Investigating Sustainable and Equitable Mobilities in Copenhagen

An Interactive Qualifying Project submitted to the faculty of

WORCESTER POLYTECHNIC INSITUTE in partial fulfilment of the

requirements for the degree of Bachelor of Science.

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Sponsored by: WPI Mobility Justice Lab (Mimi Sheller) and Aalborg University (SIMS Team)

This report represents the work of WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review.

Abstract

This project investigated sustainability and equitable mobilities in Copenhagen under the Sustainable Innovative Mobilities Solutions (SIMS) Project at Aalborg University-Copenhagen with the goal of producing recommendations for the WPI Mobility Justice Lab. We conducted interviews, counted mobilities, and created structural spatial analysis maps of Folehaven and Nordhavn. The infrastructure and perception of the locations were found to affect the sustainability and equity of the mobilities in each area. Interviews with Worcester officials, Mimi Sheller, and a focus group of WPI students led to the recommendation that the WPI Mobility Justice Lab leverage existing resources to assist Worcester in the transition of its mobilities in a sustainable and equitable direction.

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- Rick Vaz - Advisor
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Executive Summary

Introduction

The reality of climate change has caused sustainability to be a growing concern around the globe. The transportation industry's role in pollution is often viewed as an important challenge to a sustainable future on Earth. It has become necessary to understand mobilities—how and why people move in different places. Equally as important, equity and justice have come into focus as a part of ensuring that transportation transitions reach more people and serve them properly.

We aimed to understand what makes Copenhagen a world leader in sustainability while assisting with the Sustainable Innovative Mobility Solutions (SIMS) project at Aalborg University (AAU) in Copenhagen. We analyzed two focus areas, Folehaven and Nordhavn, and evaluated the mobilities of people at each location. Furthermore, the goal of this project was to bring recommendations to the newly developed WPI Mobility Justice Lab for the investigation of sustainable and equitable mobilities in Worcester and for future collaboration with Aalborg University. To achieve this goal, we focused on these four objectives:

1) Participate in mobilities research at Aalborg University.

2) Understand alternative mobility strategies used in Copenhagen.

3) Suggest how the WPI Mobility Justice Lab can approach the sustainable and equitable mobility goals of both WPI and the City of Worcester.

4) Describe how a symbiotic relationship with AAU can be developed.

To complete the objectives, we conducted research for the SIMS project and to learn more about the WPI Mobility Justice Lab, transportation in Worcester, and methods for analyzing mobilities. We completed field work in Folehaven and Nordhavn to perform a mobility study in each area, and we interviewed key individuals at WPI and AAU to inform recommendations for future work and collaborations.

For the Mobility Justice Lab, Worcester, and the future relationship between the lab and AAU, we conducted semi-structured interviews with key individuals for each topic: Mimi Sheller (mobilities expert, Dean of the WPI Global School, founder of the Mobility Justice Lab), three Worcester city officials, and members of the SIMS team from AAU.

Findings

Mobilities in Folehaven:

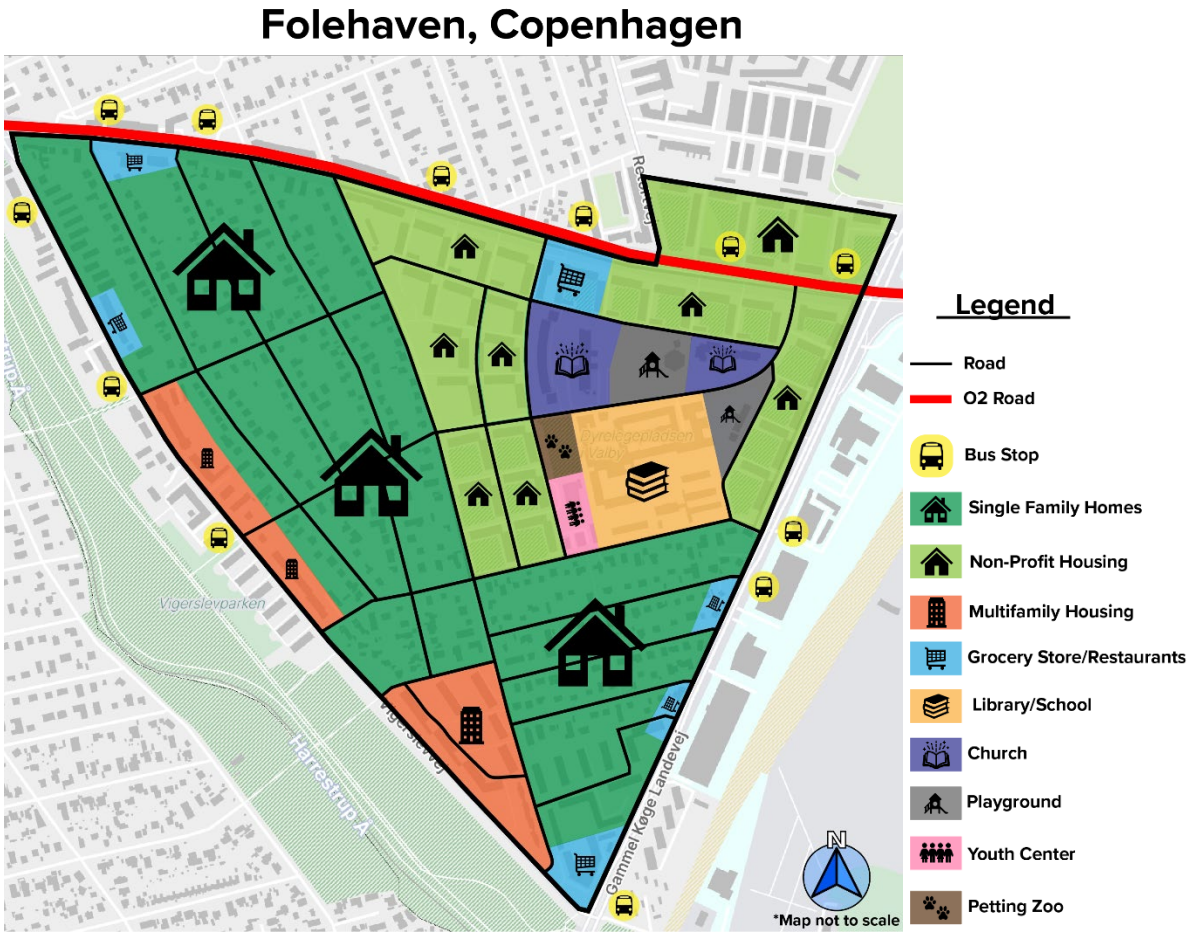

Figure 1: Structural spatial analysis map of Folehaven indicates various elements in the area.

The nearest train station, Ny Ellebjerg, was moved farther away from Folehaven in 2007 and now has a multi-platform design that is difficult to access and maneuver around. A Folehaven grocery store employee acknowledged "Ny Ellebjerg station is hard to get to from [Folehaven] because it's isolated down a long path and it's elevated, which makes it hard to access."

Limited access to public transportation results in many Folehaven residents selecting cars for travel in and out of their neighborhood. Cars accounted for at least half of the total volume of traffic, which proved how car-dominant the area is.

