestrians and planning for pedestrians. This is because the pedestrians are considered difficult to control due to *"their mobility 'in the small scale', their resistance towards being forced to take boring detours, and their interest for shops, views, common living and many other things, which not solely concern moving from A to B"* (Laursen, 1994: 436. Own translation). Among other things this means that pedestrians often choose not to use tunnels and bridges, because they seek the shortest route and not necessarily the safest route (Havarikommissionen, 2013). Laursens (1994) reservation is recognized by Vestergaard et al. (2014), who further argue that:

> *"The study of walking should not be reduced merely to the 'hardware' of mobility such as the urban environment, and infrastructure. Walking has indeed also a 'software dimension' as an embodied performance that*

> *trigger [sic] the human senses and which is closely related to the habitus and identity of the individual."*
>
> (Vestergaard et al., 2014: 41)

The 'hardware' of mobility is linked to the term 'walkability', which focuses on the physical structures in the urban environment, and whether these encourage or discourage walking (ibid.). But, as Vestergaard et al. (2014) argue, the 'software dimension' of mobility should also be included. Walking is not merely about transporting one-self through the urban environment, it is also about experiencing and sensing it.

This line of thought concerning transportation being more than moving from A to B corresponds with the thoughts regarding the mobilities turn, where the *"travel is not just a question of getting to the destination"* (Hannam et al., 2006: 13). Furthermore, Hannam et al. (2006) argue that *"time spent traveling is not dead time that people always seek to minimize"*(ibid.: 12), which makes planning problematic for the technicians in relation to incorporating mobility which includes e.g. window shopping, confer (Laursen, 1994).

It is not only in planning that pedestrians are overlooked. Pedestrian solo accidents are also neglected because *"there has been relatively little research undertaken to address the issues surrounding falls that occur while walking for transport and in public spaces"* (Oxley et al., 2018: 77). According to Schepers et al. (2017) most research regarding pedestrian injuries has been made in connection to collisions, confer the definition of traffic accidents in the European Union. Therefore, the exclusion of pedestrian falls in the definition of a traffic accident may ultimately result in their exclusion from official statistics.

1.2 Research Question

It is noteworthy that solo accidents with pedestrians in 'the transport system' do not count in the official Danish statistics, when studies such as Møller et al. (2019) and Lahrmann et al. (2020) show that solo accidents with pedestrians is a problem in Denmark.

For this reason, this thesis aims to:

> *Investigate to which extent 18 of the biggest municipalities in Denmark focus on pedestrians in their traffic safety planning, both in terms of pedestrian accidents in general and solo accidents.*

In addition to this pedestrian strategies will be included, if the municipalities have one. This will be done in order to get a better understanding of the municipalities'

efforts towards pedestrian safety.

Therefore, this thesis will take its starting point in traffic planning for solo accidents with pedestrians. For this reason, the scope does not include sociological factors such as whether the pedestrians are under the influence of alcohol or other psychedelic substances, or if the pedestrians are walking while looking at their phones.

1.3 Outline of the Thesis

The purpose of the current section is to provide a short description of the content of the different chapters, and thereby provide the reader with an overview of the paper.

Chapter 2 presents literature study and interview as the methods used throughout the thesis.

Chapter 3 reflects upon the hermeneutic theory of science, which this thesis takes as its starting point.

Chapter 4 introduces the theories which this thesis is based upon, these are the mobilities turn and sustainable mobility.

Chapter 5 examines the traffic safety plans from the 18 municipalities, and to which extent they include pedestrian safety. Furthermore, emergency room data and the municipalities' use and consideration hereof will be examined.

Chapter 6 covers the pedestrian strategies of Copenhagen's and Aarhus Municipalities. Furthermore, Odense Municipality is mentioned, since it plans on making a pedestrian strategy.

Chapter 7 concludes the findings. This is followed by a critical reflection of the methodology.

Chapter 8 presents suggestions for the municipal planners and maintenance workers, as well as the Danish Road Safety Commission for their future inclusion of solo accidents with pedestrians.

Chapter 9 introduces three proposals for further work within the field of solo accidents with pedestrians and traffic safety in general. These proposals investigate solo accidents from the pedestrian and a maintenance point of view, respectively, as well as the use of nudging to increase traffic safety.

Methodology 2

In this chapter the methods used throughout the thesis will be presented. These methods will, along with the theories presented later, frame the investigation of the role of pedestrians in traffic safety planning in the municipalities.

2.1 Literature study: Preliminary Analysis

A preliminary analysis was conducted through a literature study, where it was investigated, what kind of information there was already available concerning pedestrian safety and solo accidents, as well as general knowledge about traffic safety and traffic safety planning in Denmark. Therefore, the literature study started wider concerning searching for scientific papers about pedestrian accidents and falls. Afterwards the search was narrowed down to solo accidents with pedestrians outdoor exclusively, where both Danish and foreign papers were included. Since this thesis is set in a Danish context, it was chosen to only include Danish papers concerning pedestrian solo accidents with specific data of the extent of the unreported numbers of these types of accidents, and how traffic safety planning is structured in Denmark.

Additionally, the literature study was used to gather information regarding the benefits of walking in order to understand the importance of ensuring that walking is a safe activity for everybody. Furthermore, the problematics which the technicians encounter when planning the infrastructure, were briefly investigated in the literature study. This was done in order to get an understanding of the technical aspects of planning for pedestrians.

Finally, the literature study was used to get an understanding of who manages the traffic safety on the Danish road network.

2.2 Literature study: The Municipalities

A second literature study was performed in order to find out what the current traffic safety plans in the different municipalities consist of. Yet, not all the 98 municipalities in Denmark were selected due to a lack of time and resources. Therefore, the 20 biggest municipalities, based on the number of citizens, were chosen. Of these 20, there were two municipalities (Herning and Sønderborg), where it was not possible

to find a traffic safety plan, and therefore these were deselected. As far as possible, it was sought to find traffic safety plans valid in 2020 for the 18 municipalities, since many of the municipalities are currently working on a new one for 2021. If the municipalities did not have a valid traffic safety plan in 2020, the most recently valid plan was to be used. Furthermore, as it appears in table 2.1 on page 14, Gladsaxe Municipality has not had a valid traffic safety plan for years, and therefore their latest plan has been used in the literature study (Gladsaxe Kommune, n.d.).

Additionally, Respondent08 states that Silkeborg Municipality's plan was approved in 2017 and does not have an expiration date, but will be valid until the initiatives regarding the identified problematic locations in the plan have been addressed, and a new plan has been made (Respondent08, 2021).

Through the interview with Respondent10 from Horsens Municipality, it became apparent that the municipality does not have a traffic safety plan. The plan *Traffic 2030: Strategy for the Future Infrastructure in Horsens* is a plan for how the infrastructure in the city of Horsens is to develop towards 2030 to accommodate the growing city. However, this plan has been included in this project, since arguments can be made concerning how the plan indirectly promotes traffic safety solutions, since a sense of security in traffic is part of traffic safety work. In relation to the municipalities' work with traffic safety, they use a prioritization model, where different initiatives both from the citizens and planners are divided into three lists. From these three lists it is prioritizes which initiatives that will be put into practice in relation to the budget (Horsens Kommune, 2020).

The location of the 18 municipalities, which have been included in this project can be seen on fig. 2.1 on the next page. Furthermore, the number of citizens in the different municipalities, the name of their traffic safety plan and how long it is valid is listed in table 2.1 on page 14.

Figure 2.1 Map showing the locations of the 18 municipalities. Own production with data from Kortforsyningen (2021).

As the map illustrates, the municipalities are geographically scattered, and they vary in size regarding area. None of the municipalities in the western part of Jutland, except Esbjerg Municipality, are represented in the investigation. However, this it due to the fact that the municipalities, as mentioned earlier, are chosen based on the number of citizens in the municipalities.

Municipality	**Duration Period**	**Translated Title**	**Population**[4]
Copenhagen	2013 - 2020	Traffic Safety Plan 2013 - 2020	637,936
Aarhus	2013 - 2020	Traffic Safety Strategy 2013 - 2020	353,445
Aalborg	2020 - 2040	Mobility 2040	219,310
Odense	2015 - 2020	Strategy for Traffic Safety 2015 - 2020	205,881
Vejle	2018 - 2020	Traffic Safety Plan 2018 - 2020	116,665
Esbjerg	2015 - 2020	Traffic Safety Plan 2015 - 2020	115,498
Frederiksberg	2013 - 2020	Traffic Safety Plan 2013	104,351
Randers	2014 - 2020	Traffic Safety Plan 2014 - 2020	98,026
Viborg	2017 - unknown	Traffic Plan	96,539
Viborg city center[5]	2012 - unknown	Traffic Plan for Viborg City Center	–
Silkeborg	2017 - unspecified	Traffic Safety Plan 2017	94,892
Kolding	2013 - 2020	Traffic Safety Plan 2014 - 2025 for Kolding Municipality	93,092
Horsens	Unknown - 2030	Traffic 2030: Strategy for the Future Infrastructure in Horsens	91,764
Roskilde	2014 - 2020	Traffic Safety Plan 2014	88,758
Næstved	2019 - 2023	Traffic Plan 2019 - 2023	83,049
Slagelse	2016 - 2020	Traffic Safety Plan	79,106
Gentofte	2017 - 2020	Traffic Safety, Security and Accessibility in Gentofte Municipality: Traffic Safety Plan 2017 - 2020	74,623
Holbæk	2020 - 2025	Traffic Safety Plan 2020 - 2025	71,812
Gladsaxe	2011 - 2016[6]	Traffic and Mobility Plan	69,203

Table 2.1 The 18 biggest Municipalities in Denmark included in this thesis. Own production.

Of the 18 municipalities two, Copenhagen's and Aarhus, have developed a pedestrian strategy (Aarhus Kommune, 2020; Københavns Kommune, 2012a). Moreover, Odense Municipality wants to develop a pedestrian strategy as well (Odense Kommune, 2009b). The two pedestrian strategies are a part of the literature study regarding how the municipalities in Denmark plan for the pedestrians, in relation to safety. It should be noted that the strategy by Copenhagen's Municipality is not valid, but that it has been included, because it has not been possible to find one of a newer

[4] All numbers are from the first day of the last quarter of 2020 (Danmarks Statistik, n.d.[b]).
[5] Please note that Viborg Municipality has two traffic plans: One for the municipality and one for the city center of Viborg.
[6] Information provided by the respondent, but is subject to uncertainty (Respondent02, 2021b).

date. Furthermore, it has been assessed that this strategy depicts how Copenhagen's Municipality wants to prioritize pedestrians in their planning (Københavns Kommune, 2012b). Unfortunately, it has not been possible to complete an interview with the municipality to learn more about their traffic safety plan and pedestrian strategy.

The purpose with the literature study is to investigate the amount of focus on pedestrian safety in each individual municipality. The literature study forms the basis of the interviews with representatives from the different municipalities.

Through the literature study there has been a focus on different aspects in relation to both traffic safety as well as pedestrians. This has been noted in both an Excel document and a Word document, see appendix A on page 77 for the Excel document. The Word document was used, when the classifications in the Excel document were not sufficient, for example by the quotation of relevant text. Following this, the documents were used to make individual questions to the different municipalities in the search for identifying how the municipalities involve pedestrians in their traffic safety planning. This resulted in a different amount of questions to each municipality. For example it would not be relevant to ask Copenhagen's and Aarhus Municipalities about whether or not they promote the pedestrian culture, since they have already made pedestrian strategies, amplifying that they do.

Furthermore, in the Excel document there are columns for noting whether the municipalities focus on pedestrian accidents, solo accidents with pedestrians, cyclists accidents, car accidents and other focus areas. These were used to grade the municipalities' focus points on pedestrians, cyclists and cars. Therefore, this grading is based on an objective assessment of a subjective understanding, confer *Theories of Science* on page 18.

2.3 Interview

The purpose of the interviews was to cover gaps in the knowledge and the context in which the traffic safety plans were composed. Furthermore, the interviews were used to get a better understanding for which thoughts the different municipalities had regarding traffic safety concerning pedestrians, and especially solo accidents with pedestrians.

In order to set up an interview with the different municipalities, a search was made on the websites of the municipalities for an employee with knowledge concerning the traffic safety plan of the municipality. If it was not possible to find the contact information of a relevant employee, a call was made to the citizen service center, which could then divert the call to someone with the relevant knowledge. Based on this, there was made 12 appointments for interviews, see table 2.2 on page 17.

In order to create an overview of all the information gathered during the contact process, an Excel sheet, which was regularly updated with the current situation, was created, see appendix B on page 78 for the Excel document. Furthermore, the horizontal columns where colored according to the current status in order to create a quick overview of the progress. Green being an agreed appointment, yellow was when the municipality or a relevant employee were contacted, but had not answered. Lastly, red was when a municipality had declined to participate in an interview.

Some of the respondents wanted to receive the questions, which were based on the literature study, in advance of the interview, so that they might have the opportunity to prepare for the specific questions.

As already stated, not all municipalities participated in an interview. Two respondents from Viborg and Copenhagen declined, since they could not find the time in their schedule, even though the contact person from Viborg Municipality stated that she would have liked to have participated. Furthermore, there were four municipalities, where it was not possible to make an interview agreement, because they unfortunately never answered back. Which municipalities did or did not participate in an interview, can be seen on table 2.2 on the facing page.

Generally, the interviews were fairly short, and the longest took 27:50 minutes, and the shortest took 7:37 minutes. This is due to the fact that the questions were, as already mentioned, of a thorough nature in relation to the relevant municipality's plan/-s, and questions concerning their choices in the making of the relevant or coming plan. This means that the interviews were of a semi-structured nature. Furthermore, there were questions concerning the municipalities' considerations regarding the use of data from the emergency rooms, which is known from Aarhus and Odense Municipalities. Another reason why there is a 20 minute difference in the longest and the shortest interview, is due to the fact, that some respondents gave more elaborating answers than others.

Municipality	Interview Participation	Interview Platform
Copenhagen	Contacted via phone and followed by department mail, but no response. Then contacted via personal mail, and directed to a relevant department, but they did not have time for an interview	–
Aarhus	Interview completed	Online interview on Teams
Aalborg	Interview completed	Online interview on Teams
Odense	Contacted via phone and email, but the email was never answered	–
Vejle	Interview completed	Phone interview, but does not want to be cited
Esbjerg	Contacted by phone, gave our contact information, but they never called back	–
Frederiksberg	Contacted by phone, would find a respondent, but never reported back	–
Randers	Interview completed	Online interview on Teams
Viborg	Could not find time in the schedule for an interview	–
Silkeborg	Interview completed	Online interview on Teams
Kolding	Did not answer the phone	–
Horsens	Interview completed	Online interview on Teams
Roskilde	Interview completed	Online interview on Teams
Næstved	Interview completed	Online interview on Teams
Slagelse	Interview completed	Online interview on Teams
Gentofte	Interview completed	E-mail correspondence
Holbæk	Interview completed	Phone interview
Gladsaxe	Interview completed	Online interview on Teams

Table 2.2 Municipality participation and interviews. Own production.

Theories of Science 3

In this chapter a historical review of how traffic accidents and the prevention hereof have been investigated is presented. This is followed by a scope of hermeneutics as the theory of science and how this has influenced to this thesis.

> *"Theories of science is [. . .] not science but a reflection of and investigations of scientific practice and knowledge."*
>
> (Hansen and Simonsen, 2004: 8. Own translation)

This means, that whereas science is engaged in producing knowledge about the world, theories of science is engaged in reflecting upon the approaches used to obtain this knowledge about the world (ibid.).

Therefore, theories of science is not a science in the traditional sense. Rather, it is an investigation and a reflection of scientific practice and knowledge. In that sense, theories of science become the glasses by which the world is seen. How the world is seen and examined is determined by the data collection methods.

3.1 How Traffic Accidents have been Viewed

Since the 1960's a traffic accident have been considered as a system failure, in a system consisting of 1) the road user, 2) the vehicle and 3) the road and its surroundings. This view of the system has been based on analyses of specific accidents several locations around the world, where a special emergency team has analysed the accident on-site in order to point out flaws and/or deficiencies in the system. These flaws and/or deficiencies have been crucial for the accident. One or more system failures cannot be the cause for a traffic accident, but can be contributing factors. This is due to the fact that a cause must have a well-defined impact. That is, if a given circumstance is causing a traffic accident, this circumstance will always cause a traffic accident. Since this is not the case with traffic accidents, the term *cause* cannot be used in relation with a traffic accident. Therefore, the term *accident factor* is better practical, since it is defined as *"a circumstance, which was present at the accident and which without, the accident would not have occurred"* (Jørgensen, 1994: 182. Own translation). Thus multiple factors can be present in the same accident, and it is the

combination hereof, and not necessarily a single factor, that results in the accident (ibid.).

A Swedish project likewise argues that traffic accidents are caused by a failure, however they argue that it is an information-related failure by one or more parties as opposed to a failure in the threefold system with the road, road user and the vehicle. Therefore, they made an analysis model based on the information processes that are present during driving, see appendix D on page 80 (Jørgensen, 1994; Sørensen, 2006).

These lines of thoughts take base in an empirical analytical approach, where system mechanisms and empirical observations are used in order to identify, where a failure has occurred in the system.

> *"Accidents are considered as random in the sense that time and space for an accident never can be predicted. Even the implicated parties will not be able to predict the accident more than a few seconds before the collision."*
> (Jørgensen, 1994: 183. Own tranlsation)

Accidents can be considered as random which means that they can be studied theoretically as a Poisson process, which is a stochastic proces, where the accidents is seen as the outcome of the process itself (ibid.). When accidents are studied as stochastic processes, it is likewise an empirical analytical line of thought. This is because through probability calculation it is possible to assess, how many times a traffic accident will happen in a set amount of time (ibid.).

