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Comparative Analysis of the Urban Mobility Plans of Stockholm and Helsinki

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Summary

Stockholm and Helsinki have extensive public transport systems and are at the top ten in the world regarding urban mobility. Still, the cities strive for more people to use public transport, and they want to be the front-runners of urban mobility in the world, also in the future. The purpose of this study is to analyse the urban mobility plans of these cities, and to see how the plans relate to each other, how they plan on achieving their goals and if they are in line the science of public transportation.

The method used was comparative analysis. The similar aspects from the urban mobility plans of Stockholm and Helsinki were presented, then compared, and lastly analysed within a theoretical framework.

It was found that for the most part, the methods used by cities are quite similar. However Stockholm's approach is more of quantitative nature, whereas Helsinki's approach is on the qualitative side. Both plans together have made use of the achievements of science. In the end it is difficult to tell whether their goals will be achieved, and to make more conclusions, further analysis is needed.

Language: English Key words: urban mobility, SUMP, comparative analysis, Helsinki, Stockholm

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Tiivistelmä

Tukholman ja Helsingin laajat kaupunkiliikennejärjestelmät ovat maailman kymmenen parhaan kaupungin joukossa. Silti ne tavoittelevat lisää joukkoliikenteen käyttäjiä ja haluavat jatkossakin olla kaupunkiliikenteen johtohahmoja maailmassa. Tämän tutkimuksen tavoite on analysoida näiden kaupunkien kaupunkiliikennesuunnitelmia, ja nähdä minkälainen yhteys niillä on, kuinka ne aikovat toteuttaa tavoitteensa ja ovatko ne linjassa joukkoliikennettä käsittelevän tieteen kanssa.

Käytetty menetelmä oli vertaileva analyysi. Suunnitelmien samankaltaiset ominaisuudet esiteltiin, sitten niitä vertailtiin ja lopulta ne analysoitiin tieteen valossa.

Opinnäytetyössä todettiin, että kaupunkien käyttämät menetelmät olivat suurimmaksi osaksi samankaltaisia. Tukholman menetelmät olivat kuitenkin määrällisiä, kun taas Helsingin menetelmät olivat laadullisia. Molemmissa suunnitelmissa on käytetty tieteellisiä selvityksiä. Loppujen lopuksi on kuitenkin vaikea sanoa, saavuttavatko kaupungit tavoitteensa ja ennen pidemmälle vedettyjä johtopäätöksiä tarvitaankin lisätutkimuksia.

Kieli: Englanti Avainsanat: kaupunkiliikenne, kestävän kaupunkiliikenteen suunnitelma, vertaileva analyysi, Helsinki, Tukholma

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1 Introduction

The automobiles were invented in the beginning of the 20th century, and ever since then their numbers have grown and there is no visible end in sight. They have revolutionised mobility and are today an inseparable part of the life of people in developed countries, as urban sprawl means that people have to use their cars to move about.

Climate change is challenging the inseparability of people and cars, because fossil fuel emissions from cars are a big contributor to the existence climate change. In order for the humankind to reduce those emissions and slow down climate change, the amount of emissions from private automobiles must be cut back, as transport accounts for 26% of global CO_2 emissions (Chapman, 2007). Stockholm and Helsinki have both set their eyes on being the front-runners in this challenge. Helsinki wants to be fossil fuel free by 2035 (Helsinki City Council, 2017), and Stockholm by 2040 (City Executive Office, 2016).

The cities have taken the approach of urban mobility planning to meet their goals of fossil fuel emission reduction. The main target areas of urban mobility are increasing the usage of public transport and its capacity to attract car users to switch to public transport. Walking and biking are crucial factors in this as well, and both cities have extensive plans for increasing the modal split of those modes of transport. In this thesis the different methods that Stockholm and Helsinki have planned to take will be evaluated using a comparative analysis.

In the first chapter, background and theory will be presented, followed by the description of the method. After that the results in the form of comparative analysis, after which there is a discussion of the findings, and in the end the references used can be found.

2 Background

Stockholm and Helsinki have both set a goal to be fossil fuel free in a rather near future. For Helsinki the date is 2035 and for Stockholm it's 2040. In order to achieve this, they need to drastically reduce their greenhouse gas emissions. Emission reduction is partly an international pressure, because the world needs to work together to keep climate change to a minimum. Even so, both Stockholm and Helsinki want to be in the front line in the battle against climate change. They have both signed the Paris Agreement in 2015, and in

addition to curtailing the emissions, being sustainable is at the core of it, and that means urban mobility planning is too.

2.1 Theoretical framework

In 2013 the European Union introduced the Urban Mobility Package, which gives proposals for actions and measures to be taken in the Member States, regarding mobility in their urban areas (European Commission, 2017). For this package, the concept of Sustainable Urban Mobility Plan (SUMP) was created to make urban mobility planning more integrative and multidisciplinary than before, as it recognises the complexity of the issue at hand. (Eltis, 2018)

The SUMP outlines the characteristics of a sustainable urban mobility and transport plan. Its main goal is to improve the accessibility of urban areas by implementing high-quality transport, and to have long-term vision and planning on how this will be achieved. In addition, the SUMP requires a short-term implementation plan, where schedule, responsibilities and funding is determined, alongside with establishing the current conditions to see if the plan has had an impact, and include citizens in the planning process to ensure the needs of all groups are taken into account. In short, the goals of the plan should be SMART: specific, measurable, achievable, relevant and time-bound. (Eltis, 2018)

In essence, the Sustainable Urban Mobility Plan, by contributing to developing an urban transport system, should create a "sustainable, affordable, accessible and frequent transport for everyone". (European Commission, 2017)

With this in mind, a sustainable and affordable transport system requires that the economics of the plan be in order. One way to decrease costs per trip in the transport system is to increase the energy efficiency of it. Böhler-Baedecker and Hüging explored this in 2012, and discussed three levels with which the energy efficiency of urban transport can be measured.

The three levels to increase energy efficiency in the transport sector are *travel efficiency* for trips, *system efficiency* for the whole transport system and *vehicle efficiency* for individual vehicles (Böhler-Baedecker & Hüging, 2012). Here, the strategies to improve

them are discussed, except for vehicle efficiency, as it is mostly excluded from the urban mobility plans of both Stockholm and Helsinki. Similarly, Chapman (2007) says: "To achieve a stabilisation of greenhouse gas emissions from transport, behavioural change brought about by policy will also be required - technological innovation won't be enough."

The strategy to improve *travel efficiency* is to "reduce energy consumption per trip" (Böhler-Baedecker & Hüging, 2012). One way to reduce energy consumption is to make use of energy-efficient modes of transport, such as public transport, walking and cycling, instead of automobiles. A big part in improving travel efficiency is encouraging people to use the more efficient forms of travel. Encouraging can mean for example building high-quality pedestrian and cycling infrastructure and public transport system, as well as reducing the convenience of car use. Besides these examples, figure 1 gives an insight to the potential methods to improve energy efficiency.