The three major roads that enclose Folehaven are a major barrier to any mobility entering or leaving the area. Often, pedestrians would end up jaywalking across these major roads because moving to safe crossing points was inconvenient.

Folehaven's inhabitants largely require mobilities that take them to activities outside of the area and back, whether that be work, grocery shopping, or something else. While roads inside the neighborhood are relatively suitable for sustainable transportation, the major roads that border the area play a larger role in defining residents' mobility habits.

Mobilities in Nordhavn:

The range of businesses and amenities available in Nordhavn draws people to the area. There were many instances where pedestrians would enter Nordhavn and later exit with a purchase from a shop or restaurant. The Sandkaj boardwalk was found to be another strong attraction for both residents and visitors looking to relax.

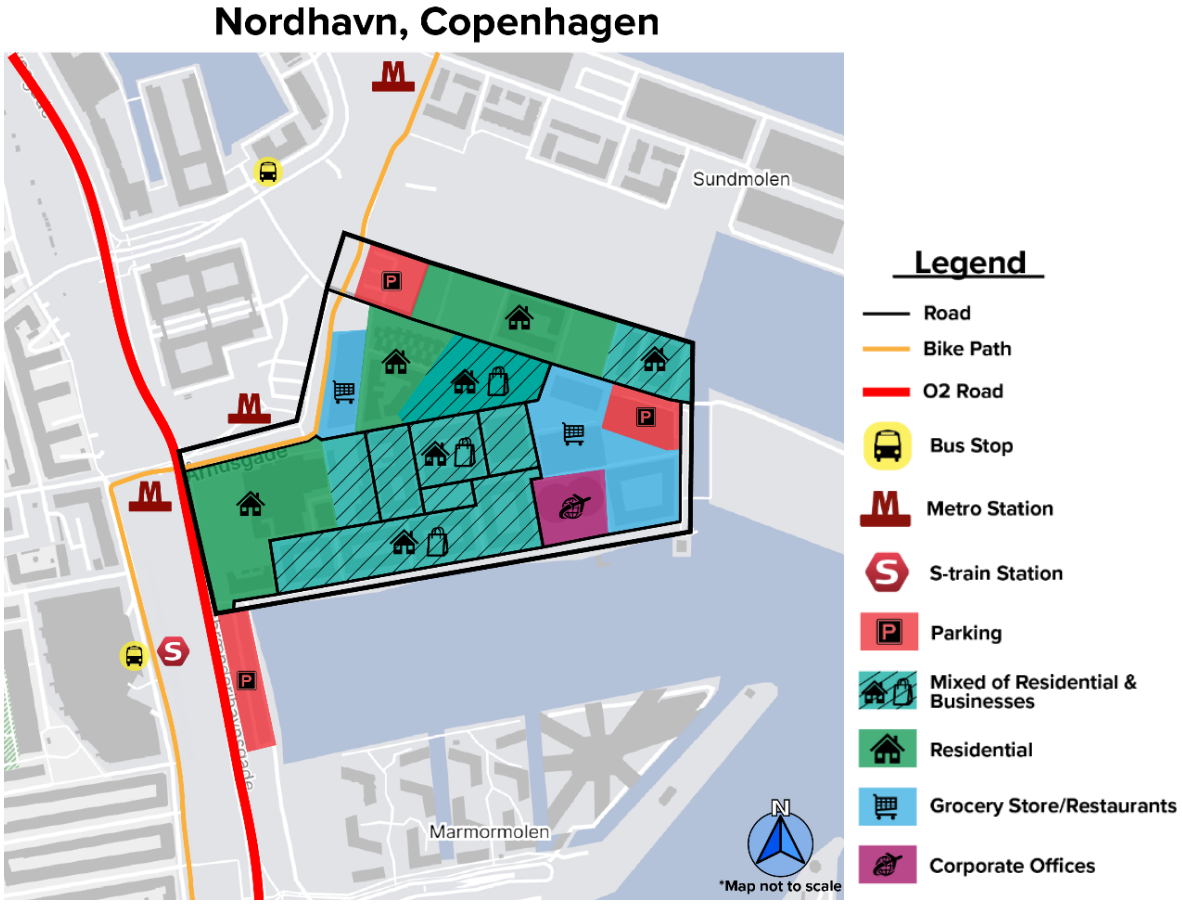

Figure 2: Structural spatial analysis map of Nordhavn indicates various elements in the area.

Nordhavn's physical infrastructure gets people out of their cars and moving through the area by foot or by bicycle. The streets in Nordhavn lead to dedicated parking structures that make it easy for travelers to park and leave their vehicle. Side streets in Nordhavn contain designed obstacles that make them harder for cars to navigate.

The counting data suggests that bikes and walking are the favored mobilities in Nordhavn. In Figure 3, the size of each pie chart represents the average daily volume of traffic counted at each spot. As can be seen, the pedestrian and cyclist traffic dominated each of the four mobility counting spots in Nordhavn.

Providing access to public transportation and sustainable mobility increases people's willingness to utilize them. A Nordhavn resident explained that she utilizes public transportation when leaving Nordhavn since the proximity of the Metro and S-train station allow her to easily exit and return home without relying on a car to move around.

Folehaven and Nordhavn Comparison:

Nordhavn is much better supported by public transportation and facilitates the use of bicycles and pedestrian traffic more than Folehaven. As seen in Figure 3, Folehaven was car-dominated while Nordhavn was dominated by pedestrians and cyclists.

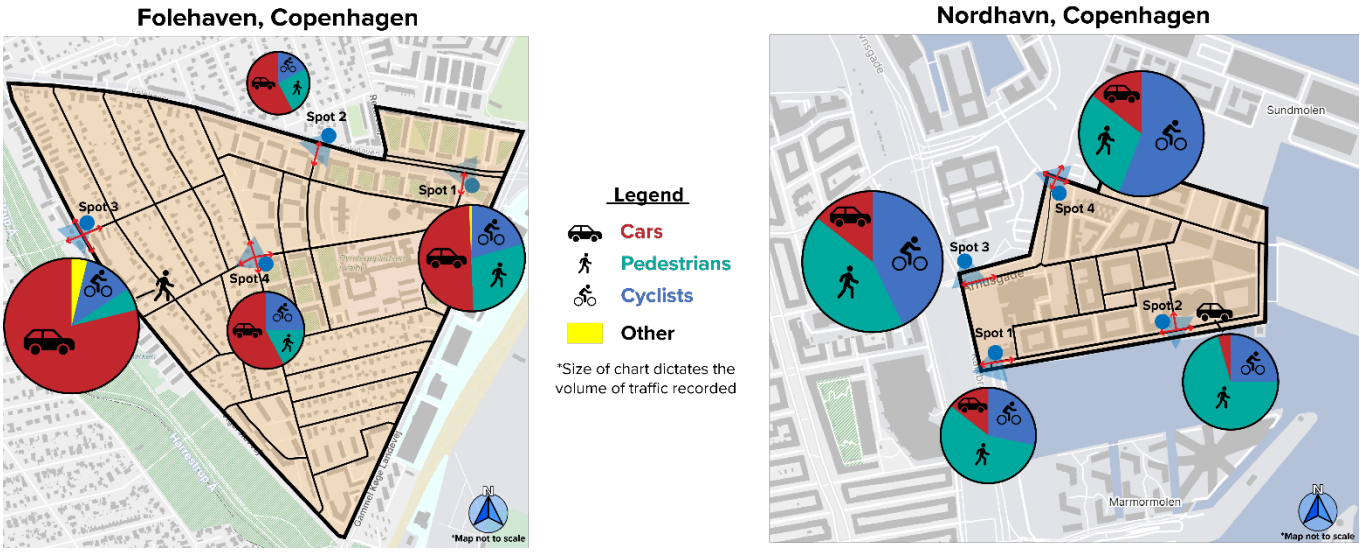

Figure 3: Comparison of mobility counting data between Folehaven and Nordhavn.