As it is evident in the municipal traffic safety plans which this thesis has investigated, the municipalities often perform traffic safety work based on accident black spots and/or 'grey' road sections. These methods are based on official accident statistics, which are then analysed in order to map the geographical areas and/or locations, where the accidents within the municipality have happened. Therefore, the municipalities' work is based on an empirical analytical line of thought. This is because statistical data is used to a great extent as the basis for the decision process concerning the prioritization of accident preventive measurements.

Sørensen (2006) describes the traditional line of thought within traffic safety work as being:

> *"Divided in the non place-bound and the place-bound traffic safety work, where the purpose is to reduce the risk of accidents through prevention or reduce the risk of injuries through minimizing the consequence. Measurements within the non place-bound traffic safety work is pointed at accidents and injury factors, which can be attributed to the road user or the vehicle, while measurements in the place-bound traffic safety work is pointed at*

> *accidents and injury factors which can be attributed to the road and its surroundings."*
>
> (Sørensen, 2006: 75. Own translation)

Based on this line of thought, it can be argued that when it comes to the place-bound traffic safety work, this is done based on an empirical analytical line of thought. This is due to the fact that there is a focus on how the road and its surroundings can be optimized in order to reduce the accident and injury factor. On the contrary, it is a matter of a pragmatic approach concerning the non place-bound traffic safety work, since here the focus is more on the road users, and how the road users' behavior during driving can be optimized.

Sørensen (2006) argues that this line of thought should change, since human errors are inevitable, and *"therefore there should not be death penalty for making mistakes"* (ibid.: 75. Own translation). Sørensen therefore believes that the purpose of the traffic safety work should be to avoid serious accident by either reducing the accident or injury risk: *"This must be done through road technical measurements pointed at both place-bound and non place-bound traffic safety issues in the form of making the road and its surroundings more forgiving and self-explanatory"* (ibid.: 76. Own translation). The line of thought should therefore change from pragmatic in the form of educating and influencing the road user and his/her behavior to reduce the number of serious injuries. This changed approach is more empirical analytical, since it is accepted that people make mistakes, why this factor to some degree is disregarded. Instead it is sought to increase the safety by making the road and its surroundings forgiving and self-explanatory, so the accident and injury factor is reduced without the road user needing further education, because the road user is able to 'read' the road.

Through this thesis the traffic safety work in the 18 municipalities will not be investigated from an empirical analytical point of view. Instead it will be examined from a hermeneutic angle, since the investigation is done through literature studies and interviews in order to understand, how the municipalities include pedestrian safety in their traffic safety plans.

3.2 Hermeneutics

This thesis is based upon a pragmatic problem concerning pedestrian safety and especially solo accidents with pedestrians. This is investigated by examining to which extent 18 of the biggest municipalities in Denmark include pedestrian safety in their traffic safety planning with a predominantly hermeneutic approach, confer the methodology presented in *Methodology* on page 11.

> *"The ancient word hermeneutics connotes 'translation' in the broadest sense."*
>
> (Gadamer, 1994: X)

Within hermeneutics the aim is to understand the whole, which in this case is to which extent 18 of the biggest municipalities in Denmark focus on pedestrians in their traffic safety planning, both in terms of pedestrian accidents in general and solo accidents. This is, confer *Methodology* on page 11, sought achieved through the study of the traffic safety plans and pedestrian strategies. The whole can only be fully understood, when the fusion of horizons is achieved, see fig. 3.1. Fusion of horizons is when a text is understood by the reader as the writer intended. This means that fusion of horizon is met, when subject A's interpretation is the same as subject B's understanding. Fusion of horizons is essential in regards to the hermeneutic circle in terms of understanding the whole. Figure 3.2 is an illustration of the hermeneutic circle and is a process towards understanding the whole through dialogue with the text, in this case the text being the various traffic safety plans and strategies as well as the interviews. However, it is important to keep in mind that the process is never fully completed, as new information and understanding can always be added to the whole. This means that subject A's interpretation can never be completely identical to subject B's understanding, but a common point of understanding can be reached, confer fig. 3.1. One of the reasons that a complete fusion of horizons can never be reached, is due to prejudice. Often people tend to judge without even knowing so, and therefore one must be very aware of this in order for it not to interfere with the investigation (Danermark et al., 2002). In other words this means that one seeks to be objective and disregard one's subjective understanding in order to fully understand the whole.

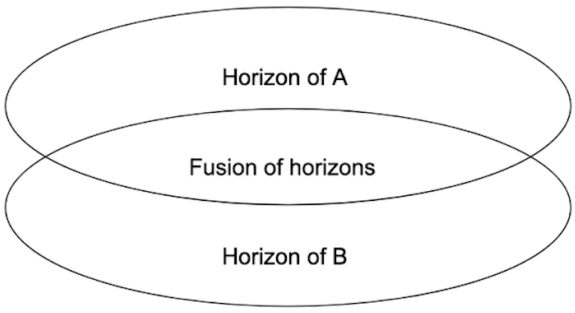

Figure 3.1 Illustration of fusion of horizons (Jensen et al., 2019: 16).

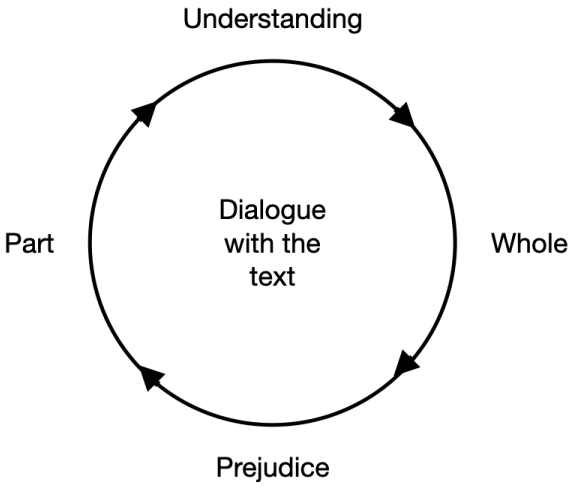

Figure 3.2 Illustration of the hermeneutic circle. Based upon (Danermark et al., 2002)

The constant interplay between the parts and the whole must always be seen in

connection with each other, which means that *"a fact must always be put into a larger context so that its significance becomes clear"* (Danermark et al., 2002: 159). This means that it is very difficult to explain a part to someone, who does not understand the concept of the whole without explaining the context of the whole: *"Every action gets its meaning in relation to other actions and in this way the web grows from a single detail to a comprehensive social web"* (ibid.: 159). Therefore, the whole and the parts are in a constant interplay, which makes all interpretations contextual in space and time (ibid.).

Theory 4

In the current chapter the theory used in the thesis is presented. The theories along with the methods frame the investigation of to which extent 18 of the biggest municipalities in Denmark focus on pedestrians in their traffic safety planning.

4.1 The Mobilities Turn from a Pedestrian Perspective

> *"Mobilities is much more than simple movements of people, goods and information from A to B. To make matters simple, the 'mobilities turn' has made it its hallmark to explore the 'more than' effects of a world increasingly on the move."*
>
> (Anon., n.d.: 1)

When investigating the 'more than', it is necessary to keep in mind that there are different kinds of pedestrians. According to Vestergaard et al. 2014, two types of pedestrians exist: 1) those walking for transport and 2) those walking for pleasure.

According to a study done by Vestergaard et al. (2014) those who walk as a means of transportation do this based on rational motives (time and distance). The choice of walking as a means of transportation is done with a clear goal: the end destination. Therefore, this group of pedestrians sometimes chooses the shortest route due to a lack of time and energy, and thereby get as quickly as possible from A to B (Vestergaard et al., 2014).

Whereas those who walk for pleasure do so in order to experience the recreational and eventful feeling of walking. This is done by a bodily experience which evokes all the senses. According to the study by Vestergaard et al. (2014), they discovered that the values of this subculture of walking are: experience, relaxation, well-being, memories, emotions, being together, wellness, meditation, and exercise. This kind of walking is connected with a surplus of time and energy, and therefore people walking or running for exercise are also included in this group (ibid.).

> *"Walking is not dependent on predetermined routes (such as the roads); pedestrian flow is less controlled and this provides the possibility to change the route in a negotiation between time restrictions and more scenic and eventful routes."*
>
> (Vestergaard et al., 2014: 47-48)

The research project UWAC (Understanding Walking and Cycling), which collected its data from 2009 - 2011, was deployed in four English towns[7]. As presented in Pooley et al. (2013), the research project identified eight reasons for walking based on a questionnaire:

1. **Enjoyment:** Interactions with the environment.
2. **Exploring the environment:** The desire to walk in a certain environment can contribute to an increase in driving in order to reach said environment.
3. **Leisure:** Performed when there is a surplus of time and energy.
4. **Financial reasons:** Walking is a free mode of transportation.
5. **Convenience:** Walking does not need parking and can be performed almost anywhere.
6. **Choosing a walking lifestyle:** The choice of living an environmentally friendly life and/or in an urban area, where everything is in a walking distance.
7. **Health and fitness:** For the benefits of walking as a source for a better mood and more energy.
8. **The sociability of walking:** Walking with others can provide protection against perceived risks and provide motivation for more walking.

(Pooley et al., 2013)

The research was designed to, among other things, account for *"their past experiences of everyday travel, and their future intentions"* (ibid.: 52).

When comparing these eight reasons with the two types of pedestrians from the study done by Vestergaard et al. (2014), they have some similarities. That includes the fact that time and energy is decisive, when deciding weather to walk or not. Furthermore, the health and fitness aspect occurs in both studies as a way of using walking in a recreational manner.

These reasons for walking support that it is much more than just moving from A to B: It is a choice based on several factors, both personal and infrastructural, and therefore it is important to include in traffic planning and safety measurements, since it affects whether people choose to walk or use another means of transportation. Furthermore it is important to include the mobilities turn in the traffic planing

[7] Leeds, Leicester, Worchester, and Lancaster.

in order to increase safety, for example for pedestrians. Since this traffic user is highly mobile and is not restricted to stay on the road such as a car, pedestrians might choose the fastest, but not necessarily the safest way. This manifests itself when pedestrians e.g. choose to cross a road where they want instead of walking to the nearest underpass for vulnerable traffic users, where it would be safer for them (Havarikommissionen, 2013). Through planning, the safest choice must therefore be more attractive for the pedestrians in order for them to take a detour.

4.2 Sustainable Mobility

> *"As we have all become more mobile, so the carbon footprint of our transport activities has grown."*
>
> (European Commission, 2021)

Since the transport sector, according to Europa-Parlamentet (2019), is related to 30 % of the EU's collective energy consumption, this sector is often the main factor in the global problems concerning sustainability and climate change (Huijbregts and Rietveld, 2011: V). The relationship between transportation and the environment is, according to Rodrigue et al. (2006) and UKEssays (2017), complex and paradoxical by nature.

According to the Brundtland Report from 1987, sustainability is defined as: *"Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs"* (World Commission on Environment and Development, 1987: 16).

Within traffic, sustainable transportation means that the transportation needs of a society are met in a way that does the least damage to the environment, and does not hinder future generations' mobility needs. In practice this means to get people to use other modes of transportation, such as walking, cycling or public transportation. Furthermore, it means that users are put first in order to provide more affordable as well as accessible, healthier and cleaner alternatives (European Commission, 2021; Rodrigue, 2020).

In order to do so, it is, according to European Commission, crucial to improve the overall efficiency of the transport infrastructure through among other things digital technologies, such as 'Mobility as a Service' (European Commission, 2021).

Since it is in the city that there is the highest accumulation of health hazardous substances from vehicles, it is also in these urban areas that the consequences hereof can be felt in everyday life. Therefore, problems concerning how transportation affects air quality, climate change, water quality, urban congestion, emissions, soil quality, biodiversity, noise, and land take need to be addressed alongside the focus

on sustainable fuel sources. Furthermore, the public transportation needs to be improved as well as the active modes of transportation such as walking and cycling need to be promoted more (European Commission, 2021; Rodrigue et al., 2006).

However, this must be done on a governmental level, and while many governments state their support in favour of sustainable mobility and its benefits, they have not done much to restrain car use and *"have often promoted less sustainable forms of travel alongside a declared commitment to change"* (Pooley et al., 2013: 9). Yet, as Rasmussen (2019) argues it is not easy to change people's transportation behavior through political decisions. Rasmussen concludes that the 'push' methods with toll rings, road pricing and increased parking charges are more efficient than 'pull' methods. The latter is more attractive to the vulnerable road users, who are already transporting themselves in a sustainable manner, and therefore this does not remedy the issues concerning e.g. congestion, pollution and serious traffic accidents. Rasmussen further states that the *"greatest effect and influence of road users is achieved through the combination of traffic political tools"* (Rasmussen, 2019: 91. Own translation).

The complexity of transportation and environment manifests itself in the United Nation's (UN) Sustainable Development Goals, see fig. 4.1. Since the transportation sector is becoming more and more linked to the environmental problems, as already listed, and the fact that the *"transportation activities support increasing mobility demands for passengers and freight, notably in urban areas. But transport activities have resulted in growing levels of motorization and congestion"* (Rodrigue et al., 2006: 210-211). Therefore, the transport sector can be linked directly and indirectly to some of the Sustainable Development Goals of the UN.

Figure 4.1 The 17 Sustainable Development Goals of the UN (Bootstrapping, 2017).

Comparing the 17 Sustainable Development Goals of the UN with the challenges the transport sector creates for the environment, it becomes clear that the transport sector is linked to the following sustainable developments goals:

3: **Good health and well-being**

- Particles and gasses from cars affect health (Lungeforeningen, n.d.). Furthermore, noise can affect both the physical and mental health (Miljøministeriet, 2007)

6: **Clean water and sanitation**

- Gasoline leaks, antifreeze, and metal dust from brake pads contribute to groundwater pollution. However, their impacts are to be investigated further in order to fully understand, how they affect the water quality (Nixon and Saphores, 2007)

7: **Affordable and clean energy**

- Some people might not buy electrical cars because of their price (Brix, 2020)

9: **Industry, innovation and infrastructure**

- The infrastructure must be more sustainable (Andersson, 2017)

11: **Sustainable cities and communities**

- No traffic jams and car-free zones are some of the factors that make a sustainable city (Andersen, 2019)

13: **Climate action**

- Be mindful of one's choice of transportation (Green Key – Green Dreams, 2021)

14: **Life below water**

- The transport sector contributes negatively to oxygen depletion (Danmarks Naturfredningsforening, n.d.[a])

15: **Life on land**

- Nitrogen from cars deposits in nature and is a contributing factor in destroying nitrogen-sensitive areas. Furthermore, roads cut off animals from their fellow species and hinders natural behaviour (Danmarks Naturfredningsforening, n.d.[b])

Since the transport sector affects so many of the Sustainable Development Goals, it is an important area to focus on, in relation to choosing more climate friendly means of transport. If more people choose to walk, cycle and/or use public transport, the collective consumption of the Earth's resources would be reduced significantly (Blondel et al., 2011).

Traffic Safety in the Danish Municipalities 5

Present chapter covers the findings of the literature study of the traffic safety plans from the 18 selected municipalities in Denmark, as mentioned in *Methodology* on page 11. Furthermore, the findings from the interviews will likewise be presented to offer an elaboration on the municipalities' plans.

5.1 Traffic Safety Plans

In this case, a traffic safety plan is made by the municipalities, but on national roads it is the the Danish Road Directorate that makes the traffic safety plans:

> *"In a traffic safety plan, different initiatives are introduced based on mapping and analysis of the problems regarding traffic safety as well as goals and strategies for the safety work. The individual initiatives are prioritised based on an evaluation of benefit and cost."*
>
> (Vejdirektoratet, 2016: 12. Own translation)

The purpose of the traffic safety plans is therefore to set the basis for the initiatives for the following years regarding traffic safety on the roads, which the municipalities are in charge of. In practice, this means that the roads owned by the government are not included in the traffic safety plans covering the municipalities (ibid.).

The municipalities decide for themselves for how long the plan is valid, and which initiatives they want to implement, thereby which themes to prioritize. The traffic safety plans from the 18 municipalities cover topics such as school roads, bikes and cars in relation to congestion, sustainability as well as health and safety for the citizens.

13 of the 18 municipalities focus to a certain extent on school roads, see for example (Esbjerg Kommune, 2015; Gentofte Kommune, 2016; Holbæk Kommune, n.d.; Odense Kommune, 2014b). This is probably due to the fact that the law regarding municipal primary and lower secondary school states that *"if the concern regarding the safety of the children in traffic is particularly required"* (Børne- og Undervisningsministeriet, 2020: Own translation), it is the municipality's responsibility to *"ensure transport between the school [. . .] and the home"* (ibid.: Own

translation). The municipalities are therefore obliged to pay for the transport to and from school, if the school road is identified as hazardous (ibid.). The assessment of whether a road is hazardous or not is achieved through analysis of data concerning the width of the road, conditions of the side and view, amount and speed of traffic, amount of heavy vehicles, etc. The data is supplemented with a survey of the stretch of road, which is performed by representatives from the police and road authorities (Kolding Kommune, 2013: 24; Transport- og Boligministeriet, 1978).

The municipalities use different means in order to increase the safety on the school roads. In Silkeborg Municipality they have e.g. 'kiss-and-drive' to encourage parents to drop off their children quickly and leave for the next car to do the same (Silkeborg Kommune, n.d.[c]). In Gladsaxe Municipality they have used campaigns in order to remind people to comply with the limitations to speed (Gladsaxe Kommune, 2020). A third and widespread method to increase safety on the school roads is the one that Odense Municipality, among others, uses, which is to make a traffic policy[8] in collaboration with the administrations from the schools (Odense Kommune, 2014b).