Moreover, improving travel efficiency is necessary, as the energy consumption per capita depends greatly on the proportion with which private vehicles and public transport are occupied. The higher the occupancy rate of vehicles, the more energy efficient they are. Consequently, this can also reduce congestion, which in turn is crucial in emission reduction. (Böhler-Baedecker & Hüging, 2012)

The fundamental strategy for improving *system efficiency* is reducing the need to travel. The main factor behind a decline in zero-carbon trips such as walking and cycling is that fewer destinations are within walking and cycling distance (Chapman, 2007). Furthermore, according to Böhler-Baedecker and Hüging (2012) the energy consumption per capita rises proportionally as city density falls.

To improve system efficiency land use needs to be mixed, so that social and economic activities are brought closer together (Figure 1). A dense city structure will mean that people are more likely to walk and cycle because distances are short (HLJ, 2015), which consequently means that the amount of emissions decreases too. (Böhler-Baedecker & Hüging, 2012) Other possible measures to achieve these three levels of efficiency can be seen in Figure 1.

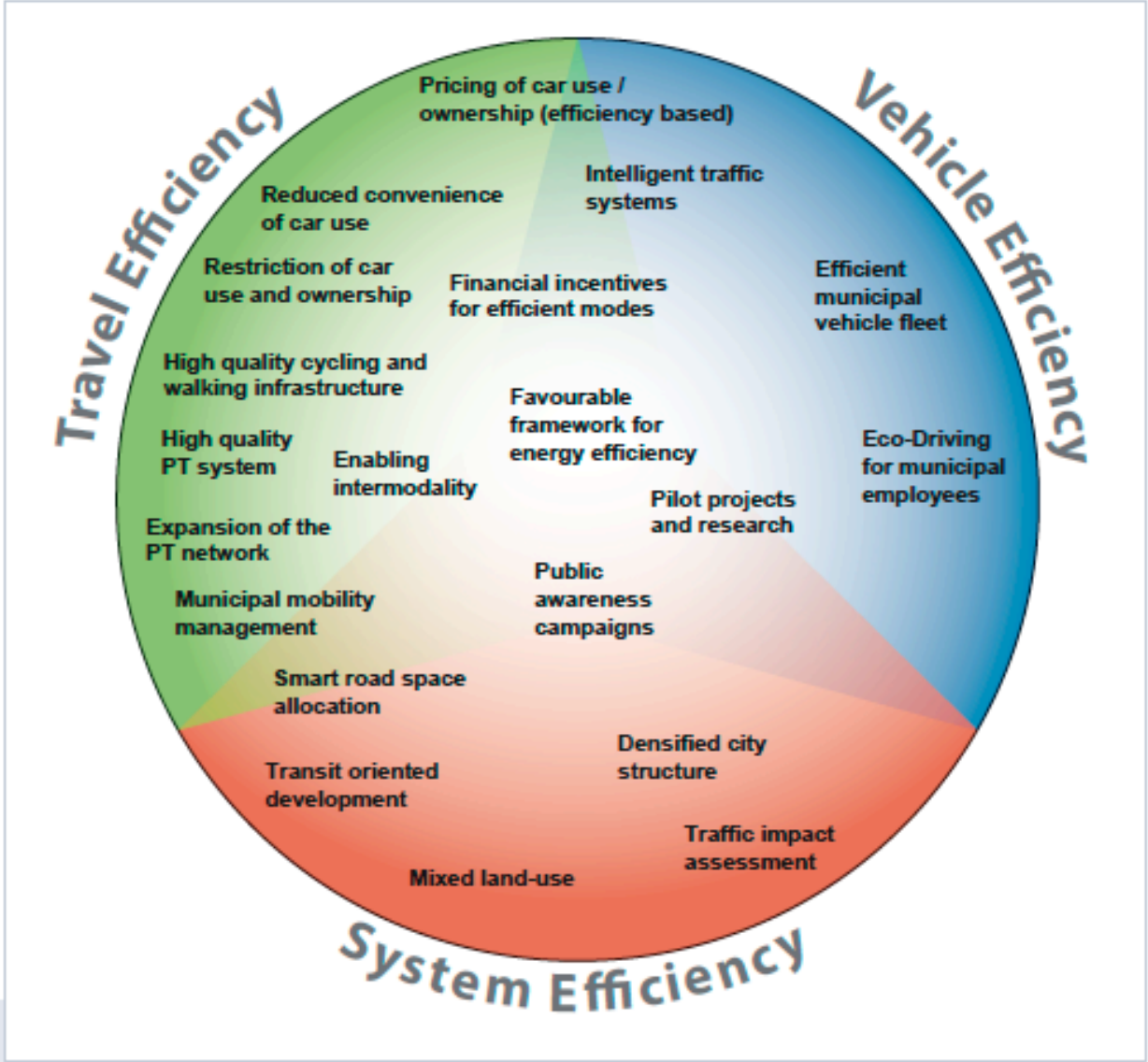

Figure 1. Measures to take to improve energy efficiency, grouped into fields of activity (Böhler-Baedecker & Hüging, 2012).

In order to realize sustainable transport, a change in the mind-set of people is needed. The use of automobiles should be a tertiary mode of transport after zero-carbon modes such as walking and cycling, being first, and public transport being second. To begin with, the public transport system has to be improved. Van Audenhove et al. (2014) has come up with a strategy, with which cities with already extensive public transport systems could attract even more users. The strategy proposes supplementary solutions to the transport system; meaning real-time information and more third party services such as car or bike sharing should be provided (Van Audenhove et al. 2014, 34). The thinking of the public transport system needs to shift to a customer-based view, and offer a combination of solutions, where public transport is combined with public individual transport like the above-mentioned car sharing, or even car rental or taxi (Van Audenhove et al. 2014, 34).

This fully integrated and seamless transport would increase the attractiveness of public transport (Van Audenhove et al. 2014, 7).

2.2 Presenting the cities and the plans

The cities compared in this thesis are Stockholm, Sweden, and Helsinki, Finland. Stockholm had a population of 950 000 in 2017, with a population density of 5000 people per km^2 (Statistics Sweden, 2018). Helsinki had 635 000 inhabitants in 2016 with a population density of 2900 people per km^2 (Tilastokeskus, 2018).

Stockholm and Helsinki are compared because of the similarities of the cities. Both are capitals of Nordic countries, with extensive existing public transport systems. These cities are also bordered by the Baltic Sea and share a similar demographic as well as climate and economic situation. They want to be front-runners for climate-friendly cities, and set an example for other cities worldwide. (Firth, 2012) (HLJ, 2015)

The urban mobility plan of Stockholm is called the “Urban Mobility Strategy”, written by Daniel Firth from the Traffic Administration of the city of Stockholm in 2012 (Figure 2). It is a strategy with four planning aims: capacity, accessibility, attractiveness and sustainability (Firth, 2012).