The perception of each area affects the interest from private mobilities companies. Folehaven is on Denmark's list of vulnerable neighborhoods, which contributes to a negative perception of the area. SIMS project partners (such as car sharing services) pulled out of Folehaven but remained in Nordhavn because they foresaw a more profitable future there.

Opportunities for the Mobility Justice Lab in Worcester:

Worcester's current infrastructure makes it challenging to incorporate better public transportation. Despite the size of Worcester County, only two public transportation services are available in the region and do not fulfill the city's needs.

Understanding the behaviors, patterns, and needs of residents in an area are critical in helping to improve it. Counting and close analysis of the flow of mobilities in a region, followed by spatial analysis and interviews offers a lot of insight that can be applied beyond the focus area.

Worcester can take inspiration from Copenhagen's focus on smaller, "low-hanging fruit" projects. Copenhagen has conducted small-scale "sneaky" changes that leveraged other projects or found other ways to adjust traffic patterns and street designs without drawing a lot of attention.

Transportation project prioritization models have a bias towards building roads. Worcester may be able to replicate the alternative ranking system Copenhagen uses that prioritizes sustainability projects by using health, wellness, and stress outcomes to evaluate the merit of potential projects.

Opportunities for the Mobility Justice Lab at WPI:

Worcester's eight universities and the city's government stand to benefit from collaboration. More specifically, WPI has a project-based curriculum and a focus on applied research that makes it a promising partner for the city.

Actively engaging with the WPI community through existing clubs and departments can increase attention towards mobility justice. The topic of mobility justice may still be unknown to the WPI community and society at large, and newcomers will require an introduction to the field.

Opportunities for Collaboration between the Mobility Justice Lab and AAU:

WPI students can learn a lot by immersing themselves in Copenhagen's mobilities. Undergraduate students from WPI could benefit from investigatory projects, while graduate students and faculty could collaborate on research projects that address broader issues and use more sophisticated methodology.

AAU students and researchers can learn from studying U.S. transportation. They would receive the opportunity to experience the culture and facilities of U.S. transportation, apply methods in a new setting, and possibly learn new methods as well.

If funding permits, higher level collaborations could take place between WPI and AAU researchers. There appears to be interest on both ends for future joint projects between WPI and AAU faculty. However, Sheller acknowledges that funding for such projects can be tricky because it tends to support the area it comes from.

Recommendations for the WPI Mobility Justice Lab at WPI:

We recommend that the Mobility Justice Lab:

- **Engage with the WPI community through events, marketing material, and courses to increase the community's knowledge and interest in the mobilities field.**
- **Propose opportunities to collaborate with clubs and departments on sustainable and equitable mobility events and projects**.
- **Look to sponsor students that are looking to start a mobility-focused club on campus.**

Recommendations for the WPI Mobility Justice Lab in Worcester:

We recommend that the lab:

- **Reach out to Worcester city officials to discuss how the lab can get involved.**
- **Prioritize involvement at the graduate and the faculty level.**
- **Set predetermined goals and deliverables for undergraduate-level projects, with dedicated time to regularly check in and advise the students.**
- **Utilize methods used by the SIMS researchers in Copenhagen in divergent neighborhoods of Worcester.**
- **Focus on small, low-hanging fruit projects within Worcester**.

Recommendations for Collaboration Between the Mobility Justice Lab and AAU:

We recommend that the lab:

- **Mainly focus on graduate and faculty level research and collaboration.**
- **Create a plan of action that details the specific actions that need to be accomplished beforehand for undergraduate collaboration.**

Authorship

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3.2	Kyle	Kayla
3.3	Peter	John
3.4	Kayla	Kyle
4.1	John	John
4.2	Peter	Peter
4.3	John	Kyle
4.4	Peter	Peter and John
4.5	Peter	All
4.6	Kayla	All
5.1	John	All
5.2	Peter	All
5.3	Kayla	All
Appendix A	All	All
Appendix B	Kyle	Kyle, Kayla, John
Appendix C	John	Kyle, Kayla, John
Appendix D	Kyle	All
Appendix E	All	All

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1. Introduction

A research summary conducted by the United States Environment Protection Agency (EPA) found that the increased need for transportation around the world has negatively impacted the global climate through increased emissions. This report concluded that transportation emissions accounted for 29% of the total emissions in the U.S. in 2019. The leading contributors of these emissions are passenger cars and light to heavy-duty trucks (EPA, 2019). To combat this threat, sustainable mobility research focuses on finding ways to minimize private car use and implement equitable alternative transportation solutions.

Research and educational institutions across the world have found that mobility is not inherently sustainable or equitable. In the paper "Addressing Sustainability in Transportation Systems," Jeon and Amekudzi concluded that the necessity for sustainable and equitable mobilities emerged as a large focus within public planning in the 1990s (Mihyeon Jeon & Amekudzi, 2005). They identified several frameworks within different literature that measured progress toward sustainability in transportation and other infrastructure systems. Their findings highlighted a growing number of sustainable mobility initiatives in places such as North America, Europe, and Oceania (Mihyeon Jeon & Amekudzi, 2005). Over the last three decades, there have been innovations in sustainable mobilities such as automation and car sharing, but unsustainable and inequitable practices in mobilities still exist.

Copenhagen's cycling and transit infrastructure makes it a promising model covering both sustainable and equitable mobilities. Malene Freudendal-Pedersen of Aalborg University-Copenhagen (AAU) is a leading expert in the field of mobility and has completed extensive research on the topic. She has drawn on her experience living in Copenhagen, its cycling infrastructure, and its overall advancements in sustainable and just mobilities (Freudendal-Pedersen, 2015a; Freudendal-Pedersen, 2015b). Freudendal-Pedersen currently serves as a professor at AAU and as a member of the Sustainable Innovative Mobility Solutions (SIMS) project. The SIMS project attempts to understand mobility sustainability and justice in Copenhagen through the analysis of three locations in Denmark and their mobility practices (About SIMS, n.d.).

Mimi Sheller of Worcester Polytechnic Institute (WPI) is another leading expert in the field of mobilities and has studied unsustainability and injustices in mobilities around the world (Sheller, 2021). Sheller currently seeks to establish a Mobility Justice Lab to advance mobility, sustainability, and justice at WPI and in its home city of Worcester, Massachusetts. Like many other U.S. cities, Worcester has a dearth of basic public transportation with even less focus on sustainability or accessibility. The city's transportation is dominated by private cars because alternative options are not easily

accessible or convenient. Alternatively, Europe, and Copenhagen specifically, have dedicated significant resources to improving mobilities and providing residents with options for alternative modes of transportation (Buehler & Pucher, 2012). Cities like Copenhagen can be an inspiration for U.S. cities like Worcester.