Half of the municipalities in this study focus on cycling in their traffic safety plans, see for example (Frederiksberg Kommune, n.d.; Gladsaxe Kommune, n.d.; Næstved Kommune, 2018; Viborg Kommune, n.d.[d]). The reason for this is to reduce the number of cyclists getting injured or killed in traffic, but on the other hand the municipalities also want to get more people to choose the bike due to factors such as sustainability, health, and congestion on the roads. Furthermore, nine of the municipalities have an indirect focus on cyclists, where they are mentioned in the category of vulnerable road users, see table 5.1 on page 35.

Two of the municipalities which focus on cycling in their plans are Viborg and Horsens. In Viborg Municipality they wish to connect the cities within the municipality through 'den midtjyske cykelstjerne'[9] (the central Jutland cycling star) as well as bike lanes along all main roads (Viborg Kommune, n.d.[c]). Furthermore, the municipality wants coherence and thereby better connection in the bike lane network, which makes it possible to take the bike into the city center. They want better parking opportunities, service facilities, and want to secure the maintenance on the bike lanes in order to ensure a good all-year-round standard. Overall Viborg Municipality wants to promote the biking tourism (Viborg Kommune, 2012).

In Horsens Municipality they also want to create coherence between a bike lane network with good parking facilities and safe crossing facilities. Furthermore, they want 2.5 meter wide cycling highways with lighting, and where the snow removal is

[8] Should you wish to read more about what a traffic policy is, see e.g. (Odense Kommune, 2014b).
[9] Should you wish to read more about the central Jutland cycling star, see (ByogLandskab, n.d.).

highly prioritized. For all their bike lanes, it is desired that they have a solid and even pavement (Horsens Kommune, n.d.). This agrees with the fact that Horsens does not have a traffic safety plan per se, but rather they have a passability plan.

Additionally, 13 of the 18 municipalities have a cycling plan or strategy or have had one within the last three years, which is not necessarily connected directly to their overall traffic safety plans, see for example Københavns Kommune (n.d.), Aalborg Kommune (2020), Silkeborg Kommune (n.d.), and Randers Kommune (n.d.).

Car traffic serves as a central point in several of the 18 municipalities, and they are connected to the Road Safety Commission's vision for 2020 that *"in 2020 there should be a maximum of 120 casualties, 1,000 severely and 1,000 minor injured people in traffic"* (Rådet for Sikker Trafik, n.d.: 9. Own translation). With this objective, the Road Safety Commission has chosen to follow the objectives set by the European Union concerning a halving of traffic related casualties (ibid.). Furthermore, the Road Safety Commission has chosen a similar objective for the number of severe and minor injuries, which is also set to be a halving by 2020. The underlying basis for this vision, concerning the casualties and severe and minor injuries, is the numbers from 2010 (ibid.).

This vision from the Road Safety Commission is likewise included by the majority of the municipalities, and Copenhagen's Municipality states that:

> *"EU has set a goal to halve the number of traffic related casualties before the end of 2020. In Denmark, the Road Safety Commission has carried a new national plan of action, which sets similar goals about halving the number of casualties, severe, and minor injuries during the period 2013 - 2020."*
>
> (Københavns Kommune, 2013: 5. Own translation)

Copenhagen's municipality has therefore chosen a halving of the number of casualties and injuries from 2013 - 2020, whereas the EU and the Road Safety Commission, as stated earlier, has chosen to set the goal beginning from 2010. Randers Municipality, on the other hand, has chosen an average from 2009 to 2011 as the underlying basis for their objective regarding fewer casualties and injuries: *"It is chosen to take point of departure in the Road Safety Commission's national objective: It is desired to halve the number of casualties and injuries in traffic in 2020 in relation to the average number during the period of 2009 - 2011"* (Randers Kommune, 2015: 6. Own translation). The average from 2009 to 2011 is something that Viborg and Roskilde Municipalities have likewise used in their objective (Respondent06, 2021; Viborg Kommune, n.d.[e]). Furthermore, there are some municipalities that use other years for their average such as 2010 - 2011, as well as municipalities that only use the numbers from 2010 (Esbjerg Kommune, 2015; Silkeborg Kommune, n.d.[e]; Vejle

Kommune, 2018). Generally it applies to the municipalities that have an objective to reduce the number of casualties and injuries, that they follow the Road Safety Commission's objective to a varying degree.

Through the interviews it was clear that only one of the interviewed municipalities, Silkeborg, had reached their goal of halving the number of casualties and injuries in traffic. However, it should be noted that not all the interviewed municipalities did remember the exact numbers, but they were of the opinion that they had not reached the goal. It is also important to note that Roskilde Municipality did not use data from the year 2020 in their comparison with 2010, because of the COVID-19 situation that affected everyday mobility in general. Therefore, the municipality used the year 2019 instead, and they believed it to be more accurate (Respondent06, 2021; Respondent08, 2021). However, when working with statistical data, this is always subject to uncertainty, and therefore there is some uncertainty toward whether or not the municipalities have reached their goals for 2020.

Moreover, the focus on cars also includes reducing congestion on the roads by either reducing travelling time in affected areas or to encourage the use of alternative transportation, primarily the bike. In Næstved Municipality they seek to optimize the existing intersections, transfer through-going traffic from the two roads in the city with the most congestion to the orbital road, transfer short car trips to bike trips, and make physical changes of the signal lights to improve the traffic flow (Næstved Kommune, 2018).

In Frederiksberg Municipality they likewise have problems with congestion on the roads. The municipality therefore wishes *"that more car drivers will use car pooling to a greater extent than today as well as public transport, bicycles or walking"* (Frederiksberg Kommune, n.d.: 30. Own translation). Additionally, the municipality wishes to improve the passability by for example prioritizing the busses in the signal related intersections (ibid.). The municipality therefore has a wish to be more sustainable. Unfortunately, it has not been possible to ask them about specific initiatives towards becoming a more sustainable municipality.

This is likewise evident in Gladsaxe Municipality, where the respondent expresses that the municipality works with four of the Sustainable Development Goals by the EU (Good health and well-being, sustainable cities and communities, climate action, and partnerships for the goals), which likewise is anchored in their coming traffic safety plan:

> *"When we discuss better health, we also talk about that there will be a consequential effect in increasing traffic safety, if we get more people to ride a bike or use other means on transportation other than the car. By doing this, there is also a beneficial effect in getting more sustainable cities,*

> *and we get something done about the climate with less CO_2 emission with greener transport."*
>
> (Respondent02, 2021b)

Furthermore, the municipality has hired a city architect, to make future traffic safety measurements more sustainable. This will be done through an architecture policy that will be incorporated in the traffic safety plan, so that the municipality *"makes greener solutions and not just an asphalt jungle"* (ibid.). Since the city architect have just been hired, they have not implemented any traffic safety measurements with their architecture policy yet. However, the municipality expects that in the future the measurements will be greener consisting of more planting (Respondent02, 2021a).

5.2 Pedestrian Safety in the Municipal Traffic Safety Plans

Through the literature study of the traffic safety plans from the 18 municipalities, it became clear that pedestrians are not one of the municipalities' main priorities. This might be due to the fact that some municipalities have not considered pedestrians, because they are not mentioned in the accident statistics as an independent factor, as mentioned in *Scoping Review and Research Question* on page 1. Therefore, the municipalities might not be aware of the extent of the possible problems concerning solo accidents with pedestrians, and for that reason pedestrians are not included to the same extent as other modes of transportation. Another reason for the absence of the pedestrians in the traffic safety plans might be, that some of the municipalities have independent pedestrian plans or strategies, and might therefore have decided to leave them out of their traffic safety plans. These strategies will therefore be presented in *Pedestrian Strategies* on page 47.

Two municipalities, however, Viborg and Frederiksberg, have specific focus points concerning pedestrians in their traffic safety plans:

> *"Pedestrian traffic is an important key towards health, to create life in the streets and revenue in the stores, but at the same time pedestrians are exposed road users."*
>
> (Viborg Kommune, n.d.[b]: Own translation)

> *"Pedestrians are exposed road users. It is by foot that children first learn to behave in traffic. Many elderly also prefer moving by foot and bus in their everyday lives. Pedestrian accidents often involve children and elderly,*

> *and therefore children and elderly are significant target groups within the 'pedestrian' focus area."*
>
> (Frederiksberg Kommune, n.d.: 53. Own translation)

Where Viborg Municipality has focus on making walking more attractive as well as safe, Frederiksberg Municipality focuses on safety especially among the children and elderly, because the municipality is aware that these age groups tend to walk the most.

Besides Viborg and Frederiksberg Municipalities, four other municipalities, Copenhagen's, Vejle, Roskilde, and Randers, include pedestrians as focus points in the category of 'vulnerable road users'. In that way pedestrians are indirectly considered in the traffic safety planning. Although, in this connection the focus is on pedestrians in relation to collisions with the additional traffic, and therefore there is not focus on solo accidents with pedestrians (Københavns Kommune, 2013; Randers Kommune, 2015; Roskilde Kommune, 2014; Vejle Kommune, 2018).

Furthermore, some municipalities such as Holbæk and Slagelse have suggested solutions, in connection with e.g. safe school roads, that will make it safer to be a pedestrian. That being e.g. making zebra crossings more visible and better infrastructure. Other municipalities are mentioning different campaigns and initiatives towards better conditions for pedestrians (Gentofte Kommune, 2016; Holbæk Kommune, n.d.; Silkeborg Kommune, n.d.[f]; Slagelse Kommune, n.d.).

The common factor for all the municipalities is that none of them have focus on solo accidents with pedestrians. It is striking that this is not mentioned, because studies show that solo accidents with pedestrians are a problem, as mentioned in *Scoping Review and Research Question* on page 1. However, Aarhus Municipality mentions solo accidents with pedestrians in connection with a description of the emergency room data (Aarhus Kommune, 2013).

Despite the fact that Silkeborg Municipality does not focus on solo accidents with pedestrians, they still focus on pedestrian safety in connection with their project about 4 more seconds of green signals for pedestrians in 10 chosen junctions:

> *"The solution is based on video investigations concerning the behavior of 3,200 pedestrians in Silkeborg. In the first junction at Sønder Torv, where the solution was established, there was a majority of elderly and slow walkers. Unfortunately, a big part of the injured pedestrians are over the age of 70, and many in this exact age group have difficulties crossing the zebra crossing in one go, without having to stop on the traffic island."*
>
> (Silkeborg Kommune, n.d.[d])

The municipality thus wishes that vulnerable groups should not have to stop on the

traffic island. There is a big difference in being responsible for others or to have a walker, which might be more of an obstacle for mobility if one has to stop on the traffic island. For this reason, the extra time for green signals has been intended primarily to childminders, walker users, blind, and the visually impaired. These population groups have therefore gotten the opportunity to request and receive a piece that can activate the prolonged green signal at the chosen zebra crossings. Respondent08 expresses that:

> *"People are very happy about the piece, and it seems that it has worked. If one has a condition that makes it difficult to press a button, then one does not need to, when one has the piece. There will both be a light signal and a sound signal, so the blind also know that it [the zebra crossing button] has been activated."*
>
> (Respondent08, 2021)

The municipality has not registered any accidents with pedestrians in these junctions since the implementation of the pieces, which give longer green signals for the pedestrians. Yet, the municipality does not know whether there has been any near-accident conflicts (ibid.).

Another municipality, Gentofte, has likewise begun the work with prolonged green signals in their junctions. However, it is uncertain whether the municipality has done the same as in Silkeborg Municipality with a small piece that needs to touch the zebra crossing signal button in order to activate the prolonged green signal (Respondent11, 2021; Silkeborg Kommune, n.d.[d]).

In table 5.1 on the next page is an overview of the content of the traffic safety plans from the 18 municipalities. The table is meant as an indicator on how the municipalities prioritize in traffic safety planning, but since the plans are subject to interpretation, the table is not conclusive.

Municipality	**Focus on pedestrian accidents**	**Focus on solo accidents with pedestrians**	**Focus on accidents with cyclists**	**Focus on car accidents**
Copenhagen	Indirectly	No	Indirectly	Yes
Aarhus	No	Indirectly	Yes	Yes
Aalborg	No	No	No	Indirectly
Odense	No	No	Yes	Yes
Vejle	Indirectly	No	Indirectly	Yes
Esbjerg	No	No	Indirectly	Yes
Frederiksberg	Yes	No	Yes	Yes
Randers	Indirectly	No	Indirectly	Yes
Viborg	Yes	No	Yes	Yes
Viborg city center	Indirectly	No	No	No
Silkeborg	Indirectly	No	Indirectly	Yes
Kolding	Indirectly	No	Indirectly	Yes
Horsens	Indirectly	No	No	No
Roskilde	Indirectly	No	Indirectly	Yes
Næstved	No	No	Yes	Yes
Slagelse	Indirectly	No	Indirectly	Yes
Gentofte	Indirectly	No	Yes	Yes
Holbæk	Indirectly	No	Indirectly	Yes
Gladsaxe	No	No	Yes	Yes

Table 5.1 Summary of the content and focus areas in the 18 chosen municipalities' traffic safety plans. Own production.

The plan that sets itself apart the most, confer table 5.1, is Aalborg Municipality's plan. This plan does not have any specific focus points concerning traffic safety, but instead it focuses on the fact that geography within the municipalities is different depending on the location. Therefore, the plan is divided into geographies: 'Northern Denmark', 'towns in the surrounding area', 'villages and open country', and 'Aalborg City' (Aalborg Kommune, 2019). This division acknowledges that the municipality is aware of the different areas' needs regarding mobility. Furthermore, the municipality's plan does not have any specific initiatives, but they have visions they seek to fulfill instead. This might be due to the fact that the plan is valid until 2040. Moreover, the plan focuses more on making mobility in the municipality more sustainable than on the traffic safety aspect of mobility. This manifests itself in the name of the plan, which is 'Mobility 2040', whereas the other municipalities have used either 'traffic' or 'traffic safety' in the title, see table 2.1 on page 14.

Furthermore, the traffic plan from Horsens Municipality also sets itself apart from the other plans. Given that the plan, as mentioned earlier in *Methodology*

on page 11, is not a traffic safety plan per se, they do not write anything about casualties and injured, but focus on how they want to improve the infrastructure in the municipality up until 2030, which indirectly can improve traffic safety (Horsens Kommune, n.d.; Respondent10, 2021).

Confer table 5.1 on the preceding page, it is noticeable that only 12 municipalities include pedestrians in their traffic safety plans, with focus being on either pedestrians as an independent road user or as a part of 'vulnerable road users'. Of the 12 municipalities, only two, Viborg and Frederiksberg, have pedestrians as a focus point in their plans. Yet, it should be noted that they do not include solo accidents with pedestrians. Unfortunately, it has not been possible to interview either Viborg or Frederiksberg Municipalities further about the specifics of their focus on pedestrians, confer table 2.2 on page 17 (Frederiksberg Kommune, n.d.; Viborg Kommune, n.d.[d]).

Of the 11 municipalities which focus indirectly on pedestrian safety, four of them, Copenhagen's, Vejle, Roskilde, and Randers Municipalities, do so through a focus on vulnerable road users, which pedestrians are a part of. Whereas Viborg city center, Silkeborg, Kolding, Horsens, Slagelse, Gentofte, and Holbæk Municipalities focus on pedestrians through e.g. a focus on safer roads for everyone and through their use of campaigns (Gentofte Kommune, 2016; Holbæk Kommune, n.d.; Horsens Kommune, n.d.; Københavns Kommune, 2013; Kolding Kommune, 2013; Roskilde Kommune, 2014; Silkeborg Kommune, n.d.[f]; Slagelse Kommune, n.d.; Viborg Kommune, 2012).

However, it should be noted that the category 'no' in table 5.1 on the preceding page does not necessarily mean that pedestrians are not mentioned at all in their traffic safety plan. The category 'no' therefore covers municipalities that mention pedestrians to such a low degree that it cannot be understood as a focus point regarding pedestrian safety.

As it appears on table 5.1 on the previous page, most of the municipalities have focus on cyclists and car accidents to a certain extent compared to their focus on pedestrians. This distortion of the focus might be caused by the official statistics, in which the municipalities base their work on. This might be due to the fact that the official statistics base its data on the definition of a traffic accident, which, as mentioned earlier, is: *"Any accident involving at least one road vehicle in motion on a public road or private road to which the public has right of access, resulting in at least one injured or killed person"* (European Union, 2010).

Comparing table 2.1 on page 14 with table 5.1 on the previous page it becomes evident that 13 municipalities focus directly or indirectly on pedestrian safety in their traffic safety plans. Only Aarhus Municipality focuses indirectly on solo accidents with pedestrians in their traffic safety plan. This means that 2,001,009 citizens live in a municipality where they prioritize pedestrian safety, and 353,445 citizens live in

a municipality where the planners show awareness of the risk regarding solo accidents with pedestrians. This means that only 34,3% of the Danish population in 2020 lived in a municipality where pedestrian safety was prioritized in the municipal traffic safety planning.

5.3 Emergency Room Data

Seven of the municipalities are aware of the unreported numbers in their plans, but only two of the municipalities, Odense and Aarhus, include accident registrations from the emergency rooms in their planning (Aarhus Kommune, 2013; Odense Kommune, 2014b). However, Copenhagen's, Holbæk, Frederiksberg and Silkeborg state that they want to be a part of a collaboration with other partners in order to include the accident registrations from the emergency rooms. For example, Copenhagen's Municipality states in their traffic safety plan that:

> *"The municipality's traffic safety work can be improved if we [the municipal planners] have information regarding the registered accidents from the emergency rooms. We expect that these 'unreported numbers' contain many personal injuries with vulnerable road users. Therefore, we aim to:*
>
> *· Collaborate with the Capital Region of Denmark to gain more information concerning the accidents that have been registered in the emergency rooms.*
>
> *· Develop tools, so that we can analyze and use the information in our forward traffic safety work, and to follow the development on the subject on a national level.*
>
> *· Improve the possibilities for road users to self-report accidents or near-accidents to the municipality via the internet."*
>
> (Københavns Kommune, 2013: 23. Own translation)

Furthermore, Silkeborg Municipality states in their traffic safety plan that it is *"expected in 2020 that a registration of accidents within the police districts will happen in the region's emergency rooms"* (Silkeborg Kommune, n.d.[b]: Own translation). Unfortunately, Respondent08 says that the system with the emergency room data collection has yet to be implemented in the municipality. Silkeborg Municipality plans to use the same set up as they do in Aarhus Municipality (Respondent08, 2021). The model Aarhus Municipality uses to register emergency room data is not the

same as the one they use in Odense Municipality[10] (Sørensen, 2008a). Unfortunately, it has not been possible to interview a representative from Odense Municipality in order to hear more about their collection of emergency room data.