The plan of Helsinki is the “Helsinki Region Transport System Plan” written by HLJ 2015 project (HLJ), and published by the HSL Helsinki Region Transport in 2015 (Figure 2). Its main aims are accessibility and fluency, and responsibility meaning social, economic and ecological sustainability (HLJ, 2015). As can be seen, the plans share two aims: accessibility and sustainability.

Figure 2. The covers of the urban mobility plans of Stockholm (on the left) and Helsinki (on the right).

The public transport network of Stockholm is vast and includes four tramway lines, three metro lines, two light rail lines and several commuter train and bus lines. The rail transit network of Stockholm is pictured in Figure 3. The share of public transport in the modal split is 33% (Figure 5). In the inner city 50% of the trips were made on foot in 2012, and in the suburbs the respective number was 30% (Firth, 2012, 42). The modal share of cycling in 2013 was 9% (Bund e.V., 2011), and its cycle path network density is the third highest in the world with 4041km/1000km^2 (Van Audenhove et al. 2014).

According to the study done by Van Audenhove et al. (2014), Stockholm has a mobility score of 57,4, which is the second highest in the world, right after Hong Kong (Figure 5). The mobility score assesses the maturity of the transport system of the city, as well as its performance. Assessment indicators include, among others, measurements of average emission concentrations, share of public transport in modal split and car and bike sharing performance (Van Audenhove et al. 2014).

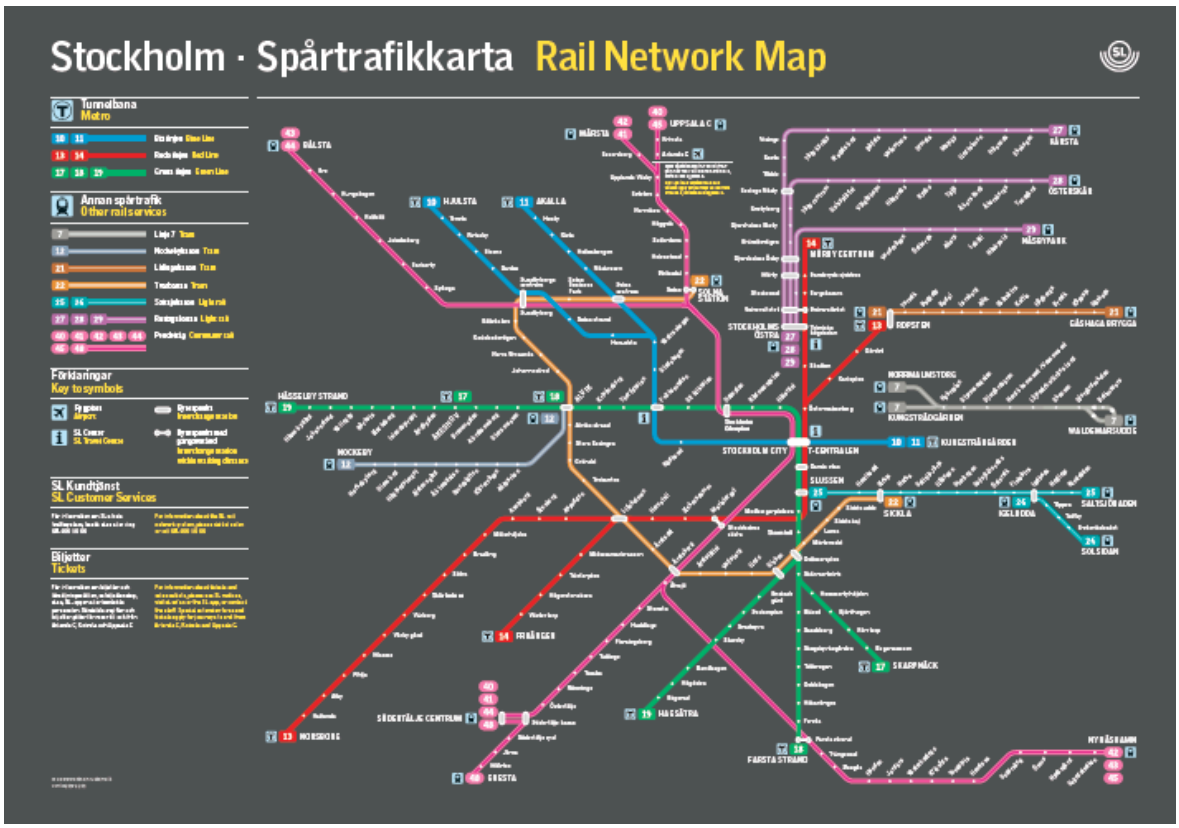

*Figure 3. Stockholm rail network map. (*Storstockholms lokaltrafik*, 2017)*

The public transport network of Helsinki comprises of 10 tramway lines, one metro line, one rapid transit bus line and a wide network of buses and commuter trains. In figure 4 the tramway network of Helsinki is pictured.

The modal split in Helsinki regarding public transport is slightly lower than in Stockholm, 27% (Figure 5). The cycle path network density however is the highest in the world, with 4678km/1000km^2 (Van Audenhove et al. 2014**)**, and the modal share of cycling was 11% in 2014 (Bund e.V., 2011). Helsinki has a mobility score of 53.2, the 9th highest in the world (Figure 5).