The goal of this project was to bring recommendations to the WPI Mobility Lab for the investigation of sustainable and equitable mobilities in Worcester and for future collaboration with AAU. To accomplish the goal, we participated in alternative mobilities research at AAU and worked to understand alternative mobility strategies used in Copenhagen. We then created suggestions for how the WPI Mobility Justice Lab can approach the sustainable and equitable mobility goals of both WPI and the City of Worcester. We then aimed to describe how a symbiotic relationship with AAU can be developed.

2. Background

In this chapter, we first discuss the increasing need for sustainability to counteract the ever-growing threat of climate change. We then review the role that sustainable and equitable mobility plays in the preservation of our planet. Next, we explore Copenhagen's current sustainable mobility infrastructure and the research currently being done by Aalborg University. Finally, we highlight WPI's current sustainability goals and the opportunity to expand its presence in the research field of mobility.

2.1 The Need for Sustainability

In 2021, the *Annual Review of Environment and Resources* published a summary spanning three decades of research about global warming and climate change mitigation (Stoddard et al., 2021). The authors highlighted that despite 30 years of political efforts, the global emissions curve has yet to decline. The burning of fossil fuels for heat, electricity, manufacturing, and transportation are large contributors of CO_2 and other greenhouse gas emissions (EPA, 2019). The continued emission of these greenhouse gases (GHG) now threatens the world with the most severe global warming to date (Lindsey & Dahlman).

In Lindsey and Dahlman's research about climate change, they concluded that the rate of global warming over the past 40 years has more than doubled from 0.08° C (0.14° F) per decade in the 1980s to 0.18°C (0.32°F) per decade today. This warming is expected to continue rising unless sustainable measures are taken to reduce global carbon emissions. According to Dr. Basanti Jain, by the year 2100, the global temperature is expected to rise another 3°C. The rise in temperature is having a consequential effect on Earth's climate and is leading to rising sea levels, warmer and more extreme weather, and droughts. Lindsay and Dahlman conclude that global warming has caused unpredictable temperature extremes, the reduction of snow covers, increased rainfall, and the altering of habitats for plants and animals.

Within the past 30 years, these destructive effects have been noticed globally. Many world leaders and researchers now understand that it is imperative for action to be taken to address global warming and the emission of greenhouse gases. The Intergovernmental Panel on Climate Change (IPCC) met in 1990 to discuss the scientifically supported warnings of the potential catastrophic impacts of climate change. This spurred a large wave of political action by national leaders which led to numerous frameworks, action plans, and work programs to improve upon emissions at the local, regional, and national levels

(Stoddard et al., 2021). Despite these efforts, the prioritization of the fossil fuel industry has resulted in the continued rise in carbon dioxide (CO_2) emissions.

The fossil fuel industry has been sustained by the domination of carbon-mobilities. Relying on carbon-intensive mobility systems for commuting to work, picking up children, going to the store or meeting friends has become an integral part of everyday life (Freudendal-Pedersen et al., 2020). The increased utilization of these high carbon mobilities has led to the ever-rising consumption of fossil fuels and the release of greenhouse gases (Stoddard et al., 2021). Despite climate change currently garnering the most social awareness to date, Stoddard et al. observe that personal vehicles are still a dominant mode of mobility.

In 2007, the *Journal of Transport Geography* published a review of transportation and climate change by Lee Chapman from the University of Birmingham that concluded transportation accounted for 26% of all global GHG emissions (Chapman, 2007). Today, the transportation sector is still one of the largest contributors to GHG emissions globally. According to the U.S. Department of Transportation, the U.S. transportation sector accounted for 27% of all national GHG emissions in 2010 (Greene et al., 2010). Figure 4 shows that in 2019, the number increased to 29%, making it the leading polluter in the country (EPA, 2019). This percentage is expected to jump another 10% by the end of 2035 if the current U.S. trends continue (EIA, 2010). Further analysis of the transportation sector indicates that private-owned mobility is the leading culprit.

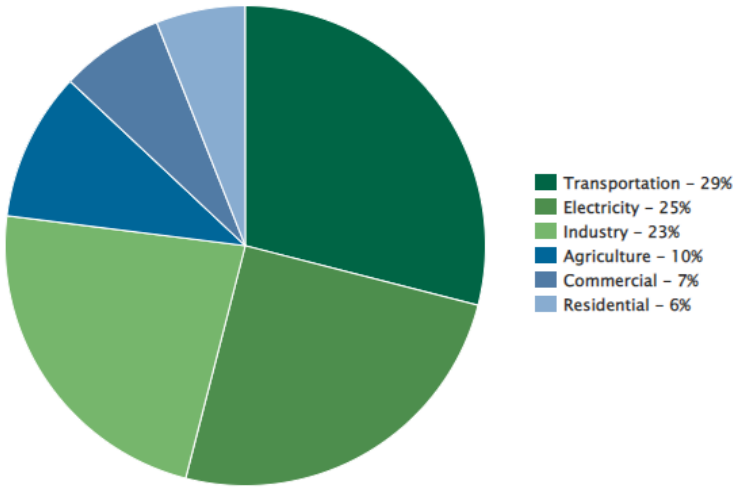

Figure 4: Total Emissions in 2019 by economic sector in the U.S. (United States Environmental Protection Agency, 2019).

Of the transportation sector, passenger cars and light-duty trucks make up approximately 60% of the total energy use and GHG emissions (Greene et al). Heavy-duty

trucks and buses emit 24% of the total energy use and GHG emissions. However, these larger vehicles move passengers and goods more efficiently (Figure 5). Since the 1990s, there has been a 48% increase in the number of miles traveled by passenger cars and light-duty trucks due to several factors including economic growth, population growth, and urban sprawl (EPA, 2019). Contrarily, the total miles traveled by public transportation only make up about 1% of the total miles traveled in the United States. Green et al. argue that incorporating more sustainable methods of mobility will result in less energy consumption and will lower the emissions of GHG. Prioritizing sustainable and equitable mobilities is an essential element in counteracting the upward trend of GHG emissions in the United States.