Esbjerg Municipality, on the other hand, recognizes the problem with the unreported numbers, but does not mention how they wish to solve it (Esbjerg Kommune, 2015). Unfortunately, it has not been possible to interview Esbjerg Municipality in order to get their view on the unreported numbers and the use of emergency room data.

Through the interviews it is clear that the municipalities agree that using emergency room data would be beneficial for their traffic safety planning. However, the municipalities are in different places in the process of acquiring emergency room data. Respondent02 from Gladsaxe Municipality does not believe that the municipality is big enough to collect emergency room data on their own, and is to some extent impressed, that Aarhus and Odense Municipalities are capable of doing it on their own. However, Gladsaxe Municipality would like to be a part of a national model concerning collection of emergency room data and currently they are a part of a collaborating network between Zealand and the surrounding islands. The collaboration is working on implementing the unreported numbers, which are not registered in the official accident statistics (Respondent02, 2021b).

Respondent11 from Gentofte declares that the municipality is a part of a task group with other municipalities from Northern Zealand and the police in connection with overcoming the issue with unreported numbers. This collaboration will be a part of Gentofte Municipality's coming traffic safety plan (Respondent11, 2021).

As it appears, there seems to be disagreements between the two neighbouring municipalities Gentofte and Gladsaxe between the type of collaboration that is on the way. Therefore, there is some uncertainty as to how the coming work on Zealand will be done. For example, Slagelse Municipality likewise wants to use emergency room registrations, and has advocated for the implementation of a national model. The municipality has therefore taken its own initiative for starting the collection of emergency room data, but has not yet started using this data in their traffic safety work:

> *"If you read the old plans of action from the Danish Road Safety Commission, it is a wish that has been there for an indefinite time. So one just has to get it going in different places, and suddenly it becomes national, then there will be a pressure on that."*
>
> (Respondent05, 2021: Own translation)

[10] For a more detailed overview of what is registered in Aarhus and Odense Municipalities respectively, can be seen in (Sørensen, 2008a,b).

However, not all municipalities have the opportunity to incorporate emergency room data in their traffic planning. For example in Roskilde Municipality, they do not use emergency room data yet, because the emergency rooms in the municipality do not note the geographic placement of the accident. After all, the municipality still wishes to use emergency room data in their planning. The municipality has also made a safety investigation concerning the sense of security and accidents in connection with the making of their traffic safety plan. This investigation, however, was primarily targeted at cyclists (Respondent06, 2021).

Furthermore, Respondent09 from Næstved, declares that the municipality had implemented a system collecting emergency room data in 2019, but for unknown reasons the municipality has not gained access to the collected data yet. Therefore, the municipality is investigating how they can get the data in order to use it in their future traffic safety planning (Respondent09, 2021).

Additionally, Holbæk Municipality sets their basis in the registered data from the police, since they do not have access to anything else yet. But the municipality would like to have access to emergency room data, if this was possible (Respondent04, 2021).

> *"Often when we [planners] make developments and plans, it is important that we target our efforts, but also when we get continuous enquiries we need to assess, whether to perhaps make precautions on the roads, where there are accidents with cars in the accident statistics. But we do not have that, when it comes to cyclists and pedestrians, so it is of course much harder to say; is there really a problem or not? Of course we can go out and look at the side walks and rules concerning the road conditions, that of course must be complied with. But it would be nice to see, whether accidents really happen or not."*
>
> (ibid.: Own translation)

Furthermore, Respondent04 mentions that foreign countries use data from insurance companies in the accident preventive work. However, Respondent04 does believe that there is more knowledge to be obtained from the emergency room registrations in relation to the further use in the preventive traffic safety work (ibid.).

Randers Municipality, on the other hand, tried to incorporate emergency room data on their own, but it never really took off. Therefore the municipality is hoping that a national model will be implemented soon, as they *"are in a vacuum, where we [the municipality] are not entirely sure whether to continue what we started or to wait for the national"* (Respondent01, 2021: Own translation). The municipality had plans to include all data that would go through the emergency room registrations, and thereby also solo accidents with pedestrians (ibid.).

Using Emergency Room Data in Aarhus Municipality

> *"That is probably what I [the respondent] think is the majority of the accidents that are registered in the emergency rooms, that is solo accidents."*
>
> (Respondent03, 2021: Own translation)

Aarhus Municipality is one of two municipalities that use registrations from the emergency rooms in Denmark. Unfortunately, it was not possible to make an interview with the other municipality, Odense, why it is only the use of data from the emergency rooms in Aarhus that is reviewed in the following.

In Aarhus Municipality they use emergency room data to the same extent as police registered data:

> *"That we [the traffic safety planners] are looking on accidents and only looking at the ones registered by the police, then I [the respondent] get a very small part of the accidents. Then I will not get the pure accidents, which the cyclists experience. Then I will only get the serious ones."*
>
> (ibid.: Own translation)

Therefore, the municipality believes that it is important to get all the data, so that all accidents are included in the planning processes. The use of emergency room data can likewise be used to clarify possible connections and patterns in the accident picture:

> *"An example from last year [2020], where the local [newspaper] Århus Stiftstidende had a campaign in relation to the many accidents that happened on [...] Brabrandstien with cyclists running down pedestrians [...] There were so many accidents. Therefore, we [the municipality] were looking at the police registered data. There were a few, but it was something about illegal mopeds, so it was not at all connected."*
>
> (ibid.: Own translation)

So despite, the municipality was looking for connections in their data, both from the emergency rooms and the police, and what Århus Stiftstidende had written, they found none. On the other hand they found out that there were many solo accidents with especially cyclists on Brabrandstien. These accidents did not happen because of collisions with pedestrians, but rather that the cyclists had fallen on their bikes, because the road was slippery or wet. These accidents would have been unknown for the municipality, if they had not used the emergency room registrations, because these types of accidents are not registered by the police. This is characteristic for many solo accidents with vulnerable road users (ibid.).

Aarhus Municipality has a practical use of the emergency room data, which is why they want to contribute to an emergency room registration system on a national level:

> *"It is very important that one [the traffic safety planners] gets this data as well, and I [the respondent] think [...] that it is important that one [the developers of the national system] do not reject the way we [the municipality] have done it, where central players, the Danish Road Directorate, The Ministry of Transport, or something, want to create a brand-new system. We have something that has already been built on."*
>
> (ibid.: Own translation)

In Aarhus Municipality's model they have reduced the number of things that the police registers in connection with traffic accidents. For this reason the personnel in the emergency rooms only need to note about 29 parameters as opposed to the more than 100 parameters that the police registers. All this information is used by Aarhus Municipality in their traffic safety work, and therefore it gives a more accurate picture of the accident situation (ibid.).

5.4 Maintenance of Pedestrian Areas and Sidewalks

Solo accidents with pedestrians are often fall accidents, where the pedestrian e.g. falls over uneven pavement or slips on ice. Therefore, it is important to maintain the pedestrians' infrastructure, so that these fall accidents are prevented by keeping a good daily maintenance all year round.

Through the literature study of the plans, there is not much focus on the daily maintenance of pedestrian areas. Yet, some of the municipalities do mention it, but they often do so in relation to cyclist infrastructure (Horsens Kommune, n.d.; Næstved Kommune, 2018; Vejle Kommune, 2018; Viborg Kommune, 2012, n.d.[d]).

Copenhagen's Municipality writes in their traffic safety plan that *"the operation and maintenance of the road has great importance for the traffic safety"* (Københavns Kommune, 2013: 14. Own translation). The municipality is therefore aware of the importance of the maintenance in relation to the collective traffic safety, yet they do not mention maintenance of the pedestrian areas much. They only mention that they strive to perform *"regular operation and maintenance of the roads, pathways and road equipment"* (ibid.: 25. Own translation).

Frederiksberg Municipality also shows awareness of the importance of maintenance in relation to traffic safety, as they want to improve the traffic safety

by performing operations and maintenance on the path and road network. This does not necessarily mean the pedestrian infrastructure such as uneven sidewalks (Frederiksberg Kommune, n.d.).

Aarhus Municipality, for example, gives maintenance another meaning, where it becomes more of an aesthetic character. The municipality focuses on keeping the pedestrian areas nice and clean:

> *"It must be prioritized to secure cleaning and maintenance of the pedestrian areas, and especially in the places where stays are possible. The cleaning plan must be set in motion with all types of events in the municipality, where it can be presumed that a gathering of people will be present, and thereby an expected need of cleaning. Furthermore, it is important that there must be cleaned up after e.g. stormy weather, so the open spaces are not marred by e.g. overturned trash cans."*
>
> (Aarhus Kommune, 2020: 16. Own translation)

However, the cleaning also affects security and safety for the pedestrians, since wet leaves and trash can be slippery and/or hide an uneven surface. This gives the impression that the municipalities plan more for the recreational pedestrians, who walk for enjoyment and leisure, confer *Theory* on page 23.

The Use of Citizen Feedback

Several of the municipalities make their maintenance plans based on feedback from the citizens in the municipality. This feedback is received via apps or the municipality's website. The feedback contains information of e.g. uneven sidewalks or other inconveniences for pedestrians and other road users.

The feedback systems are an advantage for pedestrians, since the traffic safety plans show that there is not the same focus on maintenance of the pedestrian areas compared to cycling infrastructure in the traffic safety plans.

17 of the 18 municipalities have an app, where the citizens can report, if they come across something in the infrastructure that they think should be repaired. Frederiksberg does not, as the only municipality, offer this possibility to its citizens, but they do have a website, where the citizens can give feedback. Several of the municipalities that do use an app system have, like Frederiksberg, also given their citizens the possibility to give feedback via the respective municipality's website, see e.g. (Københavns Kommune, n.d.[b]; Slagelse Kommune, 2021; Viborg Kommune, n.d.[a]).

In Silkeborg Municipality they had two different apps from 2015 until mid-2017 (Silkeborg Kommune, n.d.[b]). One of the apps is similar to the app the rest of

the municipalities use, where the citizens have the possibility to tip-off if they have seen e.g. holes in the road or uneven sidewalks. Whereas the other app gave the citizens the opportunity to report accidents, where the police had not been called, and thereby the possibility to report pedestrian accidents. However, they do not use this app anymore, since they did not receive much feedback, and the feedback that they did receive was most often of a more maintenance related nature and not about accidents (Respondent08, 2021).

When the municipalities receive feedback concerning maintenance issues, it is the maintenance department that processes this. Therefore, some of the traffic safety planners in the different municipalities do not necessarily get to know about these problems with the infrastructure. For this reason, it is the maintenance department in the municipalities which is responsible for prioritizing the incoming feedback from the citizens. In Horsens Municipality, for example, they have a fund for sidewalks:

> *"We [the municipality] do have several funds to many different things, and so we have a fund for renovating the sidewalks or for new sidewalks or whatever it may be. And so it is the person in the maintenance department that takes care of that [...] and of course, if there are any minor issues, we [the traffic safety planners] call the maintenance department and ask to get it fixed, if it only concerns a single tile or whatever it could be. But the bigger projects are managed by the sidewalk funds."*
>
> (Respondent10, 2021: Own translation)

This setup with a fund that the maintenance department can use for maintaining the pedestrian areas is recurring in the interviewed municipalities, when asked who is in charge of the maintenance of the pedestrian areas (Respondent02, 2021b; Respondent05, 2021; Respondent06, 2021; Respondent07, 2021; Respondent09, 2021).

Furthermore, few of the municipalities mention that the maintenance of pedestrian areas is often done in consideration to other projects in the municipality. This is done in order to save money and increase the synergy of the work process in the municipality:

> *"We [the municipality] also try, if someone else is going digging in a sidewalk, or TDC [Tele Denmark Communication] needs to lay down some cables or something, then you make a collaboration. So in that way it may be that there is something that is done a little earlier than it should have been. But it does not make sense to dig up the same sidewalk twice in 10 years, so it is a delicate balance between planning and collaboration with these third parties, also because you might be able to get them to finance a part of it."*
>
> (Respondent02, 2021b: Own translation)

Furthermore, Gladsaxe Municipality mentions that they intend to dig up all the roads during the next 50 years due to sewerage work. Therefore, they do not prioritize making measurements of the evenness of their pedestrian areas, which they have done earlier with their bike paths (Respondent02, 2021b).

Like Gladsaxe Municipality, Horsens Municipality seeks to find synergies in their work with maintaining pedestrian areas. For example, when the district heating will be implemented in the municipality, so that sidewalks and the like will not be dug up unnecessarily:

> *"It has caused that they [the maintenance department] have been digging in the ground many places at the same time that the public utility company have been in the ground [. . .] Then we [the municipality] try to find out, whether we can achieve something, if we can reorder priorities of e.g. these sidewalk projects, when the public utility company is digging anyways. Then we can move a curb, make the sidewalk a little wider or whatever we may want. So we try to merge projects."*
>
> (Respondent10, 2021: Own translation)

Several of the municipalities therefore give the impression that restructure of uneven sidewalk tiles is mainly prioritized when it has already been scheduled to dig up the ground. This is because it would otherwise have been too expensive if it would not be done in relation to other projects. However, it is uncertain whether the quality is secured or improved by re-establishment.

Maintenance or Safety?

As mentioned earlier, the maintenance of the pedestrian infrastructure is important for the safety. This is especially true for solo accidents with pedestrians, since solo accidents with pedestrians are often a matter of obstacles on the pedestrian areas, such as uneven tiles, wet and slippery leaves or unsalted sidewalks and pathways. Many of the problems regarding solo accidents with pedestrians can be solved with practical solutions in the daily maintenance. Gladsaxe Municipality, for example, acknowledges that such maintenance issues will not be included in their traffic safety plans because it is their maintenance department that drives around and looks at the roads and measures, what their condition is, and then prioritizes when to repair something (Respondent02, 2021b).

This connection between maintenance and safety for pedestrians in relation to solo accidents is also acknowledged by Aarhus Municipality, who argues that an *"increase [of] the maintenance of the sidewalk areas and pedestrian areas in general [are necessary] in order to avoid solo accidents with pedestrians"* (Respondent03, 2021:

Own translation). Therefore, the municipality believes it is more about the everyday maintenance, when traffic safety precautions are prioritized regarding pedestrians. Solo accidents with pedestrians thus become not only a question of safety, but instead a question of maintenance of the elements that cause the accidents.

Hence, it can be up for discussion how the maintenance should be prioritized in the municipalities. By focusing on maintenance in relation to the basic, such as an even surface without leaves or snow, there will not be made a distinction between what type of pedestrian is favoured, confer *Theory* on page 23. This is because it will favour all pedestrians with better maintenance of the infrastructure, so that the number of solo accidents and near-accidents with pedestrians is reduced.

Furthermore, Aarhus Municipality argues that it would be difficult to include solo accident with pedestrians as an independent focus point in the municipal traffic safety plans, if no support from the government's side is offered. This is due to the fact, Respondent03 argues, that preventive traffic safety measurements for solo accidents with pedestrians is a question of maintenance. Therefore, it is expensive and needs financial support from the government in order to become a part of the municipal traffic safety planning (ibid.).

5.5 Partial Conclusion

Municipal traffic safety plans are framed based on mappings and analysis of the traffic-related challenges in the individual municipalities. Different initiatives are proposed in order to reduce these traffic-related challenges and optimize traffic safety for all the different road users. However, these traffic safety plans are often based solely on the official statistics concerning accidents, and therefore they do not take unreported numbers into account, which most often concerns accidents with vulnerable road users. Furthermore, they do not include solo accidents with pedestrians, which might be due to the fact, that a traffic accident is defined as: *"Any accident involving at least one road vehicle in motion on a public road or private road to which the public has right of access, resulting in at least one injured or killed person"* (European Union, 2010).

What most municipalities focus on instead includes topics such as cars, school roads, and bikes. This is typically in relation to sustainability, health, and reducing the number of killed and injured in traffic. Hence, there is not much room for pedestrians in the plans, which are therefore often ranked alongside cyclists, and therefore do not have their own focus point. Should the pedestrians be mentioned, it is therefore often in connection with vulnerable road users. However, it should be noted that in this connection the focus is on traffic safety for vulnerable road users

in relation to collisions with other road users and not in relation to solo accidents. This distortion in the focus of the different means of transportation in the traffic safety plans is illustrated on table 5.1 on page 35.

This means, as mentioned earlier, that 2,001,009 citizens live in a municipality where they prioritize pedestrian safety in their traffic safety planning, and 353,445 citizens live in a municipality where the planners show awareness of the risk regarding solo accidents with pedestrians. Resulting in only 34,3% of the Danish population in 2020 lived in a municipality where pedestrian safety was prioritized in the municipal traffic safety planning.

It is noticeable that only Aarhus Municipality mentions solo accidents with pedestrians and they do so indirectly when talking about the use of emergency room data, which Aarhus and Odense Municipalities are the only municipalities who use in the time of writing. However, there are multiple municipalities that acknowledge in their traffic safety plans as well as in interviews that they would like to use such data forward, because it can contribute positively to the municipals' traffic safety work.