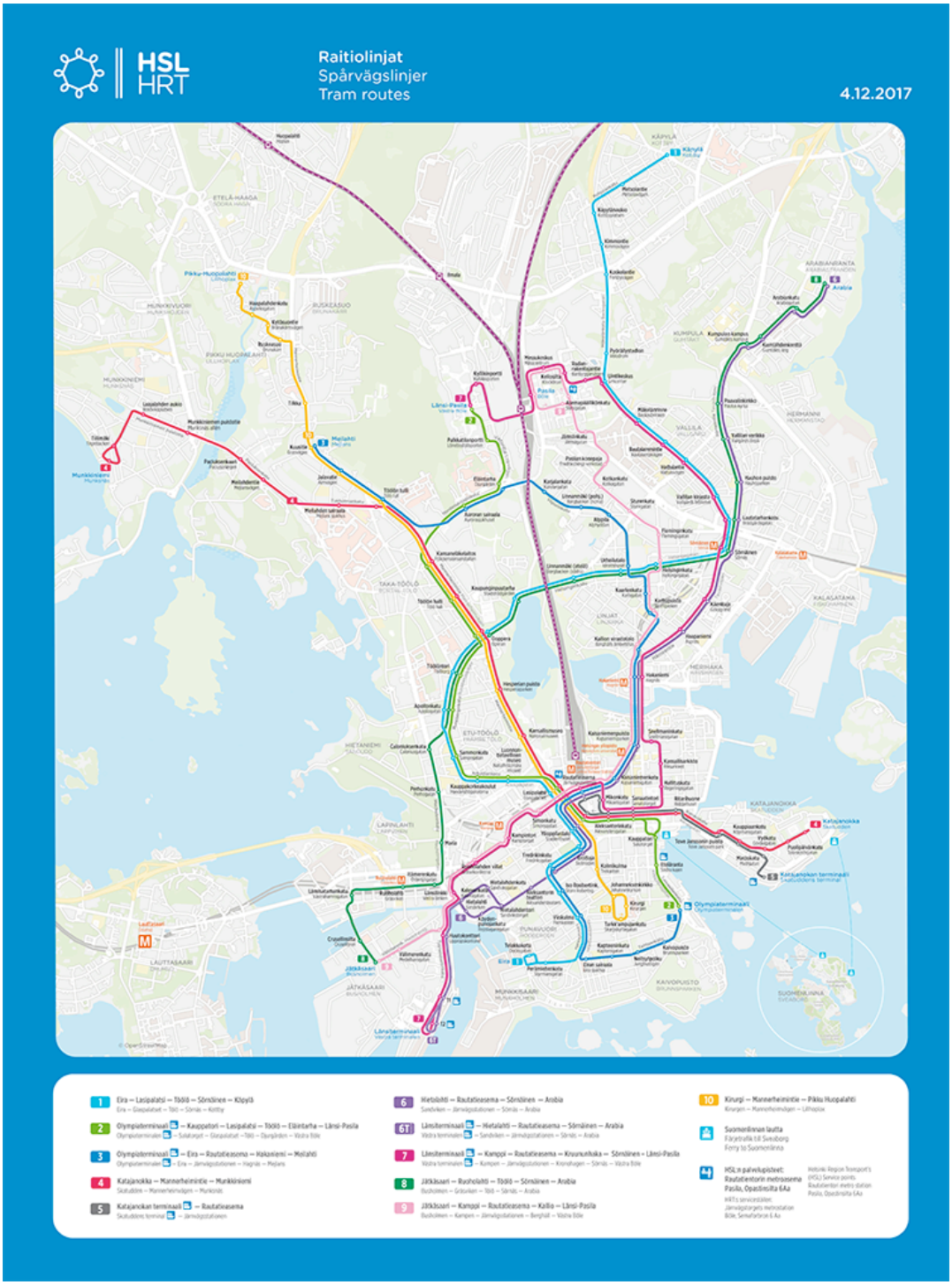

Figure 4. Helsinki tram routes. (Helsingin seudun liikenne, 2017)

		Maturity indicators												Performance indicators							
		Fin. attract. of PT (cost of 5 km PT/ cost of 5 km car)	Share of public transport in modal split [%]	Share of zero-emission modes in modal split [%]	Roads density (deviation from optimum) [km/km^2]	Cycle path network density [km/ths km^2]	Urban agglomeration density [citizens/km^2]	Smart card penetration [cards/capita]	Bike sharing performance [shared bikes/ million citizens]	Car sharing performance [shared cars/million citizens]	Density of vehicles registered [vehicles/capita]	Frequency of the busest public transport line [times/ day]	Initiatives of public sector (0 to 10 scale)	Transport related CO_2 emissions [kg/capita]	Annual average NO_2 concentration [mcg/m^3]	Annual average PM_{10} concentration [mcg/m^3]	Traffic related fatalities per 1 million citizens	Dynamics of share public transport in modal split [%]	Dynamics zero-emission modes in modal split [%]	Mean travel time to work [minutes]	OVERALL SCORE
1	Hong Kong	1.7	55%	38%	2.0	187	6.5	3.1	0	0	0.07	324	10	776	50.0	50.0	16.2	+20%	0%	36.6	58.2
2	Stockholm	6.7	33%	34%	0.5	4,041	3.7	0.6	852	400	0.40	212	10	1,348	12.5	16.7	9.4	-7%	+89%	33.7	57.4
3	Amsterdam	3.0	8%	50%	1.7	3,502	3.2	0.7	527	1,219	0.32	130	10	844	30.0	24.7	19.5	+12%	+13%	35.5	57.2
4	Copenhagen	4.8	27%	33%	2.7	3,977	2.7	0.1	1,025	246	0.24	238	10	812	56.0	28.0	4.1	+123%	-15%	29.7	56.4
5	Vienna	3.9	39%	34%	0.6	2,948	3.8	0.0	692	415	0.39	277	10	1,111	21.7	21.5	16.1	+15%	+13%	29.3	56.0
6	Singapore	2.6	48%	23%	2.6	280	7.3	2.9	19	57	0.18	233	9	1,381	22.0	29.0	32.5	+17%	+64%	36.8	55.6
7	Paris	2.9	34%	50%	8.8	3,520	3.8	0.6	2,224	219	0.46	267	10	1,163	39.2	38.0	23.9	+7%	0%	38.6	55.4
8	Zurich	3.8	39%	31%	0.7	3,700	4.2	0.0	232	1,064	0.54	149	10	1,200	30.1	19.1	15.4	+15%	+3%	30.4	54.7
9	London	3.9	34%	26%	10.8	254	5.6	3.1	1,012	253	0.39	468	10	1,050	37.0	22.9	26.6	+10%	+4%	44.1	53.2
9	Helsinki	3.6	27%	40%	2.1	4,678	2.3	0.9	0	70	0.48	246	10	1,228	28.0	20.2	13.9	-16%	+8%	28.5	53.2
11	Munich	4.6	21%	42%	0.1	3,862	3.0	0.0	727	640	0.56	210	10	1,351	35.3	21.7	15.3	0%	+11%	30.1	53.0

Figure 5. Top 11 cities in the world ranked based on their mobility score. (Van Audenhove et al. 2014)

2.3 Purpose

The purpose of this study is to analyse the urban mobility plans of Stockholm and Helsinki, and to see how the plans of two cities with similar features relate to each other and what points do they have in common. It is also important to see if the set goals are likely to be achieved, and how the plans follow the concept of the SUMP and other relevant science.

This topic was chosen because it is timely, as many countries and cities have declared wanting to be fossil fuel free in the near future. What has been given less attention, are the measures that the cities intend to take to achieve this goal. This thesis is a study of the urban mobility plans of two cities, which hope to contribute to the emission-free future of their citizens, and that's why the plans are also evaluated based on whether they contribute to the ambition of becoming fossil fuel free.

3 Method

The method chosen is a comparative analysis. This method was chosen to highlight the many similarities, and some differences, in the urban mobility plans of Stockholm and Helsinki, and to analyse how the plans of two relatively similar cities are shaped. A comparative analysis allows for grouping of the content of these two plans, and for them to be presented together detecting the notable reasons behind their similarities and differences.

Data used is almost exclusively from the urban mobility plans themselves, as the plans are both extensive and contain a lot of material. Consultants appointed by the cities collected the data for the plans, so it is considered reliable and accurate. The future changes in their public transport systems are based on these plans.