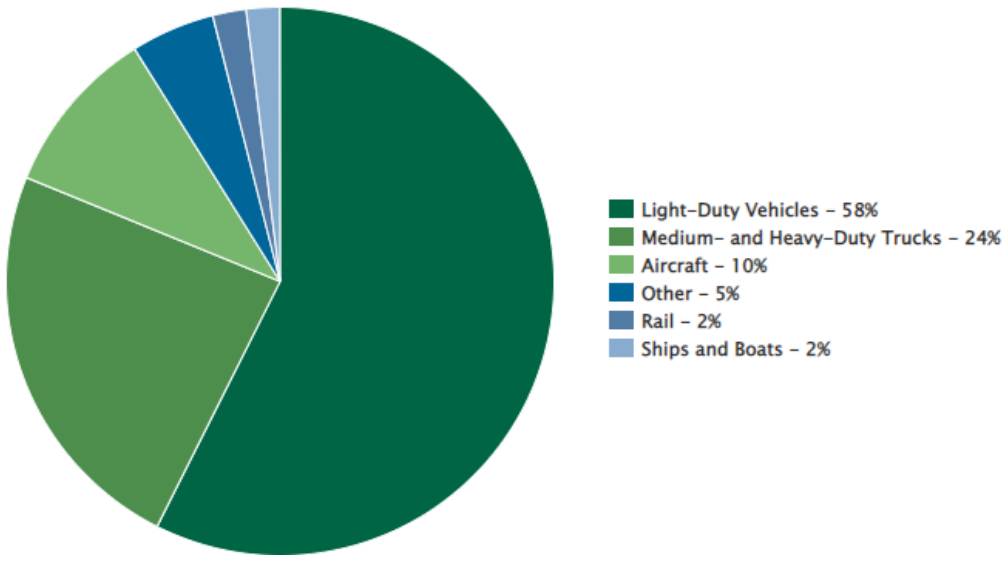

Figure 5: Total Emissions in 2019 of the transportation sector in the U.S. (United States Environmental Protection Agency , 2019).

2.2 Sustainable and Equitable Mobility

In Mimi Sheller's book *Advanced Introduction to Mobilities* (2021), she states that "mobilities research encompasses research on the spatial mobility of humans, non-humans, and objects; the circulation of information, images, and capital; and the study of the physical means for movement, such as infrastructures, vehicles, and software systems that enable travel and communication" (Sheller, 2021, p. 12). The study of mobilities has emerged and evolved over the past 20 years and is set to keep changing rapidly. Currently, sustainability is one of the main concerns in the field of mobility. According to the Intergovernmental Panel on Climate Change, it is estimated that transportation will produce 35% of all carbon dioxide emissions globally by 2050 (Sims et al., 2014). Such a

significant percentage represents both a looming threat but also an opportunity—reducing these emissions would cut into one of the biggest sources of pollution on the planet. Notably, recent mobilities research has begun to investigate the many effects that the global COVID-19 pandemic has had on mobilities around the world. One of these effects is the reduction in emissions in some regions due to the decline in the use of personal vehicles. These studies continue to focus attention on sustainability in mobilities.

A study conducted in 2003 by John Pucher and Lewis Dijkstra analyzed Dutch and German walking and cycling infrastructure, highlighting how the nature of the surroundings and layout in cities have a profound impact on the availability of transportation for its residents (Pucher & Dijkstra, 2003). Similarly, the development and modification of existing mobilities in urban environments must abide by the physical constraints of roads and structures while also interfacing with legislation and plans for other aspects of the city. These create a unique challenge for planners to figure out how to implement sustainable mobilities in cities where destinations are widely spread out or where public transportation is inefficient. Both such limitations encourage the use of personal vehicles, which hurts the sustainability of travel in a city, as Freudendal-Pedersen et al. point out (Freudendal-Pedersen et al., 2020). The reliance on personal vehicles negatively affects the equity of mobility for individuals in or around a city because not everyone is able to access or own a personal vehicle.

The transportation infrastructure in a city determines how its inhabitants move around. Daily, people rely on countless forms of mobilities to go about their lives. Often dictated by their job, schedule, and budget, people choose between public transportation, a personal car, walking, cycling, ridesharing, and more to decide how they will commute and move about the city. Traveling by car is rarely the most cost-effective form of transportation in a city, and in some cases, it is not even the fastest. Cities that lack well-developed public transportation or infrastructure supporting otherwise inexpensive means of travel harbor inequities felt by lower-income residents who cannot rely on a personal car for monetary or convenience reasons. As Sheller (2021) points out, some cities have come to be known as “fast” or “slow” (Sheller, 2021). Those adjectives refer to more than just the average speed of transportation enjoyed by the inhabitants and commuters of a city. Rather, they describe the availability of money, business, and customers, as well as the freedom of physical movement for people in the city.

A city with poorly designed mobilities is not doomed to fail, but well-designed mobilities can help support a city’s economy and social equity. Research by Peter Merriman (2009) about mobility found that effective city layouts, faster commutes, well-maintained public transportation, and similar qualities attract people to a city to work, live, and explore (Merriman, 2009). “Fast” cities where people, goods, and ideas move

efficiently and in high volumes often have good economies, or at least the potential for one (Sheller, 2021). Keeping track of these entities and noting patterns can be a source of excellent value to companies and others who can utilize this data (Merriman, 2009).

Sheller (2021) argues that there is a close connection between environment-related injustice and mobility-related injustice, observing that "[they] are two faces of the same problem, each contributing to the other, and they are intertwined with the uneven distribution of access to transport, energy, and the fundamental life requirements of clean air, water, food, and shelter" (Sheller, 2021). Lifestyle is a prime example of how mobility injustice ties to sustainable mobilities. The upper and middle classes utilize and maintain personal vehicles and frequently travel by plane, whereas people with lower incomes may not be able to, thus limiting the lower class's access to certain jobs and neighborhoods (Sheller, 2021). Addressing inequity in mobility could contribute to improving the overall sustainability of mobilities.

In 2020, the United Nations created the 2030 Agenda for Sustainable Development, which contains specific goals to ensure the future prosperity of the planet. The tenth goal of this agenda is to reduce inequalities worldwide. Specifically, this goal aims to "[ensure] no one is left behind" (Reduce inequality within and among countries, 2020). In Andreas Hackl's review paper, *Mobility equity in a globalized world: Reducing inequalities in the sustainable development agenda*, he found that to guarantee no one is left behind, a framework for mobility equity must be established. Hackl (2018) goes on to define two main components to this framework: "ensure people enjoy equal mobility opportunities" and "the creation of just and inclusive mobility regimes" (Hackl, 2018). Accomplishing these two components could help the world achieve the sustainable development agenda.

To achieve equitable and inclusive mobility regimes, transitions must occur first. A just transition entails careful consideration and planning around the perspectives of groups involved and affected by the change at hand. Change in a more sustainable direction will create noteworthy differences for many people but may not be beneficial for everyone. Many people may lose jobs, and though new ones will be created, they will not be in the same place and will not be available to the same people (Atteridge & Strambo, 2020). In a comparable way, the improvement of mobilities in an area is likely to draw in people of higher income, driving up the price of living there and pushing lower income individuals out of the area. This gentrification is difficult to avoid and can prevent people with less financial mobility from enjoying positive changes to physical mobilities.

The implementation of sustainable and equitable mobilities in an area can be thought of as a service for the people. Sheller declares that "we must consider how to combine the struggles for accessibility and bodily freedom of movement, for equitable infrastructures

and spatial designs that support rights to movement, for fair and just forms of sustainable transport…" (Sheller, 2018). Mobility as a service (MaaS) achieves this by offering mobility opportunities with the focus of the user at the center. MaaS is a multimodal and a well-connected system that is a sustainable alternative to private ownership mobility. It builds on the idea of a seamless and integrated network presented to users via a single platform like an app. Through MaaS, traditional public transportation and services like a taxi can be combined with shared mobility such as ride sharing and bike sharing (Christensen et al., 2022). As Hensher et al. (2021) claim, MaaS would be the optimal shift away from car ownership, though the car as an entity would not disappear. Further, they conclude that the "challenge is to find better ways of utilizing the car and move forward to achievable sustainable outcomes" (Hensher et al., 2021).