In Aarhus they use the emergency room data to the same extent as the police registered data. The municipality believes that the majority of the data, which they receive from the emergency rooms are concerning vulnerable road users, and therefore also solo accidents with pedestrians. By using this data, the municipality will therefore get a better picture of the actual accident situation in the municipality, since they have a better foundation for their data to plan from, since the unreported numbers are reduced. The municipality would therefore also like to be helpful in the process of developing a national model, so that more municipalities will benefit from the extra information, which the emergency rooms across the country might provide.

However, Aarhus Municipality believes that much of what needs to be done to increase safety for pedestrians is a matter of maintenance more than a traffic safety related matter.

Some municipalities thus mention that maintenance is important to traffic safety, however the municipalities generally do not mention maintenance in their traffic safety plans much. Furthermore, they refer to their maintenance department in the different municipalities, when they were asked whether they have a municipal maintenance policy.

Thus, it is the maintenance department that prioritizes many of the traffic related problems that may arise in relation to the pedestrian areas in the municipalities, such as uneven tiles in the sidewalk or salting or sweeping of the roads.

Pedestrian Strategies 6

In this chapter the pedestrian strategies from Copenhagen's and Aarhus Municipalities will be presented. Furthermore, Odense Municipality's initiatives concerning pedestrians will likewise be presented, since this sets the basis for the pedestrian strategy they wish to make.

Besides the focus on the municipalities' pedestrian strategies, the international pedestrian treaty, which Copenhagen's and Odense Municipalities support, will likewise be presented.

Respondent07 mentioned that Aalborg Municipality also wants to formulate a pedestrian strategy, but since it is not mentioned in their *Mobility 2040* plan, it is not included (Respondent07, 2021).

6.1 Copenhagen's Municipality

> *"We are all pedestrians. Every day. Sometimes it is just for a walk, other times we are moving towards a certain destination. Even when we move by bicycle, bus, train, metro or car, the journey most often begins and ends by foot."*
>
> (Københavns Kommune, 2012a: 3)

This is how Copenhagen's Municipality's minister of Technology and Environment in 2012, Ayfer Baykal, presents the municipality's pedestrian strategy. Baykal recognizes that walking is not always just a matter of moving from A to B, which recurs throughout the strategy (ibid.).

Copenhagen's Municipality has a vision of becoming the world's best city to live in, which they wish to achieve by becoming a sustainable city with a diverse and unique urban life. They want to design the city in a way that makes people choose to walk, and thereby contribute to a living capital city with a good urban life and environment. In connection with their goal to become the world's best city to live in, they want to encourage more people to walk, so they in turn will exercise more. Thereby they contribute to an improvement of the general health of the citizens both socially, physically and mentally: *"We have an aim regarding developing the walking culture in Copenhagen, so that people choose to walk, because it is healthy, because one participates in the urban life, and because it spares the environment"* (ibid.: 8. Own

translatiom). Therefore, the municipality's focus is on pedestrians, and how they contribute to a better environment recurs in the pedestrian strategy, since walking is a sustainable mode of transportation, and the municipality wants to strengthen the green mobility in the city (Københavns Kommune, 2012a).

The pedestrian strategy is one of three general objectives, from the municipality's 'Metropolis for Humans', which focuses on the urban life in the municipality:

> *"Some urban life is necessary. We need to go shopping, pick up children, go to and from work and school. We do this despite of how the city is designed. All the fun, the recreational urban life, the experiences and the unfolding only happens, if it is nice to be there."*
>
> (Københavns Kommune, 2009: 7. Own translation)

In order to make Copenhagen a nice place to be, the municipality wants to create areas that invite to longer stays such as squares, parks, harbor fronts etc., which can be located both in the city center and in new residential areas. This is connected with the goal that 20 % more of the citizens will stay in the urban spaces in 2015 compared with 2009 (ibid.: 7). Unfortunately, it was not possible to interview the municipality and find out, whether they reached their goal.

Since the pedestrian strategy is developed on the basis of 'Metropolis for Humans', the objectives in the pedestrian strategy is likewise set to be fulfilled by 2015 and it is a wish that Copenhagen should be:

- a city with even and clean sidewalks with places to rest, resulting in high comfort in the pedestrian areas;
- a city with fewer accidents involving pedestrians and thereby a city with higher traffic safety;
- a city with fewer barriers for pedestrians, in order to increase passability;
- a moving city, which offers exciting experiences in all parts of the city;
- a safe city, where people are comfortable walking in their local areas;
- a teaching city, which includes and informs its citizens about activities and traffic;
- an accessible city designed for everyone;
- a green city with green routes and surroundings.

(Københavns Kommune, 2012a: 8)

In order for the municipality to achieve these goals, they have made four focus areas: 1) The development of the walking culture, 2) pedestrian routes and meeting

places, 3) pedestrian zones, and 4) traffic nodes. Through these the municipality wants to encourage the citizens to walk more in their everyday life and to ensure a well-developed network of streets and pathways. Furthermore, they want to make the pedestrian zones gathering points in the different parts of the city. Besides this they want to make the traffic nodes a more accessible part of the pedestrian routes and thereby increase the pedestrians' comfort (ibid.).

As a part of the municipality's work within the field of pedestrians, the municipality joined the international treaty for pedestrians in 2008. This treaty has the following strategical principles:

- Greater possibility to move safely in the public space
- Well-constructed and maintained common areas for people
- Improved network of pedestrian routes
- Promoting pedestrians in spacial planning and use of rural areas
- Less danger in the traffic
- Less crime and less fear for crime
- More support from the governing organs
- A pedestrian culture

(WALK21, 2006: 1. Own translation)

The treaty is based on the thought that: *"We are becoming less healthy, our transport systems are ineffective, and our surroundings are put under still more pressure to accommodate our needs"* (ibid.: 2. Own translation). This WALK21 believes can be helped to a certain extent by more transport being performed by foot. In the treaty's ideal world view, humans choose to walk and have the possibility to do so without friction in the network in order to improve their physical and mental health. Furthermore, the vision targets authorities, organizations and individuals that:

- recognize and commit themselves to the value of walking;
- pull together to overcome the physical, social, and institutional barriers which often limit humans' incentive to walk.

(ibid.: 3. Own translation)

Copenhagen's Municipality is thus ambitious regarding their objectives for pedestrians and they wish to put actions behind their words resulting in concrete initiatives (Københavns Kommune, 2009). However, Copenhagen's Municipality's pedestrian strategy was never approved and according to Respondent12 an alternative plan

has not been made yet. Therefore, these plans to increase the walkability have unfortunately not yet become a reality (Respondent12, 2021).

6.2 Aarhus Municipality

> *"Do not on any account loose the desire to walk. Every day I walk for my daily well-being, and I out-walk every disease. I have walked my way to my best thoughts, and I know no thought so heavy that you cannot walk away from it."*
>
> (Søren Kierkegaard in Aarhus Kommune, 2020: 5. Own translation)

These are the words of Søren Kierkegaard[11] and the very beginning of Aarhus Municipality's pedestrian strategy from 2020. The quote is a clear example of how the municipality is aware that walking is much more than transportation from A to B. Aarhus Municipality writes that they want to focus more on walking as part of a more appropriate way for the inhabitants to transport themselves, as well as walking being beneficial for the environment and public health. Furthermore, the municipality argues that *"there are good conditions for pedestrians here [in the municipality], because moving by foot is the "glue" that binds different modes of transportation together"* (Aarhus Kommune, 2020: 5. Own translation).

Aarhus Municipality has made a pedestrian strategy in relation to their municipal plan from 2017, outdoor plan 2013 - 2017, and their mobility plan concerning Aarhus City Center from 2018 as well as their mobility 2050 plan from 2019 (ibid.). Respondent03 states that the pedestrian strategy is based on a wish to improve the passability for the pedestrians in the municipality, and not necessarily a wish to improve the safety for the pedestrians. However, the municipality is aware that the strategy to a great extent focuses on different questions concerning maintenance, where some of these will likewise improve the safety for the pedestrians (Respondent03, 2021).

In their pedestrian strategy, Aarhus Municipality is aware that pedestrians are different. This is illustrated on fig. 6.1 on the next page alongside how the different types of pedestrians used the city of Aarhus illustrated by the arrows. Comparing the pedestrian types on fig. 6.1 on the facing page to the two types of pedestrians mentioned by Vestergaard et al. (2014) in their investigation, see *Theory* on page 23, it is not necessarily clear, which of the pedestrian types walk for transport or pleasure. An example of this could be a family that might walk for transport one day, and the next they walk for pleasure. This is also the case for several of the other

[11] Danish philosopher, theologian and writer. Born in 1813 and died in 1855 (Grøn et al., 2020).

pedestrian types illustrated on the figure. However, the commuter's main reason for walking is for transport, but this does not necessarily exclude this pedestrian type from walking a detour, should they have the time to do so. That the pedestrian types are so difficult to divide into who walks for transport or pleasure, which underlines the difficulties in planning for pedestrians, since they can walk for one purpose one day and the other purpose the next.

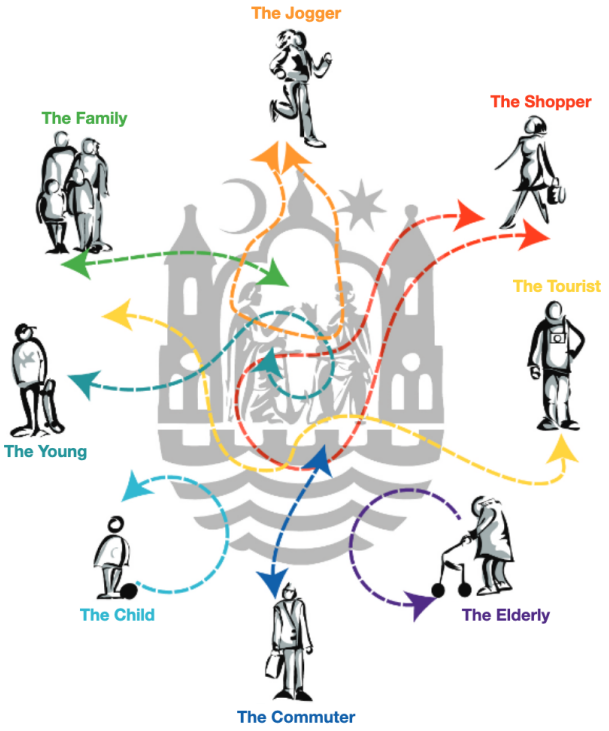

Figure 6.1 Types of pedestrians as presented by Aarhus Municipality (Aarhus Kommune, 2020: 7. Own translation).

Furthermore, the municipality are aware that pedestrians use the city differently, which also depends on the time of day and year: *"Good mobility is individual but also contains parameters such as flexibility, economy, safety and security, stays and experiences, as well as health and well-being"* (Aarhus Kommune, 2020: 6). Once again, this is an expression of how mobility is more than getting quickly from A to B. Therefore, good mobility is a transport system, where the way in which one transports oneself results in the highest value for the inhabitants in their everyday life (ibid.).

Aarhus Municipality has experienced an increase in pedestrian traffic, which among other things is due to the fact that the municipality has created more urban spaces, and thereby made walking more attractive. Due to this increase, the municipality prioritizes more space for the pedestrians as well as better possibilities for crossing the streets. In general, the municipality seeks, especially in the city center, to design the streets, so that they invite to stays. Furthermore, the conditions for pedestrians will be improved, in order to create better accessibility for everyone, including people with reduced functional capacity. Additionally, the municipality wants to minimize physical and social barriers between the different areas in the city by improving the local path network (ibid.).

Another reason that Aarhus Municipality wants more people to walk is to increase public health. It is also for this reason that the pedestrian strategy has been developed in collaboration with the Health & Care Department in the municipality. Together they aim to create the frames and facilities that invite to more physical

activity through active and green mobility. Not only will this improve public health, it will also advance the recreational city life, because walking can be performed in a pace, where all senses can be involved. Furthermore, the municipality wants to prioritize the modes of transportation that take up the least space, e.g. walking and cycling, and at the same time have the greatest health benefits:

> *"When we walk, we use the entire body. It keeps us going, and has a big impact on our health and well-being. If we all walked a bit more, we would all be a little healthier, which in the long run can have a big importance for the collective health of the citizens of Aarhus."*
>
> (Aarhus Kommune, 2020: 7. Own translation)

Aarhus Municipality is aware that in order for walking to become a concrete alternative to other modes of transportation, or to stay at home, the physical conditions must be sufficient. Therefore, it must be safe, both physically and mentally, to walk on the streets and squares, and the accessibility must be good. Furthermore, the municipality would like to present information to the citizens about the possibilities for walking, so it will be easier for them to realize that walking is a real alternative (ibid.).

This has led to four focus areas:

1. **Accessibility:** The pedestrian environment must be accessible to all citizens, including people with disabilities.
2. **Passability:** In order for the citizens to experience easy access to their destination, the pedestrian network must be passable.
3. **Safety:** Aarhus Municipality must be a safe place to be a pedestrian.
4. **Stays and facilities:** The necessary facilities in the urban space must be available in order to invite pedestrians to stay.

(ibid.: 8)

For all four focus areas the municipality works on the basis of a principle of more equality in health. This means everyone must have the opportunity to live a healthy life. The pedestrian strategy shall therefore be a part of creating the possibilities for both children, adults and elderly to transport themselves by foot (ibid.).

The four focus areas result in 20 specific initiatives such as lighting, snow clearing, designing pedestrian areas, focus on urban fixtures etc., see appendix C on page 79 for a complete list of the initiatives (ibid.). When looking at the 20 initiatives, it appears that they are more concerned with passability and accessibility than safety, which agrees with the plan, as mentioned earlier, has been created from a matter of passability rather than a matter of traffic safety (Respondent03, 2021).

It should be noted that the strategy was finally passed in March 2021, why the municipality has yet to begin specific projects related to the different initiatives. The municipality intends to form working groups for each individual initiative, and thereby assess how the different initiatives can be processed and implemented in the best way possible (ibid.).

Despite the fact that the municipality has not yet implemented any of the initiatives, they are aware that they have to assess the projects differently than other transport and mobility projects. This is because *"the assessment of what good conditions are for the pedestrians, is not necessarily the same as for other road users"* (Aarhus Kommune, 2020: 8. Own translation).

Through the evaluations there will be a focus on how mobility is not only measured in travel time and traffic counts, but that it should also be measured through experiences, sensory perception, experienced safety and the quality of the urban space in the municipality. The evaluation will therefore focus on the experienced quality of mobility, and the results are expected to contribute to the work with other strategies and plans of action (ibid.).

6.3 Odense Municipality

> *"The pedestrians are VIP, and they must feel that. Where there are many pedestrians they must be prioritized higher than cars and bikes. Walking must be experienced as a quality, as a positive additional choice."*
>
> (Odense Kommune, 2009b: 36. Own translation)

Despite Odense Municipality not having a pedestrian strategy, they do include pedestrians in their urban space strategy for the city center formulated in 2009. Furthermore, the municipality states in this strategy that they want to make a special pedestrian strategy, where the pedestrian principles concerning safety, passability and accessibility from the city center strategy are further developed (ibid.).

Despite the fact that the urban space strategy was created in 2009, and the fact that in 2011 the City and Culture Committee granted money for the creation of a pedestrian strategy, it has unfortunately not been possible to procure a pedestrian strategy for Odense Municipality yet (Odense Kommune, 2014a). In addition, it has not been possible to interview a representative from the municipality in order to learn more about their focus on pedestrians. Though it should be noted that the municipality adopted the international treaty for pedestrians in 2009 (Odense Kommune, 2009a). It is the same treaty, which Copenhagen's Municipality has commenced, why the same visions and principles are valid for Odense Municipality, confer *Copenhagen's Municipality* on page 47.

Confer the urban space strategy for the city center, Odense Municipality wants to secure good and pedestrian friendly connections to the most important parts in the city. By doing so it makes the healthy and sustainable choice of walking easier, and thereby it is experienced as a quality (Odense Kommune, 2009b).

Odense Municipality has set a goal to become the most sustainable big city in Denmark, which they believe that pedestrians are the key to achieving. The municipality has therefore set some goals for improving the walking experience for the pedestrians, and thereby achieve their goal. The pedestrians goals are the following:

- **Security:** Focus on speed where there are many pedestrians and on the conditions of the overviews and safe crossings.
- **Safety:** Despite the time of day, it must be safe to move around in the city, and it should happen on the pedestrians' terms at the places, where multiple road users are. Special precautions should be taken towards the most vulnerable pedestrians.
- **Accessibility:** The public space must be designed so it can be used by everyone, and it contains the necessary facilities for the pedestrians, including benches, information and public toilets.
- **Passability:** Traffic must not be a barrier, and the pedestrian areas must be kept clear of obstacles and be capable of withstanding everyday traffic.
- **A connected network:** The most important destinations, nodes, green areas, residential areas etc. must be connected via a pedestrian friendly network.
- **Experiences:** The roads must be interesting and adapted to the human scale with a high quality, variation, and identity. Furthermore, the speed must be adjusted to 5 km/h.
- **Comfort:** The environment must be adapted to the pedestrians, so that noise does not become a nuisance, and where it is possible to shelter from the weather. Drinking water and resting opportunities must also be accessible.
- **Contact:** Social inclusion must be a part of the pedestrian connections, and it must be possible to engage in interactions with one another.

(ibid.: 36)

Despite the fact that Odense Municipality has not made a pedestrian strategy yet, it is clear that they have focus on expanding the pedestrian culture through their urban space strategy for the city center. Furthermore, this strategy advocates for pedestrian safety when they move around among other traffic users.

6.4 Partial Conclusion

Of the 18 investigated municipalities, only Copenhagen's and Aarhus Municipalities have made pedestrian strategies, and only Aarhus Municipality has a valid strategy in the time of writing. Furthermore, Odense Municipality has had a wish of having a pedestrian strategy since 2009 based on their urban space strategy for the city center. However, this has yet to be formulated.