In addition to the urban mobility plans, some topics related to public transport are covered in the cities' separate city and land use plans. They were not used in this study, which can cause some information to be lacking, especially when considering the differences. Some differences pointed out here may be addressed in the city plan. This is a comparison of the two urban mobility plans, and should be treated as such.

The focus of this thesis is on private people, and how their choices and needs of travel are addressed in the urban mobility plans. In the plans logistics and businesses are considered as well, but as their needs are very different from the needs of private people, those are not taken into account in this particular study. Even though all aspects in the plans are loosely linked, for the sake of narrowing the scope, not all features can be taken into account.

The two plans are very differently arranged, and that has sometimes caused problems with presenting the data in a comparable form. Also, translations from the Finnish language in the case of the Helsinki plan may have some minor discrepancies.

4 Results

4.1 Organisation of the comparative analysis

In this comparative analysis, the similarities between the two cities are presented and analysed, after which some interest is drawn to the differences of the plans. In the end a conclusion is formed.

The comparison is ordered under subheadings. Each subheading represents a topic discussed in the urban mobility plans. On each topic the elements from Stockholm are presented first, then the arguments from Helsinki, and finally they are compared and analysed against each other. The organization of the analysis follows the guidelines of Kerry Walk (1998) from the Writing Center at Harvard University.

The urban mobility plan of Stockholm has four main aims, which are capacity, accessibility, attractiveness and sustainability. The plan includes objectives for each of these aims. In the plan it is then specified what happens if each objective is achieved, what is required to fulfill the objective, what happens if nothing is done, who is responsible, and what is the current situation. At the end of the plan an appendix lists proposed measures to tackle these objectives. (Firth, 2012)

In its urban mobility plan Helsinki states that its aims are accessibility and fluency together with social, economic and environmental responsibility. In the first part of the plan, the background of the topic is covered, followed by the aims, then the strategy itself and finally the impact assessment. (HLJ, 2015)

The main visible difference in the strategies is the order. When Stockholm lists all the effects and impacts of each objective after said objective, Helsinki groups objectives together to provide a wider scope of things. Helsinki does this at the cost of precision, as Stockholm's objectives and goals are very precise. Furthermore, Stockholm addresses the impacts after each objective, when Helsinki analyses its plan as a whole in the end, and what its repercussions are. This actually allows for a clearer view on what the final impacts of the whole plan are, which is important, as both cities state that the plans are interconnected and cannot be separated without losing something.

4.2 Cross-city routes and nodes

The first similarity of the plans of Stockholm and Helsinki are that they both promote cross-city routes. A cross-city route, or corridor, is a public transport route that links one suburb or district to another, usually a distant one. It can also connect a distant district to better access to the inner city by connecting it to a suburban railway or tramway station. Cross-city corridors allow for a more efficient network because radial connections only connect suburbs through the city centre. In fact, most cities have a lot of these radial routes, so for a long time, travelling between districts has been easiest and fastest by car, and this is the problem the cross-city routes are trying mend.

4.2.1 Cross-city routes and nodes in Stockholm

In objective A2 of the Stockholm plan, it is stated that 80% of the traffic in the peak hours should be public transport (10% increase from 2010) by 2030. One method with which Stockholm wants to achieve this is to strengthen the cross-city routes that link city districts. This will increase the attractiveness and reliability of public transport and therefore ultimately increase its usage. In addition, these cross-city routes will link some districts to a rail traffic station, so they also have better access to the inner city.

Another way Stockholm plans to increase public transport usage is by making more dedicated lanes for public transport than before. In fact, this would have an effect in the whole city because travel-time in public transport would become more reliable, also on cross-city routes. Moreover, eight public transport nodes have been pinpointed in Stockholm. In those locations services will be improved, especially regarding parking space.

4.2.2 Cross-city routes and nodes in Helsinki

Helsinki's goals with the cross-city routes are to connect different centres, and create a wide public transport network, where more city districts have good accessibility. Helsinki intends to have five cross-city bus lines by the year 2025, and four radial bus lines. According to the Helsinki plan a fast and frequent connection attracts more users, and it will also increase the predictability of travel-time. Currently 54% of all trips in Helsinki are made by public transport.

Additionally, Helsinki wants to improve the connections to the corridors. These connection points are called nodes. Without adequate connections, the full potential of the new routes won't be reached. Furthermore, if more connections to the nodes are added, regional centres are also better connected to the corridors.

4.2.3 Cross-city routes and nodes comparison

For both Helsinki and Stockholm the main goal is to increase the use of public transport, the secondary goal being to improve the reliability and fluency of the journeys. Both cities have suburbs with poor connections, and they want to make them more accessible. Cross-city routes are vital in connecting different parts of the city, as are the nodes where transition from one mode of transport to the next is made.

The goals in both strategies are measurable and specific: Helsinki wants five cross-city bus lines by 2025, and Stockholm wants 80% of journeys to be made by public transport during peak traffic hours by 2030. Stockholm's main method is to have dedicated lanes for public transport, when Helsinki simply wants to increase the amount of routes. To sum it up, increasing public transport connections will increase the usage of the system, but cross-city corridors will also significantly reduce travel-time for people who use them, which will probably reduce car use in this group of people.

4.3 Biking

Stockholm aims to become a world-class cycling city. They want to have a well-functioning bike network, that's also safe. Similarly, Helsinki wants to increase the use of bicycles by making it more attractive and fluent, as well as safe.

4.3.1 Biking in Stockholm

While Stockholm also has a "Bicycle Plan", it addresses the bikers' needs in the urban mobility plan too. Stockholm wants 15% of all journeys during peak hours to be made with bicycles by 2030 (Objective A3), which would be a 5% increase from when the plan was made in 2012.

Stockholm recognises that it's important to reserve more space for cycle lanes, and that that's a crucial method to increase bicycle usage. Because of the limited space on the roads, removing or moving parking spaces to make way for bikers has been considered, especially "on the most important commuting corridors" (Firth, 2012, 27). And where it is not possible to create enough space for an increasing amount of bikers, speed limits for cars should be lowered to make biking safer. A safe place to leave the bike is also a prerequisite for increasing the amount of bikers.

4.3.2 Biking in Helsinki

Helsinki's aim for cyclists is similar to that of Stockholm's. Helsinki wants to have a good quality regional bicycle network. The city wants the network to be ready by 2040, and it has priority in the urban mobility plan, as it is one of the most cost-effective measures to increase zero-carbon transport, of all the methods projected.

Better upkeep of cycling paths during winter is also proposed, as well as regional programs to promote biking and walking as ways to transport. According to the plan, better timetable information at public transport stations could also increase the amount of bikers, as many cycle to a public transport station to switch to a bus or a tram. Having real-time information about delays makes planning easier and travel-time more reliable. Keeping this in mind, the city aims to grow the number of bicycle parking spots at public transport connection points by 8200 by the year 2025.