What makes mobilities "good" is not always clear, but sustainability and equity have become strong points of emphasis in that definition (Sheller, 2021). According to David Banister in his article "The Sustainable Mobility Paradigm" (2008), the ideology of sustainable mobilities moves away from popular car-centric transportation to form a new hierarchy where walking and cycling are at the top (Banister, 2008). This ideology fits in with the concept of "livable cities," where the design of the city makes travel by foot and bike viable in terms of safety, enjoyment, and time, simultaneously increasing accessibility for all people (Freudendal-Pedersen et al., 2020).

2.3 Copenhagen's Leading Sustainable Mobility Strategies

Copenhagen's public transportation network consists of three major systems: the S-train, Metro, and buses, which allow users reliable service even during rush hour (7:00am-9:00am and 3:30pm-5:30pm). The S-train operates on seven different lines that cover 86 stations between the hours of 5:00am and 12:30am. Trains on the F-line run every five minutes, trains on the A, B, C, and E-lines run every 10 minutes, and the H and Bx-line trains run every 20 minutes (*S-Train | Get around the Capital Easily*, n.d.). The Metro has four lines identified as M1, M2, M3, and M4 that serve 39 stations (*Se Metroens Linjer - Metroen*, n.d.). Metro trains run about every three minutes during weekday rush hours, 5 minutes outside rush hour and on weekends, and on 15-minute intervals after 1:00am on Fridays and Saturdays (*Public Transport*, n.d.). In 2021, the Metro had over 70 million passengers, with 99.5% of departures on the M1 and M2 lines being on time, and 99.1% of M3 and M4 departures being on time (*Metroen i Tal - Metroen*, n.d.). Of the 39 Metro stations, nine are multimodal hubs with S-train stations attached. This allows travelers to easily transfer to other lines to get to their final destinations.

Figure 6: S-train and Metro map.

In addition to the S-train and Metro, there are two types of buses in Copenhagen, A-buses, and S-buses. The A-buses operate 24 hours a day and stop every 3-7 minutes during rush hour, or every 10 minutes outside rush hours. S-buses make fewer stops than A-buses and operate from 6:00am until 1:00am, stopping every 5-10 minutes during rush hours and every 20 minutes outside rush hours (*Public Transport*, n.d.). Travelers can access all three of these systems using the same travel card which they can preload with funds for their journeys. Denmark even has its own travel application, Rejseplanen, which translates to "journey planner" in English. Rejseplanen produces routes based on the user's starting location and destination, as well as filters for their preferred modes of transport, number of transfers, maximum distances to walk or bike, and even choices to exclude or only include certain lines (*Rejseplanen*, n.d.).

Research using the Spatial Analysis for Multimodal Transport Systems (SNAMUTS) tool found that Copenhagen was one of the best performers in accessibility indicators among 11 other European cities (Scheurer, 2013). The spatial analysis showed that Copenhagen's network density is a major factor in the city's transportation success. In this context, network density is a derived measurement that determines what percentage of the potential routes in a network can be made without a transfer. Being scored with a high network density means Copenhagen provides access to public transportation within a 30-minute curb-to-curb walk from the starting node to three out of four residents and jobs in the metropolitan area.

However, when examining the actual usage of public transportation, Copenhagen's annual public transport boarding per capita was only average (Scheurer, 2013). Dr. Jan Scheurer of the Royal Melbourne Institute of Technology's Center for Urban Research defines boardings as trips a user makes per mode. For example, if a person takes two different metros that is only considered one boarding, but if a person takes a car and then a metro, that will count as two boardings. Dr. Scheurer theorized that the unexpectedly low boarding per capita was related to the average trip length on public transportation taken in Copenhagen (about 8.0 km). This distance is much greater than comparable European cities such as Zurich, Munich, and Vienna (about 3.5 to 5.6 km). Dr. Scheurer attributed Copenhagen's renowned cycling culture as the reason this is longer than in these comparable cities, speculating that people found it easier to take bikes for shorter journeys than public transportation (Scheurer, 2013).

Alongside Amsterdam, Copenhagen is considered one of the most successful and prominent large city-cycling models in the world (*PeopleForBikes City Ratings | Every Ride. Every Rider. Join Us.*, n.d.). This cycling culture can be contributed to the Danish city's combination of flat elevation and early establishment of cycling infrastructure, as well as resources and policies it has allocated to cycling. Cycling is easier and less strenuous when

the terrain is flat, which increases people's willingness to take their bike over driving. Over time, the city's network of traffic-protected bicycle tracks has increased from about 25 km (about 15 mi) in the 1900s, to roughly 200 km (about 124 mi) in the 1960s, to over 380 km (about 236 mi) in 2018. These tracks are often found in between roads for motorized traffic and walkways for pedestrians, separated by a curb on each side.

In addition to its topography and infrastructure, Koglin et al. (2021) attributed Copenhagen's cycling success to the city's innovative "rules of the road" that prioritize cyclists at intersections and traffic signals. The authors noted that at traffic signals, the lights for cyclists turn green before the respective lights for cars. This allows drivers to see cyclists more easily, therefore making them less likely to get into accidents with each other. "Green waves" are another benefit for cyclists regarding traffic signals that make biking more convenient. A "green wave" is when traffic signals along the same road are synchronized to turn green at the average cycling speed (Koglin et al., 2021).

The Department of Planning at Aalborg University-Copenhagen (AAU) is actively studying mobility-related issues in the city. AAU recently released its new "Knowledge for the World 2022-26" strategy. One of the four themes in this strategy is "AAU partners on a green sustainable world." In this, the university undertakes the mission to "help create a balanced and sustainable future for people and our planet" (*Mission-Oriented University*, n.d.). AAU's Department of Planning for Urban Sustainability features 19 faculty, 6 active projects, and 42 publications to date (*Planning for Urban Sustainability*, n.d.). Professor Malene Freudendal-Pedersen, a member of the faculty and a researcher in the department, has contributed to 12 projects and over 100 publications. She is a contributor in the ongoing project Sustainable Innovative Mobility Solutions (SIMS), which is dedicated to studying alternative mobility solutions tailored for everyday life, as well as investigating how and why people choose the methods they use to get around.

SIMS has examined two distinct neighborhoods of Copenhagen: Nordhavn, a well-off, modern, up-and-coming district and Folehaven, a blue-collar non-profit housing neighborhood. Figure 7 below shows where Folehaven and Nordhavn are in Copenhagen.