Common for both Copenhagen's and Aarhus Municipalities' pedestrian strategies as well as Odense Municipality's urban space strategy for the city center is, that the primary focus is on promoting pedestrian culture in the municipalities. However, all three municipalities write that they focus on safety in the form of e.g. slower speed limits for cars, better options for crossing the streets as a pedestrian, and more clean pedestrian areas. These focus areas clarify some initiatives regarding increasing the general sense of safety and security for pedestrians, because other road users pose as a safety risk as well as a cleaner pedestrian environment focusing on the aesthetics. Copenhagen's and Odense Municipalities do not write about how they tend to measure the traffic safety for pedestrians concerning e.g. solo accidents with pedestrians, which Aarhus Municipality to some extent has included in their strategy. They focus on how walking is more than just a matter of transportation, which all three municipalities agree upon. Furthermore, it is important to keep in mind that Aarhus Municipality uses data from emergency rooms, why the municipality has information regarding solo accidents with pedestrians at their disposal when planning for traffic safety in the municipality, as opposed to Copenhagen's Municipality. Despite of Odense also having available data from the emergency rooms, the municipality does not mention, how they will assess the walking conditions and safety for pedestrians in their municipality, and unfortunately it has not been possible to interview a representative further about this.

Conclusion and Reflections 7

This chapter serves as a conclusion of the findings, regarding to which extent 18 of the biggest municipalities in Denmark focus on pedestrians in their traffic safety planning. This will be followed by a critical reflection of the used methods.

7.1 Findings

> *"We are all pedestrians. Every day. Sometimes it is just for a walk, other times we are moving towards a certain destination."*
>
> (Københavns Kommune, 2012a: 3)

Therefore walking is a big part of our everyday lives, no matter the reason why we walk. However, as with other traffic users, this mode of transportation involves a certain level of risk. If one looks at the municipal traffic safety plans, it appears that 13 municipalities have a direct or indirect focus on pedestrian safety. The municipalities primarily focus on traffic safety in relation to collisions with other road users and not on solo accidents with pedestrians, which might be due to the definition of a traffic accident: *"Any accident involving at least one road vehicle in motion on a public road or private road to which the public has right of access, resulting in at least one injured or killed person"* (European Union, 2010). Only Aarhus Municipality indirectly focuses on solo accidents with pedestrians, since they mention these solo accidents in relation to their use of emergency room registrations. Pedestrian safety is therefore, confer table 5.1 on page 35 an overlooked focus area in the municipal traffic safety plans. Aarhus Municipality is the only interviewed municipalities that, in the time of writing, use emergency room registrations in connection to their traffic safety planning. Among other things the municipality mention *"that is probably what I [the respondent] think is the majority of the accidents that are registered in the emergency rooms, that is solo accidents."* (Respondent03, 2021: Own translation). Furthermore, Aarhus Municipality, and the other interviewed municipalities, support a national model for registration in the emergency rooms, which the Danish Road Safety Commission is also a supporter of. It should also be noted that Odense Municipality likewise uses emergency room registrations in relation to their traffic safety planning, but unfortunately it was not possible to interview a representative

from the municipality. Several of the interviewed municipalities also mention that they have started incorporating emergency room data themselves in their traffic safety planning, for as Respondent05 states: *"One just has to get it going in different places, and suddenly it becomes national, then there will be a pressure on that"* (Respondent05, 2021: Own translation). Despite the fact that the Danish Road Safety Commission likewise wishes to make a national model for the use of emergency room registrations, they do not include solo accidents with pedestrians in their plan of action from 2020 (Færdselssikkerhedskommissionen, 2020a).

Confer table 5.1 on page 35 and table 2.1 on page 14, there are 2,001,009 citizens living in a municipality that has either directly or indirectly focus on pedestrian safety in their municipal traffic safety plan. Only in Aarhus, where there are 353,445 citizens, the municipality focuses indirectly on solo accidents with pedestrians. Furthermore, Aarhus Municipality is the only one of the 18 municipalities that, in the time of writing, has a valid pedestrian strategy, despite that this originates in a wish to increase passability for the pedestrians and not a wish to increase the safety for the pedestrians (Respondent03, 2021). However, the municipality mentions that safety for pedestrians, especially concerning solo accidents, are often a question of maintenance. Additionally, several of the municipalities mentioned that it was the municipal maintenance department that was responsible for maintaining the pedestrian areas, and therefore it is the maintenance department's responsibility to ensure even, clean and possibly salted pedestrian areas and sidewalks. However, all of the municipalities have had an app and/or a website, where the citizens can register, if they come across anything they believe should be taken care of. This could include holes in the road, uneven tiles, downed trees, and so on. In the traffic safety plans, maintenance is mentioned more in an aesthetic manner rather than a matter of passability and safety. However, maintenance in the form of cleaning is also important, since a clean environment attracts more pedestrians to the area, as well as the fact that leaves and trash can hide uneven surfaces that might pose as a fall risk for the pedestrians. Therefore, the operations and maintenance departments are essential in the prevention of solo accidents with pedestrians.

7.2 Reflection of Methods

The choice of literature study and interviews in this thesis has been suitable for the collection of data. However, it can be discussed, whether the way in which the literature has been chosen and the interviews have been performed has been the optimum.

For example, it can be discussed, whether it was right to use the plans from

Horsens, Aalborg, and Gladsaxe Municipalities, respectively, in the literature study. The reason for this is that these plans were either not valid in 2020, or they were not traffic safety plans but rather mobility plans, and therefore these did not focus directly on traffic safety but rather on passability and sustainable mobility. Had these plans not been included in the literature study, there had not been the same level of diversity in the plans. Meaning that there are many ways in which to view traffic safety. Horsens Municipality views it as a matter of passability, whereas Aalborg Municipality views it as a matter of sustainability, where they seek to get more people out of the cars and on the bikes or sidewalks instead.

Furthermore, the use of Copenhagen's Municipality's pedestrian strategy can be discussed, since this was never formally approved (Respondent12, 2021). Therefore, the initiatives in the strategy were never implemented. However, the strategy shows which thoughts the municipality had in relation to the promotion of pedestrians in the municipality. The strategy was the first of its kind in a Danish context, and it depicts how Copenhagen's Municipality would like to prioritize pedestrians in their planning.

The questions to the municipalities were made based on the relevant municipality's traffic safety plan as well as a possible pedestrian strategy. For this reason none of the interviews are identical. If all the interviews contained the same questions, this would presumably have given more uniform responses. By tailoring the questions to the individual municipalities, knowledge regarding how the individual municipalities prioritize in their traffic safety planning, as well as which considerations they have regarding pedestrian safety and solo accidents with pedestrians has been achieved.

Since COVID-19, it has been our experience that there is a bigger willingness to perform interviews online. For this reason, as well as the geographical diverse locations, it has been relevant to do this. If online interviews had not been possible, then surveys could have been used as an alternative. These could likewise have been designed with individual questions for the relevant municipalities. However, it would not have been possible to ask follow up questions to the same extent as with interviews. Therefore, as well as due to the number of respondents, it has been assessed that in this case, the use of online interviews was the most optimum.

In table 5.1 on page 35, the municipalities have been graded in relation to how much they focus on pedestrian accidents, solo accidents with pedestrians, cyclist accidents and cars accidents, respectively, in the relevant municipality's traffic safety plan. This grading has been made based on a review of the plans, why this grading is subjective. The grading has been sought done as objectively as possible. Therefore, the table only indicates how the municipalities prioritize in their traffic

safety planning, and since the traffic safety plans are subject to interpretation, the table is not conclusive.

Suggestions 8

The purpose of this chapter is to make suggestions for the future traffic safety planning, and how solo accidents with pedestrians should be perceived. This will be done on the basis of the investigation regarding the role of pedestrian safety in the municipal traffic safety planning.

8.1 Suggestion 1: Including Solo Accidents

Solo accidents with pedestrians are to a great extent neglected in the preventive traffic safety work. This is probably caused by the low level of inclusion of solo accidents with pedestrians, since this type of accident is not considered a traffic accident, confer the definition: *"Any accident involving at least one road vehicle in motion on a public road or private road to which the public has right of access, resulting in at least one injured or killed person"* (European Union, 2010). Therefore, solo accidents with pedestrians are not included in national statistics, which the Danish municipalities base their work on. This definition of a traffic accident conflicts with the Danish definition of a pedestrian, which is a *"walking person in traffic"* (Det Danske Sprog- og Litteraturselskab, n.d.: Own translation). Therefore, solo accidents with pedestrians should, in our opinion, be included in statistics concerning traffic accidents. For this reason we further suggest that the Danish Road Safety Commission should include solo accidents with pedestrians prospectively in their plans of action in the traffic safety area. Thereby, the Danish municipalities will likewise be aware of this often overlooked accident group, confer *Scoping Review and Research Question* on page 1.

8.2 Suggestion 2: Emergency Room Data

Since 1988 the Danish Road Safety Commission has advocated for the municipalities to start using injury registrations from the emergency rooms: *"The initiative to begin this registration and utilize its possibilities is with the owners of the hospitals, in other words the counties and the individual municipalities. The commission recommends that this registration should be carried out as part of the local traffic safety work"* (Færdselssikkerhedskommissionen, 1988: 81. Own translation). However, not all

municipalities use this data from the emergency rooms in the time of writing. Only Aarhus and Odense Municipalities use this data. Nevertheless, several of the interviewed municipalities mentioned that the use of the data from the emergency rooms would be beneficial for the municipal traffic safety work. Furthermore, several of them were in the process of implementing the collection of emergency room data in their municipality.

The Danish Road Safety Commission expresses a wish for implementing a national data collection model, which includes both police reported accidents, as well as information from the emergency rooms and the National Patient Register, but this has not yet become a reality (Færdselssikkerhedskommissionen, 2020b). Therefore, we suggest that the Danish Road Safety Commission investigates how far the different municipalities are in the process of collecting and using emergency room registrations in their traffic safety work. The basis of this should then begin the development of a national model, so that all municipalities can benefit from the additional information, and in that way increase the level of their traffic safety work by including all types of accidents, such as solo accidents with pedestrians.

8.3 Suggestion 3: Cooperation Between Departments

A well-functioning infrastructure without flaws and deficiencies that also looks inviting, is an important part of the desire to walk. However, this is the maintenance department's area of responsibility and not the planner's, confer *Maintenance of Pedestrian Areas and Sidewalks* on page 41. Therefore, it is important for the safety that these two departments communicate, both in terms of planning and the day-to-day running.

Since the maintenance department is the recipient of the citizen requests concerning the maintenance of the infrastructure, they could be included in the traffic safety planning with advantage. By doing this they can help ensuring that the infrastructure is not only nice and pleasant to look at, but that it also functions as planned concerning safety. For this reason we suggest that the cooperation between the maintenance department and the traffic safety planners increases, and that the maintenance is included to a greater extent in the municipal traffic safety planning.

8.4 Suggestion 4: Promotion of Apps

As mentioned in *The Use of Citizen Feedback* on page 42, 17 of the 18 municipalities have an app and/or a website, where the users can report if they come across

e.g. holes in the pavement or something else they believe should be fixed in the infrastructure. This app is a good tool in anticipating the day-to-day maintenance of the infrastructure, and it might alert the maintenance department of possible areas of conflict before they become a safety issue. However, these apps are only as useful as the number of people using them and giving feedback. Therefore, we suggest that the municipalities consider promoting these apps more, so that more people will report problems in the infrastructure, resulting in increased safety. Furthermore, at one point Silkeborg Municipality also had an app, where the users could report, if they had been involved in solo accidents as a vulnerable road user (Respondent08, 2021). If more municipalities were to implement this as well, depending on the users using it for the right purpose, it could be a useful addition to using emergency room data, if the accident does not require medical attention.

Further Work 9

This chapter presents reflections of further work within this topic, which we believe would both be relevant and interesting to investigate. These topics have one thing in common: they revolve around traffic safety for pedestrians.

9.1 Proposal 1: Factors Causing Pedestrian Falls

Generally, there is very little information concerning solo accidents with pedestrians, which also means that the circumstances for these accidents are hardly investigated and documented. Therefore, it could be interesting to investigate what people were doing when they fell. In other words, which factors were the reason for the fall in question? Was it outer, physical factors such as the infrastructure, or inner factors such as the individual's inattention or level of sobriety.

In order to investigate this, it could be beneficial to send out a survey. In order to get an reliable response rate, the survey must be sent out via the Danish civil registration number registry to all citizens of 18 years and older. The survey should concern their latest falling accident, as long as this accident occurred within the last 12 months in order to secure reliable data. Furthermore, the survey should contain questions regarding the scene of the accident, physical and mental factors that might have caused the accident, degree of the possible injury and whether or not the accident was reported to any authorities such as the police.

Such an investigation will depict solo accidents with pedestrian accidents from the pedestrians' point of view, opposite to this thesis, which has been investigating solo accidents with pedestrians from a municipal point of view. For this reason it would be interesting to compare the two investigations in order to find out, whether the municipalities prevent solo accidents with pedestrians on the right parameters in relation to reducing the number of solo accidents with pedestrians.

9.2 Proposal 2: The Maintenance Departments

Through this thesis, it has become clear that the safety for pedestrians, especially falling accidents, is highly connected with the maintenance of the pedestrian areas. Therefore, it could be interesting to further investigate, how the different maintenance

departments in the municipalities prioritize, which sidewalks should be swept, salted and/or rearranged among all the other tasks the departments perform. Furthermore, it would also be relevant to investigate, if they perform measurements of the evenness of the pedestrian areas, as some municipalities do with the cycle paths.

In order to investigate this it would therefore be ideal to contact the different maintenance departments to find out, how they prioritize their tasks, as well as how they assure the quality of their work. Furthermore, it would be interesting to enquire into which capacity they work together with the traffic safety planners.

Such an investigation will depict solo accidents with pedestrians from the maintenance point of view, which would then turn it into an investigation of the actual conditions of the road. Based on this it would be relevant to investigate possibilities in improving safety for pedestrians.

9.3 Proposal 3: Using Nudging to Increase Traffic Safety

Another interesting way to investigate traffic safety and the increase hereof could be through the use of nudging.

> *"A nudge, as we will use the term, is any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not."*
>
> Richard Thaler and Cass Sunstein in (Brave, 2020)

It could be interesting to investigate to which extent nudging could be used to increase traffic safety. An example of an already existing nudging method is optical illusions of pedestrian crossings that incites the car drivers to slow down[12], as well as speed reducing lines. These lines resemble rumble strips, where the distance between the lines decreases, which gives the car driver the impression that they are speeding up, why they would compensate by slowing down. This is especially useful in the moments up to a hazardous turn (ibid.).

Therefore, it could be interesting to investigate, whether these nudging methods can be used in Denmark, as well as how other methods can be used in traffic and thereby increase the safety for all road users on the Danish roads.

[12] See (Gústi Productions, 2017) for a video illustrating an optical illusion with a pedestrian crossing.

Bibliography

Aalborg Kommune (2019). *Mobilitet 2040*. Danish. Aalborg Municipality, By- og Landskabsforvaltningen (Urban and Countryside Administration). URL: https://www.aalborg.dk/media/12472657/mobilitet2040_plan-2019.pdf (visited on 03/24/2021).

Aalborg Kommune (2020). *Cykelpolitik*. Danish. Draft. Aalborg Municipality. URL: https://www.aalborg.dk/media/12480048/cykelpolitik_forslag_juni2020.pdf (visited on 03/24/2021).

Aarhus Kommune (2013). *Trafiksikkerhedsstrategi 2013-2020*. Danish. Aarhus Municipality. URL: https://www.aarhus.dk/media/12858/bilag-1-aarhus-trafiksikkerhedsstrategi_2013-2020_endelig.pdf (visited on 03/24/2021).

Aarhus Kommune (2020). *Fodgængerstrategi 2020*. Danish. Municipality of Aarhus. URL: https://deltag.aarhus.dk/sites/default/files/documents/Fodg%C3%A6ngerstrategi%20-%202020_0.pdf (visited on 03/10/2021).

Andersen, Anne Anthon (2019). *Bæredygtige byer*. Danish. URL: https://faktalink.dk/baeredygtige-byer (visited on 05/11/2021).

Andersson, Ole Grann (2017). "Bæredygtig asfalt med mere genbrug". In: *TRAFIK & VEJE*. Vejforum. URL: http://php73.vejtid.dk/htdocs/Artikler/2017/11/8811.pdf (visited on 05/11/2021).

Anon. (2019). *Bedre forhold for fodgængere vil styrke den kollektive transport*. URL: https://www.trafikdage.dk/papers_2019/Presentations/Tirsdag_formiddag/linje_6/Notat%20fra%20special%20session%20om%20fodg%c3%a6ngere%20og%20kollektiv%20transport.pdf (visited on 05/05/2021).

Anon. (n.d.). "Introduction". In: *Mobilities* 1 (), pp. 1–18.

Arthritis Foundation (n.d.). *12 Benefits of Walking*. URL: https://www.arthritis.org/health-wellness/healthy-living/physical-activity/walking/12-benefits-of-walking (visited on 02/24/2021).

Bendtsen, Hans (1994). "Trafikkens miljøkonsekvenser". In: *Vejtrafik. Trafikteknik & Trafikplanlægning*. Ed. by Harry Lahrmann and Steen Leleur. Odense: Polyteknisk Forlag. Chap. 12, pp. 337–367.

Blondel, Benoît, Mispelon, Chloé, and Ferguson, Julian (2011). *CYCLE MORE OFTEN 2 COOL DOWN THE PLANET! Quantifying CO2 savings of Cycling*. The European Cyclists' Federation. URL: https://ecf.com/system/files/Quantifying%20CO2%20savings%20of%20cycling.pdf (visited on 05/17/2021).