4.3.3 Biking comparison

Even though both Stockholm and Helsinki aim to have a wide and well-functioning bicycle network and increase bike use, their methods to achieve this are different from each other. Stockholm's methods are mainly focused on maximising the use of space and they suggest making cycle lanes in the road network. In contrast, Helsinki doesn't have an issue with space, but is more focused on increasing cycle paths within the regional bicycle network, outside the road network. The plan also focuses on the upkeep of winter roads, and promoting the use of bikes as well as a high quality information system.

As mentioned earlier, the population density of Helsinki is 2900 people/km^2, while the one of Stockholm is almost double of that, 5000 inhabitants/km^2. This can mean that

Stockholm has more shortage of space than Helsinki, which could be the reason Stockholm's methods are directed towards increasing space on the roads for cycling, while Helsinki focuses on a regional cycling network.

Another difference between the two plans is that Stockholm clearly lists the parties responsible for planning, creating and coordinating the changes for the objective, when Helsinki states that those will be specified in following works. Funding for the plan however is openly demonstrated for Helsinki (biking paths are funded half by municipalities and half by the state, KUHA-funding), when Stockholm is completely lacking in this aspect. This could of course, be listed in the "Bicycle Plan" of Stockholm, but funding is an essential part of any big project, and should be addressed.

One last difference in the cycling part is the information systems. The urban mobility plan of Stockholm makes no mention of an information system, which could mean that one is already in place. Regardless, Helsinki seems to make abundant effort in ensuring a smooth transition from cycling to public transport.

4.4 Walking

Significantly, both Stockholm and Helsinki want to plan their cities particularly for pedestrians. Keeping in mind that most of the trips taken in the cities are by foot, both realise that a vibrant urban environment increases the city's attractiveness and vitality, and as a consequence, increase walking even further. A friendly and safe walking space increases the use of public transport too because when walking is seen as pleasure, people are more likely to do it, and less likely to think of it as a chore to walk to a public transport stop.

4.4.1 Walking in Stockholm

The city plan of Stockholm has been named the Walkable City, and it's an integral part of the urban mobility plan too. Its key aspect is to reduce the need to travel by building denser and creating destinations that are varied and within a short distance of each other. Short distances invite people to walk and cycle.

In planning aim C of the urban mobility plan, the objective specifies that Stockholm wants 60% of journeys made in the inner city to be on foot by 2030, and 50% in the suburbs (compared to the current 50% and 30% respectively).

Improved walkability means that roads and streets are seen as attractive areas. In order to achieve this, the plan proposes to first identify the places that are frequented with a lot of pedestrians, and start by making those areas more attractive and pleasant. For this to be possible, city officials are required to change their thinking from considering streets and roads as only being there for transport, to realising they are a social place too. According to the plan walking has social and recreational values, and that people living in walking-friendly areas are more likely to know their neighbours, be politically active and socially responsible. (Firth, 2012)

The plan also states that in order for people to walk more, the environment needs to be easy to navigate. Walking routes should be direct, and connect different destinations.

4.4.2 Walking in Helsinki

In Helsinki walking is considered a cornerstone of sustainable transport. One big goal for improvement, similar to Stockholm, is making walking safer and more attractive, especially in the centres and in public transport nodes. To enhance attractiveness, the plan proposes more space for pedestrians, and that plans are made from pedestrians' perspective instead of car users'.

To increase safety, one option that Helsinki proposes is to completely separate the walking space from all other traffic, and reducing speed limits and traffic altogether. Winter upkeep is essential too. In addition, the urban mobility plan recommends promoting walking and biking in municipalities.

An appealing pedestrian space increases the vitality and the pleasantness of the area, which in turn leads people to spend more time there, which can have a positive effect on nearby businesses. Unobstructed access plays an important role too as it gives population groups such as the elderly and the disabled more freedom and a possibility for an active lifestyle.

Funding in Helsinki's urban mobility plan is in a big role. The focus point of the KUHA-funding (cost-effective funding) is on walking and biking, as they are the most cost-effective measures to increase overall sustainability of modes of transport.

4.4.3 Walking comparison

Pedestrian traffic combined with public transport is a highly efficient way to use the street capacity, according to the Stockholm plan. Both cities clearly recognise this, as their priorities lie in improving the prerequisites of walking.

As shown above, both cities have very similar objectives. Safety is in a significant role in both plans, and they recognise the need to have more space for pedestrians, and Helsinki proposes the possibility to separate walking space from other modes of transport, even biking.

In its plan, Stockholm addresses the need to build denser in order to attract more walkers, and says that shorter distances invite people to walk more. This is in part confirmed in the Helsinki plan as it states, that in Helsinki ¾ of trips less than 1 km are made on foot. This is a great example of why building dense and having varied destinations within a short distance is so effective. And even though Helsinki has plans to build denser too, it doesn't refer to this when addressing walking.

Both Helsinki and Stockholm acknowledge streets to be a social place, but Stockholm goes one step further referring to studies that say people who live in walking-friendly districts are more socially responsible. The mentioned studies are not referred to in the plan, so the question remains how accurate the information is.

Stockholm's aims on walking are more quantitative and measurable than Helsinki's, and it has relatively clear goals. The Stockholm plan admits to needing more studies to specify their walking aims, but overall the goals are precise. Helsinki has a wider scope in its plan, and walking is considered a priority, but the measurable goals are few. Walking and biking together as one are seen as a priority, but the biggest method is to improve the regional bicycle network. There are no concrete goals to measure if the walking conditions have been improved. Even so, Helsinki admits that more planning is required, and that in a future phase distinct goals are needed.

4.5 Tramway

Stockholm and Helsinki both have existing tramway lines, and they want to further expand them. The reasons behind investing in a tramway are many. Despite its initial building costs being higher than that of a bus line, it is cheaper when calculating per traveller and per trip (HLJ, 2015). The operating costs also grow slower than the amount of passengers will (HLJ, 2015). The tram is not easily hindered by congestion, which makes the travel-time very reliable. A tramway can also add value to the buildings in the surrounding area, as it is a relatively permanent investment, different from the bus.

4.5.1 Tramway in Stockholm

Stockholm's aim is to expand the city centre by making the travel patterns in nearby suburbs similar to those of central Stockholm. To achieve this, workplace and housing density need to be increased, and the expansion of tramway to the suburbs is important in making travel similar to the inner city.

Keeping this in mind, the plan wants to connect districts by cross-city tramway lines (objective A2), which they describe as the backbone of Stockholm's transport network (Firth, p.34, 2012). The tramways belong to the rapid transit network, which includes buses and trains as well. As said, with the expansion of the tramway network, the city hopes to expand the city centre. In addition to that, Stockholm wants to convert a busy rapid bus line to a tramway.