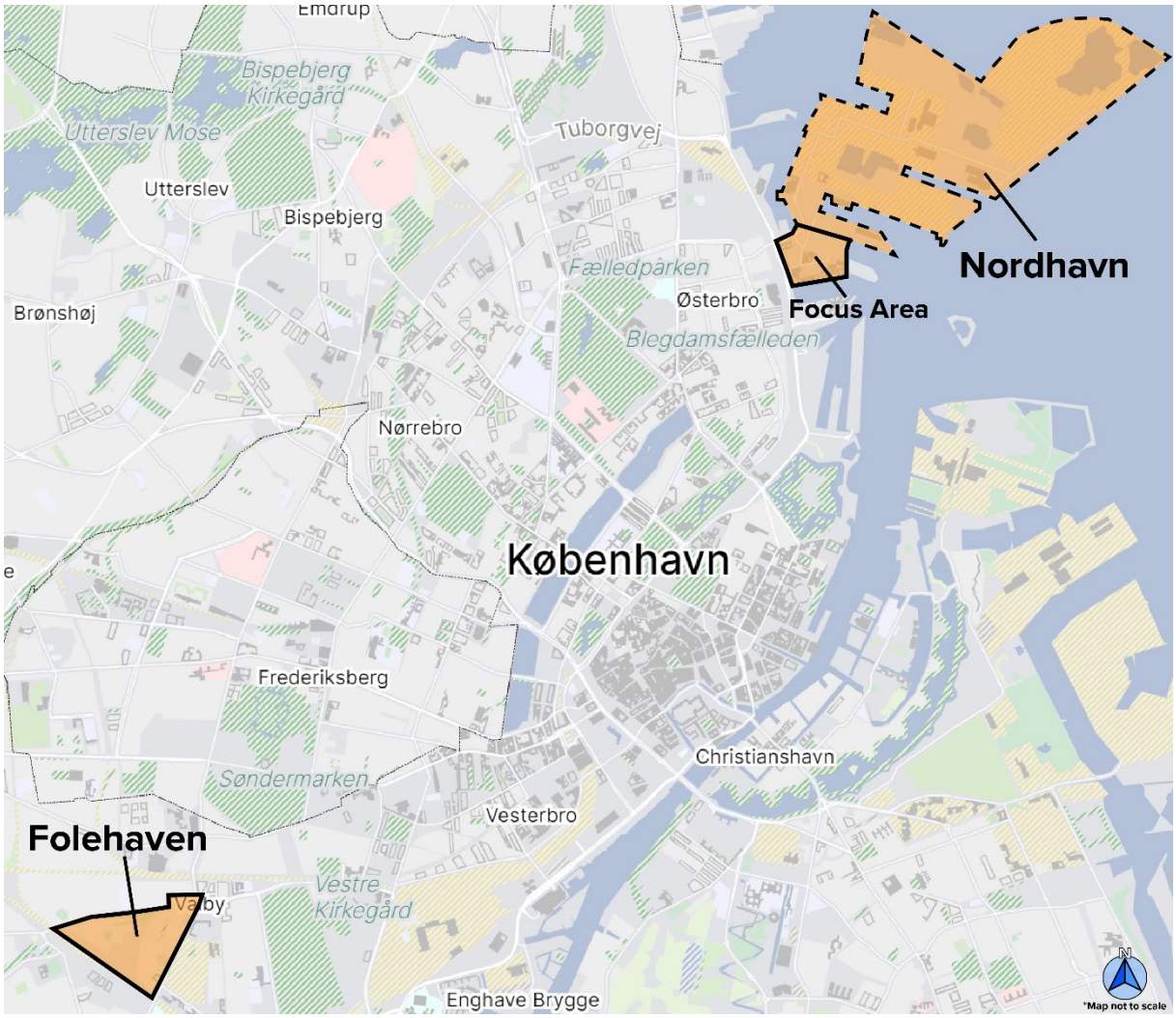

Figure 7: Folehaven and Nordhavn on a map.

The SIMS project focuses on developing sustainable urban mobility solutions, with a focus on interlinked mobilities for everyday life. Sustainable and accessible mobility research at Aalborg University and the strategies employed by the city of Copenhagen have produced leading innovations in the industry, positioning themselves as a successful model for American cities and universities.

2.4 WPI's Role in a Sustainable Society

Worcester Polytechnic Institute (WPI) is a private research university that specializes in science and engineering education. Currently, the university's mission statement states "WPI transforms lives, turns knowledge into action to confront global challenges and revolutionizes STEM (Science Technology Engineering and Math) through distinctive and inclusive education, projects, and research" (Mission & Values, n.d.). The university strives for excellence not only for the benefit of its students, but also for the greater community. One aspect of this commitment to the community can be seen in WPI's work in its Office of Sustainability. WPI has acknowledged the role it plays in combating the global climate crisis and has taken measures to increase sustainability efforts through increased research efforts (Sustainability Plan, 2020). Currently, there are over 100 available undergraduate courses and 30 graduate courses that are related to sustainability (Sustainability Academics and Research, n.d.). WPI's STEM-based curriculum provides students with a technical background that can be used to research unique innovations in the field of sustainability (*About*, n.d.). Additionally, WPI has created a five-year sustainability plan that gives an in-depth look into current and future efforts for 2020-2025. Within this plan are goals that the university hopes to accomplish to better their research efforts and have a positive effect on the surrounding Worcester community (Sustainability Plan, 2020).

In 2021, WPI named Mimi Sheller as the Inaugural Dean of the Global School ("Mimi Sheller", 2021). Sheller is an internationally acclaimed scholar who has dedicated her time to advancing mobility research. More specifically, Sheller is credited with co-establishing the "new mobilities paradigm," an innovative approach to seeing movement as a broader range that encompasses people, technology, and culture (Sheller & Urry, 2006). Before joining WPI, Sheller was a fellowship scholar at several universities, including at Aalborg University where she was a part of their Center for Mobility and Urban Studies. During her tenure at Drexel University, Sheller was the founding Director of the Center for Mobilities Research and Policy Studies (*Mimi Sheller*, n.d.). Sheller continues to contribute to the field of mobility, as seen by her most recent publication, Advanced Introduction to Mobilities (2021). Sheller's expertise in the field of mobilities can help WPI advance its mobility research and further the field.

WPI is located in Worcester, Massachusetts, which is the second largest city in New England. The city has created its own sustainability plan called the Green Worcester Plan. This plan focuses on improving various aspects of everyday life to improve the city's sustainability. There are ten specific visions for improvement outlined in the plan. The fourth vision focuses on transportation and states a specific goal of "provid[ing] safe, convenient, and comfortable pedestrian, bicycle, and public transportation networks to get

around our vibrant city and promote the transition to vehicles powered by renewable energy" (City of Worcester & Green Worcester Working Group, 2021). This goal shows that sustainability and equity are the future focus for Worcester's transportation. Adapting the current infrastructure is of high priority but accomplishing these goals has been difficult because of Worcester's sprawled urban nature and limited public transportation access. This means that many residents of the area rely on a personal vehicle.

According to a 2017 report from the U.S. Census Bureau about Worcester transportation, nearly 84% of Worcester residents take a car, truck, or van to work, while only 2.5% percent take the bus. Additionally, The Census Bureau found that 6% of Worcester households owned no automobiles, whereas 40% owned two cars (City of Worcester & Green Worcester Working Group, 2021). Furthermore, The Worcester Regional Transit Authority (WRTA) has seen its ridership since 2016 decrease every year with buses reaching only 45% of total capacity. Inefficient and under-utilized public transportation poses a barrier to residents that inhibits their ability to travel for work, leisure or necessities like groceries or medical visits. Establishing an infrastructure that allows for alternative mobility methods to succeed can positively benefit residents and the city itself.