Bootstrapping (2017). *How UN's Sustainable Development Goals Changed Our Mindset*. URL: https://bootstrapping.dk/en/how-uns-sustainable-development-goals-changed-our-mindset/ (visited on 04/16/2021).

Børne- og Undervisningsministeriet (2020). *Bekendtgørelse af lov om folkeskolen*. Danish. Ministry of Children and Education. Declaration of law regarding municipal primary and lower secondary school. URL: https://www.retsinformation.dk/eli/lta/2020/1396 (visited on 03/23/2021).

Brave (2020). *Hvad er nudging?* Danish. URL: https://nudging.nu/definition-af-nudging/ (visited on 05/24/2021).

Brix, Lise (2020). *Trods klimakrisen: Derfor køber danskerne ikke elbiler*. Danish. URL: https://videnskab.dk/teknologi-innovation/trods-klimakrisen-derfor-koeber-danskerne-ikke-elbiler (visited on 05/11/2021).

Brömmelstroet, Marco Te (2021). From Marco Te Brömmelstroet's LinkedIn. Designed by JAJA Architects. URL: https://www.linkedin.com/feed/update/urn:li:activity:6762735653957500928/ (visited on 03/09/2021).

ByogLandskab (n.d.). *DEN MIDTJYSKE CYKELSTJERNE*. Danish. Landskabsarkitektur og Rådgivning (Landscape Architecture and Counselling). URL: https://byoglandskab.dk/den-midtjyske-cykelstjerne (visited on 03/25/2021).

Danermark, Berth, Ekström, Mats, Jakobsen, Liselotte, Karlsson, Jan Ch., and Studenterlitteratur (2002). *Explaining Society: Critical Realism in the Social Sciences*. Sweden, 1997: Routledge.

Danmarks Naturfredningsforening (n.d.[a]). *Havet er Danmarks sidste vildmark*. Danish. URL: https://www.dn.dk/vi-arbejder-for/vand/hav/ (visited on 05/11/2021).

Danmarks Naturfredningsforening (n.d.[b]). *Transport*. Danish. URL: https://www.dn.dk/energi/transport/ (visited on 05/11/2021).

Danmarks Statistik (n.d.[a]). *59 pct. flere over 80 år i 2030*. Danish. Statistics Denmark. URL: https://www.dst.dk/da/Statistik/nyt/NytHtml?cid=30674 (visited on 02/16/2021).

Danmarks Statistik (n.d.[b]). *Folketal den 1. i kvartalet efter alder, køn, område og tid*. Danish. Statistics Denmark. URL: https://www.statistikbanken.dk/FOLK1A (visited on 04/07/2021).

Danmarks Statistik (n.d.[c]). *Vejnet efter landsdel, tid og vejtype*. Danish. Statistics Denmark. URL: https://www.statistikbanken.dk/statbank5a/selectvarval/saveselections.asp (visited on 04/07/2021).

Dansk Vejforening (2017). *FAKTA OM VEJE*. Danish. URL: https://dv.dk/Vejenes-betydning/Fakta-om-veje/ (visited on 04/07/2021).

Det Danske Sprog- og Litteraturselskab (n.d.). *fodgænger*. Danish. Danish Language and Literature Society. URL: https://ordnet.dk/ddo/ordbog?query=fodg%C3%A6nger (visited on 02/24/2021).

Esbjerg Kommune (2015). *Trafiksikkerhedsplan 2015-2020*. Danish. Esbjerg Municipality. URL: https://www.esbjerg.dk/Files/Filer/Planer_projekter%20og%20trafik/Trafikplanl%C3%A6gning/Trafiksikkerhed/Trafiksikkerhedsplan/Trafiksikkerhedsplan_sept2015.pdf (visited on 03/24/2021).

Europa-Parlamentet (2019). *CO2-emissioner fra biler: fakta og tal (infografik)*. Danish. URL: https://www.europarl.europa.eu/news/da/headlines/society/20190313STO31218/co2-emissioner-fra-biler-fakta-og-tal-infografik (visited on 05/17/2021).

European Commission (2021). *Sustainable transport*. URL: https://ec.europa.eu/transport/themes/sustainable_en (visited on 03/23/2021).

European Union (2010). *Illustrated Glossary for Transport Statistics*. 4th. Eurostat, European Commission. URL: https://ec.europa.eu/eurostat/documents/3859598/5911341/KS-RA-10-028-EN.PDF.pdf/6ddd731e-0936-455a-be6b-eac624a83db4?t=1414781588000 (visited on 02/15/2021).

Færdselssikkerhedskommissionen (1988). *Færdselssikkerhedspolitisk handlingsplan. Betænkning afgivet af Færdselssikkerhedskommissionen*. Danish. The Danish Road Safety Commission. URL: https://www.elov.dk/media/betaenkninger/Faerdselssikkerhedspolitisk_handlingsplan.pdf (visited on 04/26/2021).

Færdselssikkerhedskommissionen (2020a). *2021-2030 Handlingsplan. Anbefalinger til indsatser*. Danish. The Danish Road Safety Commission. URL: https://faerdselssikkerhedskommissionen.dk/media/1090/anbefalinger-til-iindsatser.pdf (visited on 04/26/2021).

Færdselssikkerhedskommissionen (2020b). *2021-2030 Handlingsplan. Mål og Strategi*. Danish. The Danish Road Safety Commission. URL: https://faerdselssikkerhedskommissionen.dk/media/1089/maal-og-strategi.pdf (visited on 04/26/2021).

Feypell, Véronique, Methorst, Rob, and Hughes, Tim (n.d.). *Non-Motorized Pedestrian Accidents: A Hidden Issue*. Results of the ITF/OECD report on Pedestrian Safety, Urban Space and Health. URL: https://www.ictct.net/wp-content/uploads/23-Hague-2010/ictct_document_nr_740.pdf (visited on 02/22/2021).

Frederiksberg Kommune (n.d.). *Trafiksikkerhedsplan 2015-2020*. Danish. Frederiksberg Municipality in collaboration with Moe A/S. URL: https://www.frederiksberg.dk/sites/default/files/2017-01/trafiksikkerhedsplan.pdf (visited on 03/24/2021).

Gadamer, Hans-Georg (1994). "Forword". In: *Introduction to Philosophical Hermeneutics*. Ed. by Jean Grondin. New Haven and London: Yale University Press, pp. IX–XI.

Gentofte Kommune (2016). *Trafiksikkerhed, tryghed og fremkommelighed i Gentofte Kommune. Trafiksikkerhedsplan 2017-2020*. Danish. Gentofte Municipality. URL: https://gentofte.dk/media/fz4hyp5g/anbefalinger-opgaveudvalg-trafiksikkerhedsplan-2017-til-2020.pdf (visited on 03/24/2021).

Gladsaxe Kommune (2020). *Sænk farten på skolevejene*. Danish. Gladsaxe Municipality. URL: https://gladsaxe.dk/kommunen/kommunen/nyhedsarkiv/veje-og-trafik/saenk-farten-paa-skolevejene (visited on 03/24/2021).

Gladsaxe Kommune (n.d.). *Trafik- og Mobilitetsplan*. Danish. Gladsaxe Municipality. URL: https://gladsaxe.dk/kommunen/politik/planer-politikker-og-visioner/veje-og-trafik/trafik-og-mobilitetsplan (visited on 03/24/2021).

Green Key – Green Dreams (2021). *Vi elsker bæredygtig transport*. Danish. URL: https://www.green-key.dk/rejsetips-og-oplevelser/baeredygtig-transport/ (visited on 05/11/2021).

Grøn, Arne, Garff, Joakim, and Cappelørn, Niels Jørgen (2020). *Søren Kierkegaard*. Danish. Den Store Danske. URL: https://denstoredanske.lex.dk/S%C3%B8ren_Kierkegaard (visited on 04/08/2021).

Gústi Productions (2017). *Vegamálun GÍH*. URL: https://www.youtube.com/watch?v=szJbz-z7iJw (visited on 05/24/2021).

Hannam, Kevin, Sheller, Mimi, and Urry, John (2006). "Editorial: Mobilities, Immobilities and Moorings". In: *Mobilities* 1.1, pp. 1–22.

Hansen, Frank and Simonsen, Kirsten (2004). *Geografiens videnskabsteori. En introducerende diskussion*. Danish. 1st ed. Roskilde Universitetsforlag.

Havarikommissionen (2013). *Ulykker med fodgængere*. Danish. Havarikommissionen for Vejtrafikulykker. The Accident Commission for Road Traffic Accidents. URL: http://www.hvu.dk/SiteCollectionDocuments/Tema%2011%20dokumenter/Rapp11_WEB6_UlykkerMedFodg%C3%A6ngere_2.pdf (visited on 05/05/2021).

Health in Aging Foundation (2021). *Tip Sheet: Walking for Older Adults*. URL: https://www.healthinaging.org/tools-and-tips/tip-sheet-walking-older-adults (visited on 05/05/2021).

Holbæk Kommune (n.d.). *Trafiksikkerhedsplan 2020-2025*. Danish. Holbæk Municipality. URL: https://planer.holbaek.dk/media/15859/trafiksikkerhedsplan-2020-2025.pdf (visited on 03/24/2021).

Horsens Kommune (2020). *Håndtering af trafiksikkerhedsprojekter. Prioriteringsmodel og udvælgelse af projekter for 2020*. Danish. Horsens Municipality.

Horsens Kommune (n.d.). *Trafik 2030. Strategi for fremtidens infrastruktur i Horsens*. Danish. Horsens Municipality, Teknik og Miljø (Technology and Environment). URL: https://horsensvokser.dk/Trafik/Trafik/Trafikplanen (visited on 03/24/2021).

Huijbregts, Paul and Rietveld, Piet (2011). "Preface". In: *Transition Towards Sustainable Mobility. New Solutions and Approaches for Sustainable Transport Systems*. Ed. by Jo A.E.E. van Nunen, Paul Huijbregts, and Piet Rietveld. Springer, pp. V–VI.

International Transport Forum (2012). *Pedestrian Safety, Urban Space and Health*. OECD Publishing. URL: https://read.oecd-ilibrary.org/transport/pedestrian-safety-urban-space-and-health_9789282103654-en#page11 (visited on 02/15/2021).

Jensen, Sara Merete Kjeldbjerg, Nielsen, Camilla Lønne, Stiegele, Julian Steffen, and Vasile, Andreea-Diana (2019). *User Mobility in Aalborg Airport. A Study of Place and Non-Place*. 1st semester project, Mobilities and Urban Studies. Aalborg University.

Jørgensen, N.O. (1994). "Trafiksikkerhed og uheldsbekæmpelse". In: *Vejtrafik. Trafikteknik & Trafikplanlægning*. Ed. by Harry Lahrmann and Steen Leleur. Odense: Polyteknisk Forlag. Chap. 6, pp. 181–202.

Kelsey, Jennifer L. et al. (2010). "Indoor and Outdoor Falls in Older Adults Are Different: The Maintenance of Balance, Independent Living, Intellect, and Zest in the Elderly of Boston Study". In: *The American Geriatrics Society* 58, pp. 2135–2141.

Kingham, Simon and Ussher, Shannon (2007). "An assessment of the benefits of the walking school bus in Christchurch, New Zealand". In: *Transportation Research Part A* 41, pp. 502–510.

Københavns Kommune (2009). *Metropol for mennesker. Vision og mål for Københavns byliv 2015*. Danish. Copenhagen's Municipality's Technical and Environmental Administration. URL: https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=646 (visited on 04/22/2021).

Københavns Kommune (2012a). *Flere går mere. Fodgængerstrategi for København*. Danish. Copenhagen's Municipality's Technical and Environmental Administration. URL: https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=943 (visited on 03/10/2021).

Københavns Kommune (2012b). *Fodgængerstrategi for København*. Danish. Copenhagen's Municiplality. URL: https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=943 (visited on 04/22/2021).

Københavns Kommune (2013). *Trafiksikkerhedsplan 2013-2020. Kort version*. Danish. Copenhagen Municipality, Teknik- og Miljøforvaltningen (Technical and Environmental Administration). URL: https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=1155 (visited on 03/24/2021).

Københavns Kommune (2019). *Bylivsregnskab 2019. Tendenser i det københavnske byliv*. Danish. Municipality of Copenhagen. URL: https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=2043 (visited on 03/10/2021).

Københavns Kommune (n.d.[a]). *Fra god til verdens bedste. Københavns cykelstrategi 2011-2025*. Danish. Copenhagen Municipality, Teknik- og Miljøforvaltningen (Technology and Environmental Administration).

Københavns Kommune (n.d.[b]). *Giv et praj*. Danish. Copenhagens Municipality. URL: https://givetpraj.kk.dk/ (visited on 05/03/2021).

Kolding Kommune (2013). *Trafiksikkerhedsplan 2013-2025 for Kolding Kommune*. Danish. Kolding Municipality, By- og Udviklingsforvaltningen (Urban and Development Administration. URL: https://docplayer.dk/39637423-Trafiksikkerhedsplan-for-kolding-kommune-kolding-kommune.html (visited on 03/24/2021).

Kortforsyningen (2021). *Danmarks Administrative Geografiske Inddeling 1:10.000*. Danish. Styrelsen for Dataforsyning og Effektivisering (Administration of Data Supply and Efficiency Improvement. URL: https://download.kortforsyningen.dk/content/danmarks-administrative-geografiske-inddeling-110000 (visited on 05/06/2021).

Lahrmann, Harry, Møller, Katrine Meltofte, and Olesen, Anne Vingaard (2020). "Estimering af antal personskader efter trafikulykker i Danmark baseret på selvrapportering". Danish. In: BUILD Rapport 2020:17. URL: https://sbi.dk/Assets/Estimering-af-antal-personskader-efter-trafikulykker-i-Danmark-baseret-paa-selvrapportering/BUILD-Rapport-2020-17.pdf (visited on 02/15/2021).

Laursen, Bjarne and Møller, Hanne (2011). "The Danish Injury Register". In: *Scandinavian Journal of Public Health* 39, pp. 65–67. URL: https://journals-sagepub-com.zorac.aub.aau.dk/doi/pdf/10.1177/1403494810393564 (visited on 02/22/2021).

Laursen, Jan Grubb (1994). "Planlægning for let trafik". In: *Vejtrafik. Trafikteknik & Trafikplanlægning*. Ed. by Harry Lahrmann and Steen Leleur. Odense: Polyteknisk Forlag. Chap. 15, pp. 431–455.

Li, Wenjun et al. (2006). "Outdoor Falls Among Middle-Aged and Older Adults: A Neglected Public Health Problem". In: *American Journal of Public Health* 96, pp. 1192–1207. URL: https://ajph.aphapublications.org/doi/pdfplus/10.2105/AJPH.2005.083055 (visited on 02/16/2021).

Lungeforeningen (n.d.). *NOx og andre skadelige gasser og partikler*. Danish. The Lung Association. URL: https://www.lunge.dk/luft/viden-nox-og-andre-skadelige-gasser-og-partikler (visited on 05/11/2021).

Methorst, Rob (2021). *Exploring the Pedestrians Realm. An overview of insights needed for developing a generative system approach to walkability*. Ph.D thesis. Delft University of Technology. URL: https://www.swov.nl/en/news/phd-defense-swov-guest-researcher-rob-methorst (visited on 02/22/2019).

Methorst, Rob et al. (2017). "'Pedestrian falls' as necessary addition to the current definition of traffic crashes for improved public health policies". In: *Journal of Transport & Health* 6, pp. 10–12. URL: https://www.sciencedirect.com/science/article/abs/pii/S2214140516304133?via%3Dihub (visited on 02/16/2021).

Miljøministeriet (2007). *Støj fra veje. Vejledning fra Miljøstyrelsen Nr. 4 2007.* Danish. Department of the Environment. URL: https://mst.dk/media/180448/vejstjvejledning3.pdf (visited on 05/17/2021).

Møller, Katrine Meltofte, Olesen, Anne Vingaard, and Lahrmann, Harry (2019). "Bedre data om trafikulykker. Data fra akutmodtagelserne suppleret med selvrapportering". In: *DCE Technical Report No. 291.*

Mulley, Corinne, Gebel, Klaus, and Ding, Ding (2017). *Walking: Connecting Sustainable Transport with Health.* 1st ed. Transport and Sustainability, Volume 9. Bingley: Emerald Publishing Limited.

Næstved Kommune (2018). *Trafikplan 2019-2023.* Danish. Næstved Municipality, Center for Trafik og Ejendomme (Center of Traffic and Buildings) in collaboration with Via Trafik Rådgivning A/S. URL: https://www.naestved.dk/media/aasaxh5h/trafikplan_2019-2023.pdf (visited on 03/24/2021).

Nixon, Hilary and Saphores, Jean-Daniel M. (2007). *Impacts on motor vehicle operation on water quality - Clean-up Costs and Policies.* UC Irvine. URL: https://escholarship.org/uc/item/8tn1w17s (visited on 05/17/2021).

Odense Kommune (2009a). *10 - Tiltrædelse af International Traktat for Fodgængere.* Danish. Odene Municipality. URL: http://78.46.150.91/agenda_item/ld_9A69FC6CE8550DA3C1257626003BDF3B (visited on 04/21/2021).

Odense Kommune (2009b). *Byrumsstrategi. Odense Bymidte.* Danish. Odense Municipality, By- og Kulturforvaltning (Urban and Cultural Administration).

Odense Kommune (2014a). *5 - Anlægsrammen "Bløde trafikanter": Tilgængelighed for alle.* Danish. URL: http://78.46.150.91/agenda_item/ld_C50E014E46068436C1257CB40048A912 (visited on 04/16/2021).