As mentioned earlier, space is a problem for Stockholm, so in addition to building dense, more space is needed for public transport and tramway. In objective A2 it is stated that "The most important bus and tram lines must be given dedicated lanes by taking space from parking or mixed traffic lanes."

4.5.2 Tramway in Helsinki

According to the Helsinki plan, tramway increases the eco-efficiency of their public transport system. The tramway system will be expanded step-by-step starting from inner city (see current network in Figure 4). In the Helsinki plan the strengthening of the inner city tramway has been given second priority, right after walking and biking. A new

tramline, further from the inner city is also in planning phase, to substitute a busy existing rapid bus line. The focus is nevertheless on making full use of the current system, and improving connections to the existing network, to get more users, because that will boost the efficiency.

Yet, the plan sees a fault in the planning of the tramway: the current land use plans to the end of 2040 will not see a substantial increase in population on certain areas where a tramway line is being planned. So some capacity of the tramway will remain unused. The plan proposes to further increase the combination of land use and urban mobility planning, and to take full advantage of areas that already have good accessibility.

4.5.3 Tramway comparison

Identically, both cities have extensive on going and future plans to expand their tramway network. Both also want to start the expansion from the inner city, and replace rapid transit bus lines with tramway. As seen earlier, Stockholm is, perhaps forced, to take into account building dense, at least more so than Helsinki.

Funding in the Stockholm plan is not listed, when in Helsinki it is stated that for tramway the government will contribute to the costs of new tramway lines together with the city. Schedules are missing from both strategies, and even though plans are there to convert a bus line to a tramway, the goals are only preliminary and without detail. The lack of actual decisions in the plans could in part be because of the high initial investment of tramway, which can slow the decision-making process. These missing aspects are perhaps covered in another plan, but nevertheless could be tackled here too. In conclusion, tramway is definitely seen as the public transport method of the future; seeing that it is an essential part of both of these urban mobility plans.

4.6 Differences between the plans of Stockholm and Helsinki

4.6.1 Unique aspects in the Stockholm plan

Stockholm and Helsinki have different needs when it comes to expanding their public transport network. Whereas Helsinki has no mention about redirecting traffic or taking space from it, those themes are constant in the Stockholm plan.

In other words, most of Stockholm's methods for making public transport travel-time more reliable are about directing the traffic. Stockholm wants to have more dedicated lanes for public transport, which are discussed in its Appendix that has proposed measures for the aims of the urban mobility plan. In the proposed measure 1 it's suggested that moving traffic should be prioritised over stationary traffic. Removing parking spots from busy lanes during the day, to allow space for a lane for public transport only, could be a solution. Another measure would be to take space from all other moving traffic except public transport. This would mean banning any manoeuvres that can disturb the traffic, such as left turns.

Signal priority for public transport is suggested as well. This could mean giving public transport priority at traffic lights, which would in turn mean that all other traffic crossing the transit traffic would have worse accessibility. In addition to that, there are other ways to slow traffic. Parking fees and congestion tax are some methods Stockholm has already implemented and is looking into their expansion because they have been successful.

4.6.2 Unique aspects in the Helsinki plan

Helsinki is also looking into making travel-time more reliable, but using completely different methods than Stockholm. Rather than focusing on signal priority or dedicated lanes for public transport, Helsinki is putting a lot of effort into incident management and information systems.

Helsinki says in its plan that users of the public transport system should have easy access to information about modes of transport, routes, conditions, services, costs and emissions. That can have an impact to the choice of transport, to the fluency of the journey and safety.

However, it is unclear how and when this information will be implemented. (HLJ, 2015, 56)

4.7 Conclusion of the comparative analysis

In summary, Helsinki and Stockholm have many similarities in their urban mobility plans. Their situations vary mostly because of the higher population density in Stockholm. The goals to improve the urban mobility are notably similar yet their methods differ. Both cities want to develop the accessibility of suburbs, increase the amount of cyclists and pedestrians and build more tramway lines.

The differences are mainly linked to the scarcity of space, and Stockholm also needs to arrange traffic to be the most suitable for public transport, and not so much for private vehicles. Helsinki in turn has devoted a lot of thought for information systems. In general, Stockholm has very precise objectives and ways to achieve them. Helsinki on the other hand has a wide outlook without much detail.

5 Discussion

The concept of Sustainable Urban Mobility Plan (SUMP) was created to help European countries to plan their urban mobility, it is interesting to compare the requirements set by the SUMP to the plans of Helsinki and Stockholm. The urban mobility plans of both cities have the same goals as the SUMP. All these plans wish to create sustainable transport for everyone, and increase accessibility along with it. The SUMP was introduced in 2013, which means that the urban mobility plan of Stockholm was already published by then. Helsinki's plan was published only in 2015, but makes no mention of the European Union context.

The Stockholm plan, even though it was published before the SUMP guidelines, follows most of its requirements. The Stockholm plan as a whole has a long-term vision drawn from the Stockholm City Plan, and almost all objectives have listed a schedule, the parties responsible and the current situation. In addition an impact assessment is included. The parts required by the SUMP but missing in the Stockholm plan are funding and

participatory planning. The objectives themselves are SMART, as they are all specific, measurable, achievable, relevant and time-bound. The precision of goals is satisfying, but without a proper action plan and funding the goals cannot be achieved.

When Helsinki composed their urban mobility plan, the SUMP guidelines were at their disposal. Nevertheless, Helsinki's plan fulfills less of the objectives of the SUMP than the Stockholm plan. Unlike in Stockholm, funding and participatory planning are present, but the parties responsible and the current situation are missing. In addition, the schedule is loose, but a short-term implementation plan is referred to being planned in a separate document (KUHA). The goals in the Helsinki plan are not SMART, because they are not specific, measurable or adequately time-bound.

When it comes to measuring the energy efficiency, several measures exist to improve travel and system efficiency, as seen in Figure 1. Stockholm and Helsinki use many of these measures in their plans. Stockholm wants to connect city districts by creating cross-city routes, which means it is doing an "expansion of the PT [public transport] network". The same is true for Helsinki. By creating these wide urban mobility plans clearly indicates that they want a "high quality public transport system" as well.

Intermodality is thought of in both plans too. Investing in public transport nodes increases the possibility to go to a public transport stop by bike or by bus. And, as Helsinki intends to increase the amount of bicycle parking spots, that enables intermodality even further. The prospective information systems in Helsinki help with this too, because reliable travel-time is essential when having to choose between the comfort of the automobile and public transport.

Walking and cycling are priorities in the two plans. Stockholm is calling itself the "Walkable city", and Helsinki has prioritised walking and cycling above everything else in its urban mobility plan. So a "high quality cycling and walking infrastructure" from Figure 1 will be put in place.

In addition in Stockholm the city will implement signal priority for public transport, which means that other modes of transport will be slowed, meaning the plan has "reduced convenience of car use". Stockholm has also already created a congestion tax for the inner city, which means that they are using the "pricing of car use".

System efficiency is also demonstrated in the urban mobility plans of both cities. Helsinki and Stockholm recognise the requirement to reduce the need to travel, and how it means that land-use must be mixed so that people can work, live and do their everyday tasks within walking or cycling distance. Equally important is to have "transit oriented development" to have as many people living close to public transport routes as possible. This not only increases the ridership of public transport, but also reduces car use when public transport is close by. "Public awareness campaigns" will be used in the municipalities of Helsinki, which is according to Figure 1 also a valid measure to increase system efficiency.

Some of these methods to improve system efficiency are related to city and land use planning, which is why they are not extensively covered in the urban mobility plans. Regardless, the shift towards public transport usage is best affected by land use planning, which is why it should be an integral part of any urban mobility plan.

As shown above, the urban mobility plans of Stockholm and Helsinki have very similar goals. The methods to achieve these goals vary to a degree, but ultimately the plans resemble each other. The resemblance gives strength to the arguments why those goals or methods were chosen. With both being in the top ten in the world based on modality scores (Van Audenhove et al. 2014), and top three in cycle path network density, it is clear that these cities are already front-runners when it comes to sustainable public transport.

Lastly, as Van Audenhove et al. (2014) say, in cities where the modal split of public transport is high, new methods need to be implemented to attract even more users. Old methods will only do so much, and a new way of thinking must be adopted. Offering solutions that go beyond expanding the public transport network to a seamless transport system with car sharing and rentals at public transport nodes is the future.

6 Conclusion and critical analysis

As a conclusion, it is difficult to see whether the cities of Stockholm and Helsinki will achieve their goals. Stockholm is more likely to reach their goals than Helsinki, because their aims are more defined, and because the current conditions have been established, so in the end there's a way to measure if the goals have been reached. In the case of Helsinki

it will not be easy to see if the goals have been reached because the goals themselves are very vague and of qualitative nature. Probably most aspects of the plan will be completed, but without points of reference and measurable goals we can't say if the plan was completed to the full.

However, when these methods are put into action, people will most likely walk and cycle more. That in turn will affect the use of public transport, which will be further increased because of the expansion of the public transport network. As seen in the discussion, some methods Stockholm and Helsinki have adopted are present in Figure 1. The plans have high travel and system efficiency, and almost all the methods in those two sections are covered in the plans. Still, Helsinki is much more focused on for example intermodality and public awareness campaigns than Stockholm is, when as Stockholm has a wider outlook on smart road space allocation and pricing of car use than Helsinki.

Vehicle efficiency is absent from the plans: the efficiency of the vehicle fleet of the public transport service providers is lacking, as is the promotion of eco-driving for city employees. This means that there are still some aspects that have not been established in these urban mobility plans.

All things considered, it can be said that any actions taken to get people to walk more and use public transport is a step in the right direction. Based on these plans it is unclear whether their goal of increasing public transport ridership will be increased, but if any of the objectives that the cities have set for themselves are achieved, then a contribution to their fossil free future is made too, be it big or small.

In the future, as Van Audenhove et al. (2014) say, cities that already have a high modal share in public transport, new methods and thinking from the cities is needed to increase the share even more. The current urban mobility plans of neither of the cities are especially innovative, but in the future they will need to be. It would be interesting to study whether the future urban mobility plans of these two Nordic cities will have a different approach to increasing the use of public transport, and becoming fossil fuel free.

To further expand on the results of this study, additional knowledge could be gained by analysing the city and land use plans of both Stockholm and Helsinki. It would be interesting to see if some aspects found to be missing here, such as transit oriented

development in Helsinki, and efficiency of the municipal vehicle fleet from Figure 1, are covered in those plans.

When I analyse my work critically, I can say that the method of comparative analysis was new to me and it could have been performed in a better order. The different layout of the urban mobility plans of Stockholm and Helsinki made seeing similarities difficult. Another obstacle was that the Stockholm plan was in English and the Helsinki plan was in Finnish, and that direct translations of some terms could not always be found. If I were to continue working on this topic, studying the city plans would give additional insights. They might also change some conclusions reached in this study.

7 References

Bund e.V. (2011). The European City Ranking. http://www.sootfreecities.eu/sootfreecities.eu/public/city (Visited 18.4.2018)

Böhler-Baedecker, S. & Hüging, H. (2012). *Urban Transport and Energy Efficiency (Module 5h).* Bonn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

City Executive Office. (2016). *Strategy for a fossil-fuel free Stockholm by 2040.*

Chapman, Lee. (2007). Transport and climate change: a review. *Journal of Transport Geography 15*, 354-367.

Directorate-General for Mobility and Transport (European Commission). (2017). *European Urban Mobility - Policy Context*. Luxembourg: Publications Office of the European Union

Eltis. (2018). *The SUMP concept*. http://www.eltis.org/mobility-plans/sump-concept (Visited on 12.4.2018)

Firth, D. (2012). *Urban Mobility Strategy*. Stockholm: City of Stockholm Traffic Administration.

HLJ 2015 project. (2015). *Helsingin seudun liikennejärjestelmäsuunnitelma HLJ 2015.*

Helsingin seudun liikenne. (2017). *New tram routes 2017*. https://www.hsl.fi/en/new-tram-routes-2017/new-routes-and-maps (retrieved 28.4.2018).

Helsinki City Council. (2017). *Helsinki City Strategy 2017-2021 – The most functional city in the world.*

Storstockholms lokaltrafik. (2017). Rail Network Map. http://sl.se/ficktid/karta/vinter/SL_Spårtrafik.pdf (retrieved 28.4.2018).

Statistics Sweden. (2018). *Population in the country, counties and municipalities on 31/12/2017 and Population Change in 2017.* http://www.scb.se/en/finding-statistics/statistics-by-subject-area/population/population-composition/population-statistics/pong/tables-and-graphs/yearly-statistics--municipalities-counties-and-the-whole-country/population-in-the-country-counties-and-municipalities-on-31122017-and-population-change-in-2017/ (visited on 19.3.2018)

Sweden population density (w.y.). http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START__BE__BE0101__BE0101C/BefArealTathetKon/?rxid=a109a668-2db6-449f-860c-a9d55e9c5dd3 (visited on 19.3.2018)

Tilastokeskus. (2018). *Väestö*. https://www.tilastokeskus.fi/tup/suoluk/suoluk_vaesto.html (visited on 19.3.2018)

Van Audenhove, F-J., Korniichuk,O., Dauby, L. & Pourbaix, J. (2014). *The Future of Urban Mobility 2.0.* (w.p.): Arthur D. Little.

Walk, Kerry. (1998). *How to Write a Comparative Analysis.* Writing Center at Harvard University. https://writingcenter.fas.harvard.edu/pages/how-write-comparative-analysis (visited on 7.4.2018)