Odense Kommune (2014b). *Strategi for traffiksikkerhed 2015-2020.* Danish. Odense Municipality. URL: https://www.byregionfyn.dk/temp/SBSYS/Dagsordener/By-_og_Kulturudvalge(2015)/08-12-2015/Dagsorden(ID43)/Bilag/Punkt_13_Bilag_2_Strategi_for_trafiksikkerhed_20152020pdf.pdf (visited on 03/24/2021).

Oxley, Jennifer, O'Hern, Steve, Burrt, Duane, and Rossiter, Ben (2018). "Falling while walking: A hidden contributor to pedestrian injury". In: *Accident Analysis and Prevention* 114, pp. 77–82. URL: https://www.sciencedirect.com/science/article/abs/pii/S0001457517300350?via%3Dihub (visited on 02/15/2021).

Pooley, Colin et al. (2013). *Promoting Walking and Cycling: New perspectives on sustainable travel*. 1st ed. Policy Press.

Rådet for Sikker Trafik (n.d.). *Hver ulykke er én for meget - et fælles ansvar. Færdselssikkerhedskommissionens nationale handlingsplan, 2013-2020*. Danish. Council for Safe Traffic. URL: https://faerdselssikkerhedskommissionen.dk/media/1058/handlingsplan-2013-2020-hver-ulykke-er-%C3%A9n-for-meget-et-faelles-ansvar.pdf (visited on 03/24/2021).

Randers Kommune (2015). *Trafiksikkerhedsplan 2014-2020*. Danish. Randers Municipality, Miljø og Teknik (Environment and Technology). URL: https://www.randers.dk/media/12280/randers-trafiksikkerhedsplan-2014-2020_endelig.pdf (visited on 03/24/2021).

Randers Kommune (n.d.). *Cykel- og stiplan. En handlingsplan*. Danish. Randers Municipality, Miljø og Teknik (Environment and Technology). URL: https://docplayer.dk/10737894-Cykel-og-stiplan-en-handlingsplan-randers-kommune.html (visited on 03/24/2021).

Rasmussen, Line Røjkjær (2019). *Pisk eller gulerod? En undersøgelse af trafikpolitiske styringsmidler til at påvirke grøn transportadfærd*. URL: https://projekter.aau.dk/projekter/files/306400133/Afgangsprojekt_hovedrapport.pdf (visited on 05/17/2021).

Respondent01 (2021). *Respondent from Randers Municipality*. Conducted via Microsoft Teams. April 7th, 2021.

Respondent02 (2021a). [e-mail]. Correspondence with respondent from Gladsaxe Municipality, 05/17/2021 11:16.

Respondent02 (2021b). *Respondent from Gladsaxe Municipality*. Conducted via Microsoft Teams. April 9th, 2021.

Respondent03 (2021). *Two respondents from Aarhus Municipality*. Conducted via Microsoft Teams. April 9th, 2021.

Respondent04 (2021). *Respondent from Holbæk Municipality*. Conducted via phone. April 13th, 2021.

Respondent05 (2021). *Respondent from Slagelse Municipality*. Conducted via Microsoft Teams. April 14th, 2021.

Respondent06 (2021). *Two respondents from Roskilde Municipality*. Conducted via Microsoft Teams. April 14th, 2021.

Respondent07 (2021). *Respondent from Aalborg Municipality*. Conducted via Microsoft Teams. April 14th, 2021.

Respondent08 (2021). *Respondent from Silkeborg Municipality*. Conducted via Microsoft Teams. April 15th, 2021.

Respondent09 (2021). *Respondent from Næstved Municipality*. Conducted via Microsoft Teams. April 23th, 2021.

Respondent10 (2021). *Respondent from Horsens Municipality*. Conducted via Microsoft Teams. April 28th, 2021.

Respondent11 (2021). [e-mail]. Correspondence with respondent from Gentofte Municipality, 04/22/2021 10:04.

Respondent12 (2021). [e-mail]. Correspondence with respondent from Copenhagen's Municipality, 05/10/2021 13:20.

Rodrigue, Jean-Paul (2020). "Transportation, Sustainability and Decarbonization". In: *The Geography of Transport Systems*. Ed. by 5th. New York: Routledge. Chap. 4.4. URL: https://transportgeography.org/contents/chapter4/transportation-sustainability-decarbonization/ (visited on 04/13/2020).

Rodrigue, Jean-Paul, Comtois, Claude, and Slack, Brian (2006). *The Geography of Transport Systems*. Abingdon: Routledge.

Roskilde Kommune (2014). *Trafiksikkerhedsplan 2014*. Danish. Roskilde Municipality, Veje og Grønne Områder (Roads and Green Areas) in collaboration with Via Trafik. URL: https://roskilde.dk/da-dk/om-kommunen/udvikling-og-projekter/vi-udvikler-trafikken-og-mobiliteten/trafiksikkerhed-og-trafiksikkerhedsplan/ (visited on 03/24/2021).

Schepers, Paul, Brinker, Berry den, Methorst, Rob, and Helbich, Marco (2017). "Pedestrian falls: A review of the literature and future research directions". In: *Journal of Safety Research* 62, pp. 227–234. URL: https://www.sciencedirect.com/science/article/abs/pii/S0022437517304292 (visited on 02/16/2021).

Silkeborg Kommune (n.d.[a]). *Cykelhandlingsplan 2017. Silkeborg Kommune*. Danish. Silkeborg Municipality, Teknik- og Miljøafdelingen (Technical and Environmental Department). URL: https://silkeborgsektorplaner.viewer.dkplan.niras.dk/plan/68#/ (visited on 03/24/2021).

Silkeborg Kommune (n.d.[b]). *Hvad er skyggeuheld?* Danish. Silkeborg Municipality, Teknik- og Miljøafdelingen (Technical and Environmental Department). URL: https://silkeborgsektorplaner.viewer.dkplan.niras.dk/plan/67#/21164 (visited on 03/24/2021).

Silkeborg Kommune (n.d.[c]). *Kys&Kør pladser skal sikre trygge forhold ved skolerne*. Danish. Silkeborg Municipality, Teknik- og Miljøafdeling (Technical and Environmental Department). URL: https://silkeborgsektorplaner.viewer.dkplan.niras.dk/plan/67#/23885 (visited on 03/24/2021).

Silkeborg Kommune (n.d.[d]). *Lille brik giver "udvalgte" fodgængere mere grønt*. Danish. Silkeborg Municipality. URL: https://silkeborgsektorplaner.viewer.dkplan.niras.dk/plan/67#/21842 (visited on 05/03/2021).

Silkeborg Kommune (n.d.[e]). *Målsætning*. Danish. Silkeborg Municipality, Teknik- og Miljøafdelingen (Technical and Environmental Department). URL: https://

silkeborgsektorplaner.viewer.dkplan.niras.dk/plan/67#/21351 (visited on 04/27/2021).

Silkeborg Kommune (n.d.[f]). *Trafiksikkerhedsplan 2017*. Danish. Silkeborg Municipality, Teknik- og Miljøafdelingen (Technical and Environmental Department). URL: http://silkeborgsektorplaner.viewer.dkplan.niras.dk/plan/67#/ (visited on 03/24/2021).

Slagelse Kommune (2021). *Giv et praj - om park og vej*. Danish. Slagelse Municipality. URL: https://www.slagelse.dk/borger/trafik-veje-og-havne/giv-et-praj-om-park-og-vej (visited on 05/03/2021).

Slagelse Kommune (n.d.). *Trafiksikkerhedsplan*. Danish. Slagelse Municipality, Center for Miljø, Plan og Teknik (Center of Environment, Planning and Technology). URL: http://sektorplaner.slagelse.dk/dk/trafiksikkerhedsplan/forside/ (visited on 03/24/2021).

Sørensen, Mette Mandrup (2008a). *Bilags- og Notatrapport*. Danish. URL: https://projekter.aau.dk/projekter/files/14460190/Skadestueregistrering_af_trafikuheld_bilag.pdf (visited on 05/17/2021).

Sørensen, Mette Mandrup (2008b). *Skadestueregistrering af trafikuheld*. Danish. URL: https://projekter.aau.dk/projekter/files/14460189/Skadestueregistrering_af_trafikuheld.pdf (visited on 05/17/2021).

Sørensen, Michael (2006). *Grå strækninger i det åbne land. Udvikling, anvendelse og vurdering af alvorlighedsbaseret metode til udpegning, analyse og udbedring af grå strækninger*. Danish. Ph.D thesis. Aalborg Universitet: Institut for Samfundsudvikling og Planlægning. URL: https://vbn.aau.dk/en/publications/hazardous-road-sections-in-rural-areas-development-application-an (visited on 09/02/2019).

State of Victoria (2020). *Walking for good health*. URL: https://www.betterhealth.vic.gov.au/health/healthyliving/walking-for-good-health (visited on 02/24/2021).

Trafik-, Bygge- og Boligstyrelsen (n.d.). *Råden over vejarealer*. Danish. Traffic, Building and Accommodation Administration. URL: https://www.borger.dk/transport-trafik-rejser/Veje/Raaden-over-vejarealer (visited on 04/07/2021).

Transport- og Boligministeriet (1978). *Cirkulæreskrivelse om sikring af skoleveje (* 1)*. Ministry of Transport and Housing. URL: https://www.retsinformation.dk/eli/accn/C19781121310 (visited on 05/17/2021).

UKEssays (2017). *Relationship between Transport and Environment*. URL: https://www.ukessays.com/essays/environmental-sciences/the-relationship-between-transport-and-environment-environmental-sciences-essay.php (visited on 05/17/2021).

Vejdirektoratet (2016). *Rådgivning indenfor Trafiksikkerhed*. Danish. Danish Road Directorate. URL: http://kls.vejdirektoratet.dk/DA/vejsektor/ydelser/raadgivning-og-salg/trafikogsikkerhed/Documents/Trafiksikkerheds_haefte_061216_web.pdf (visited on 03/23/2021).

Vejdirektoratet (2017). *Indberetning af færdselsuheld. Rapportnr 580*. Danish. The Danish Road Direktorate. URL: https://www.vejdirektoratet.dk/api/drupal/sites/default/files/2019-03/indberetrning_af_faerdselsuheld_web.pdf (visited on 02/22/2021).

Vejdirektoratet (2020a). *Store forskelle på trafikulykker i landets politikredse*. Danish. [Press Release]. The Danish Road Directorate. URL: https://www.vejdirektoratet.dk/pressemeddelelse/store-forskelle-paa-trafikulykker-i-landets-politikredse (visited on 02/15/2021).

Vejdirektoratet (2020b). *Trafikulykkerfor året 2019*. Danish. The Danish Road Direktorate. URL: https://www.vejdirektoratet.dk/api/drupal/sites/default/files/2020-10/Trafikulykker%202019.pdf (visited on 02/22/2021).

Vejdirektoratet (2021). [e-mail]. Correspondence with Katrine Terp Nielsen, engineer in Traffic Safety and Cycling at the Danish Road Directorate 02/11/2021 13:20.

Vejle Kommune (2018). *Trafiksikkerhedsplan 2018-2020*. Danish. Vejle Municipality in collaboration with Via Trafik Rådgivning A/S. URL: https://www.vejle.dk/media/26990/vejletrafiksikkerhedsplan2018-20_populaerudgave_050218.pdf (visited on 03/24/2021).

Vestergaard, Maria Quvang Harck, Olesen, Mette, and Helmer, Pernille Falborg (2014). "The Act of Walking: Exemplifying Danish Pedestrian Culture". In: *Walking in the European City. Quotidian Mobility and Urban Ethnography*. Ed. by Timothy Shortell and Evrick Brown. Surrey, England and Burlington, USA: Ashgate Publishing Limited. Chap. 3, pp. 41–56.

Viborg Kommune (2012). *Trafikplan for Viborg Midtby*. Danish. Viborg Municipality, Teknik og Miljø (Technology and Environment). URL: https://viborg.dk/media/ywufia5j/trafikplanpop_red4-1.pdf (visited on 03/24/2021).

Viborg Kommune (n.d.[a]). *Giv os et Borger Tip*. Danish. Viborg Municipality. URL: https://viborg.dk/service-og-selvbetjening/selvbetjening/giv-os-et-borger-tip/ (visited on 05/03/2021).

Viborg Kommune (n.d.[b]). *Trafikplan. Fodgængere*. Danish. Viborg Municipality, Teknik og Miljø (Technology and Environment). URL: https://viborg.viewer.dkplan.niras.dk/plan/12#/5761 (visited on 03/24/2021).

Viborg Kommune (n.d.[c]). *Trafikplan. fokusområder*. Danish. Viborg Municipality, Teknik og Miljø (Technology and Environment). URL: https://viborg.viewer.dkplan.niras.dk/plan/12#/5785 (visited on 03/24/2021).

Viborg Kommune (n.d.[d]). *Trafikplan. Forside*. Danish. Viborg Municipality, Teknik og Miljø (Technology and Environment). URL: https://viborg.viewer.dkplan.niras.dk/plan/12#/5737 (visited on 03/24/2021).

Viborg Kommune (n.d.[e]). *Trafikplan. Mål*. Danish. Viborg Municipality, Teknik og Miljø (Technology and Environment). URL: https://viborg.viewer.dkplan.niras.dk/plan/12#/5945 (visited on 03/24/2021).

WALK21 (2006). *International Traktat for Fodgængere*. Danish. URL: https://www.kk.dk/sites/default/files/edoc_old_format/OEkonomiudvalget/02-12-2008%2015.15.00/Referat/05-12-2008%2013.25.38/4126214.PDF (visited on 04/23/2021).

WHO (2007). *WHo Global Report on Falls Prevention in Older Age*. World Health Organization. URL: https://www.who.int/ageing/publications/Falls_prevention7March.pdf?ua=1 (visited on 02/16/2021).

WHO (2018). *Falls*. World Health Organization. URL: https://www.who.int/news-room/fact-sheets/detail/falls (visited on 02/16/2021).

World Commission on Environment and Development (1987). *Report of the World Commission on Environment andDevelopment: Our Common Future*. URL: https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf (visited on 05/17/2021).

Appendix A

Municipality	Traffic safety plan - name	Pedestrian accidents	Solo accidents with pedestrians	Cyclist accidents	Car accidents	Other focus areas	Ureported numbers + ER registrations	Pedestrian strategy	Bicycle strategy	Link to the traffic safety plan	Valid years	Number of inhabitants
Copenhagen												
Aarhus												
Aalborg												
Odense												
Vejle												
Esbjerg												
Frederiksberg												
Randers												
Viborg												
Silkeborg												
Kolding												
Horsens												
Herning												
Roskilde												
Næstved												
Slagelse												
Gentofte												
Sønderborg												
Holbæk												
Gladsaxe												

Figure A.1 Excel sheet used during the literature study.

Appendix B

Municipality	Phone number	Contact person	Department	Contacted	Status	GDPR document sent	GDPR recived signed
Copenhagen							
Aarhus							
Aalborg							
Odense							
Esbjerg							
Vejle							
Frederiksberg							
Randers							
Viborg							
Silkeborg							
Kolding							
Horsens							
Roskilde							
Næstved							
Slagelse							
Gentofte							
Holbæk							
Gladsaxe							

Figure B.1 Excel sheet used for contact information of the municipalities.

Appendix C

Initiatives in Aarhus Municipality's pedestrian strategy

Accessibility

1. Accessibility strategy
2. Procedures for accessibility in Aarhus
3. Designing pedestrian areas
4. Park and Walk
5. Increased use of accessibility revisions

Passability

1. Improved conditions for pedestrians in intersections
2. Interconnected path network
3. Bicycle parking
4. Focus on pedestrians at roadwork
5. Snow clearing
6. Special disposal of road areas

Safety

1. Lighting
2. Classification of pathways in green areas
3. Analysis of pedestrian accidents
4. Have a traffic safety committee

Stays and facilities

1. Distance between residences and recreational areas
2. Urban spaces for everyone
3. Urban fixtures
4. Utilisation of waiting time for movement and experiences
5. Maintenance and cleaning

(Aarhus Kommune, 2020: 18)

For more information regarding the specifics of the different initiatives, see (ibid.).

Appendix D

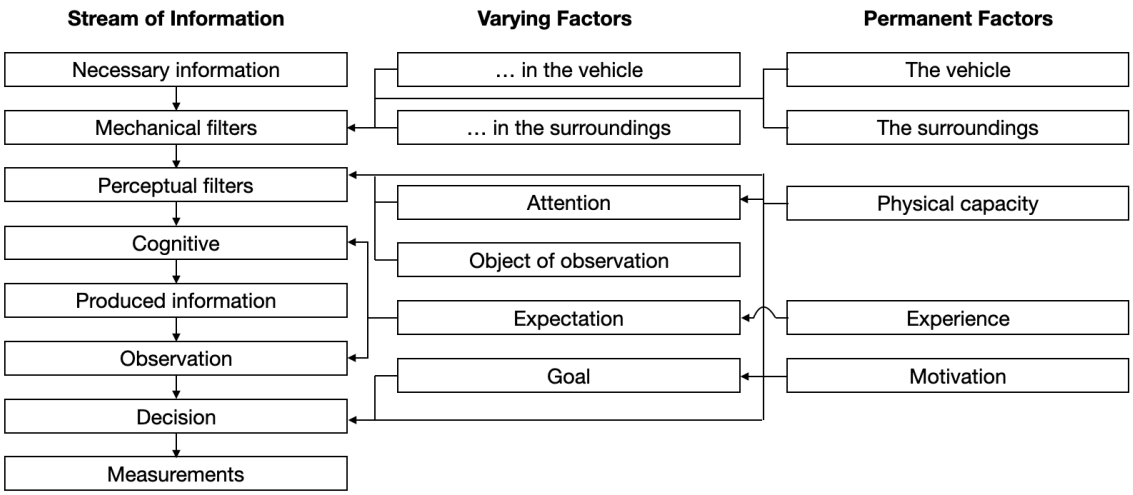

Figure D.1 Analysis model based on information processes (Jørgensen, 1994: Own translation).