3. Methodology

The goal of this project was to bring recommendations to the WPI Mobility Lab for the investigation of sustainable and equitable mobilities in Worcester and for future collaboration with Aalborg University. We achieved this goal through the following objectives:

- Participate in Mobilities Research at Aalborg University.
- Understand alternative mobility strategies used in Copenhagen.
- Suggest how the WPI Mobility Justice Lab can approach the sustainable and equitable mobility goals of both WPI and the City of Worcester.
- Describe how a symbiotic relationship with AAU can be developed.

In this chapter, we describe the methods we used to gather and analyze data on sustainable and equitable mobilities.

3.1 Participate in Mobilities Research at Aalborg University

The first objective was to participate in alternative mobilities research at Aalborg University (AAU). We contributed to the SIMS project at AAU by utilizing mobility counting and structural spatial analysis to understand transportation in two of their areas of interest; Folehaven and Nordhavn. We wanted to learn about these collection methods so that they may be modified and replicated in the U.S. Through our participation, we sought to understand:

1. What types of questions do mobility researchers explore?
2. What methods can help answer those questions?
3. How are the methods implemented and what challenges do they encounter?
4. How is this data analyzed and subsequently presented to identify actions for improvement?

To learn about the questions mobility researchers explored and the methods they used to help answer those questions, we drew on semi-structured interviews with members of the SIMS project to learn more about what sustainable mobilities look like in Demark and the research already completed by the SIMS project. The semi-structured nature of the interviews allowed the interviewees to discuss their research methods freely and articulate what has worked well for them. The protocol for these semi-structured interviews can be found in Appendix A-1 through A-3. Key points and themes from these interviews were pulled from the notes and used to help identify common ideas and points of interest. We

only conducted interviews with three of the six SIMS members due to scheduling constraints, resulting in a somewhat limited range of perspectives on methods and the project. Also, because we only spoke with SIMS members, their views on mobilities may have been affected in some way by their involvement with the project.

We completed three days of counting at Folehaven and Nordhavn to learn about the volume and types of traffic commonly entering and exiting the areas by counting cyclists, pedestrians, cars, scooters, mopeds, and buses as they passed by (see Appendix B for the counting protocol). For each day there were three 45-minute counting sessions: a morning session from 8:15am - 9:00am, an afternoon session from 12:15pm -1:00pm, and an evening session from 4:00pm – 4:45pm. The chosen time spots align with rush hour when residents are out commuting to and from work.

Four counting spots were selected for each location and the location of each spot can be seen in Figures 10 and 11 below. The location of each counting spot was chosen because it was considered a "gateway into the focus area" where travelers would be most likely to enter or exit throughout the day. Spots on the edges of the neighborhoods would only count traffic moving into the focus areas. For example, in Folehaven, the observer assigned to Spot 1 positioned themself so that they could only count travelers on the road leading into the neighborhood, with travelers on the major road out of their field of view. However, the observer assigned to Spot 4 positioned themself so that they could count travelers from all four directions of the intersection.

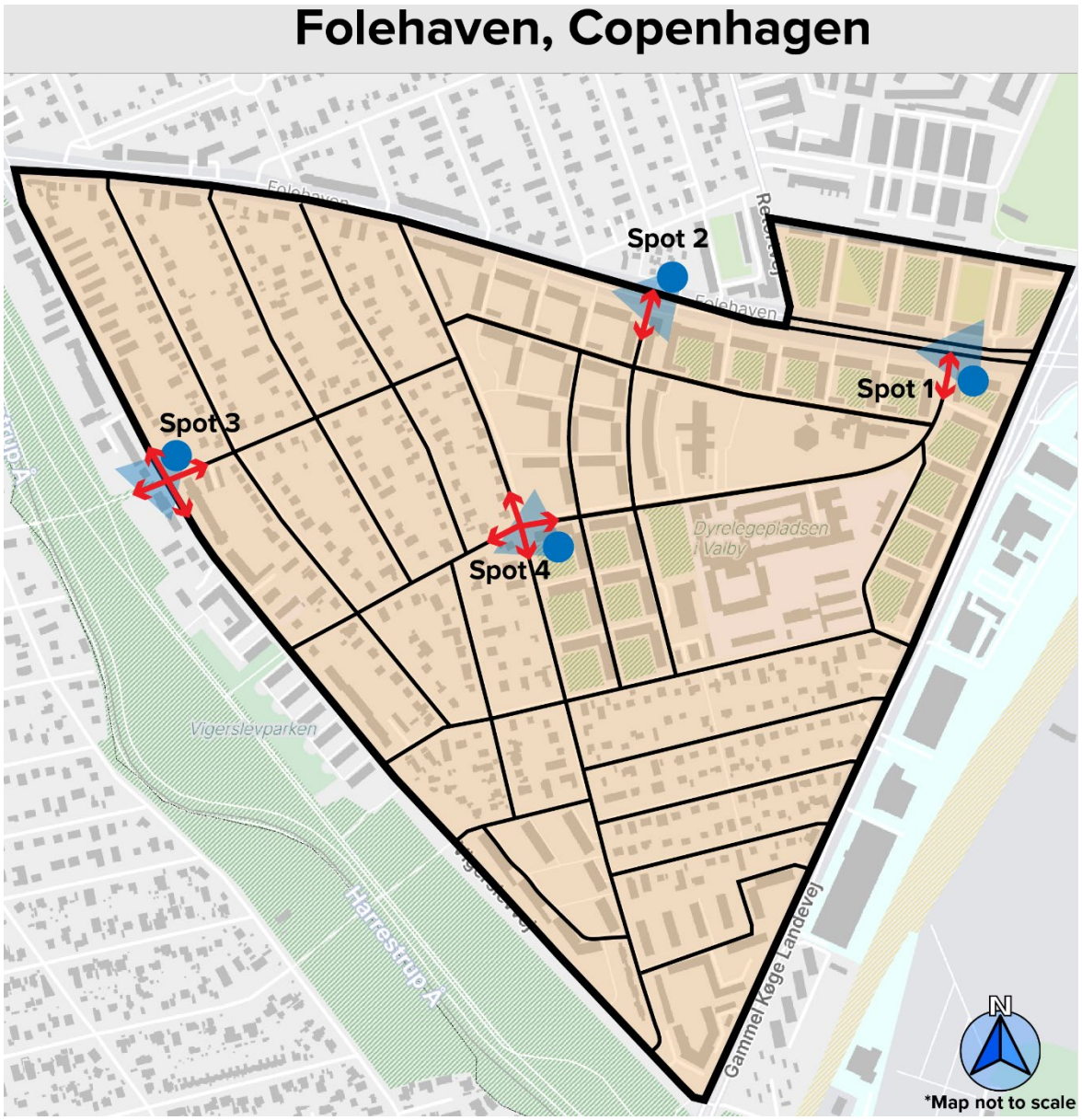

Figure 8: A map of the four locations in Folehaven for mobility counting.

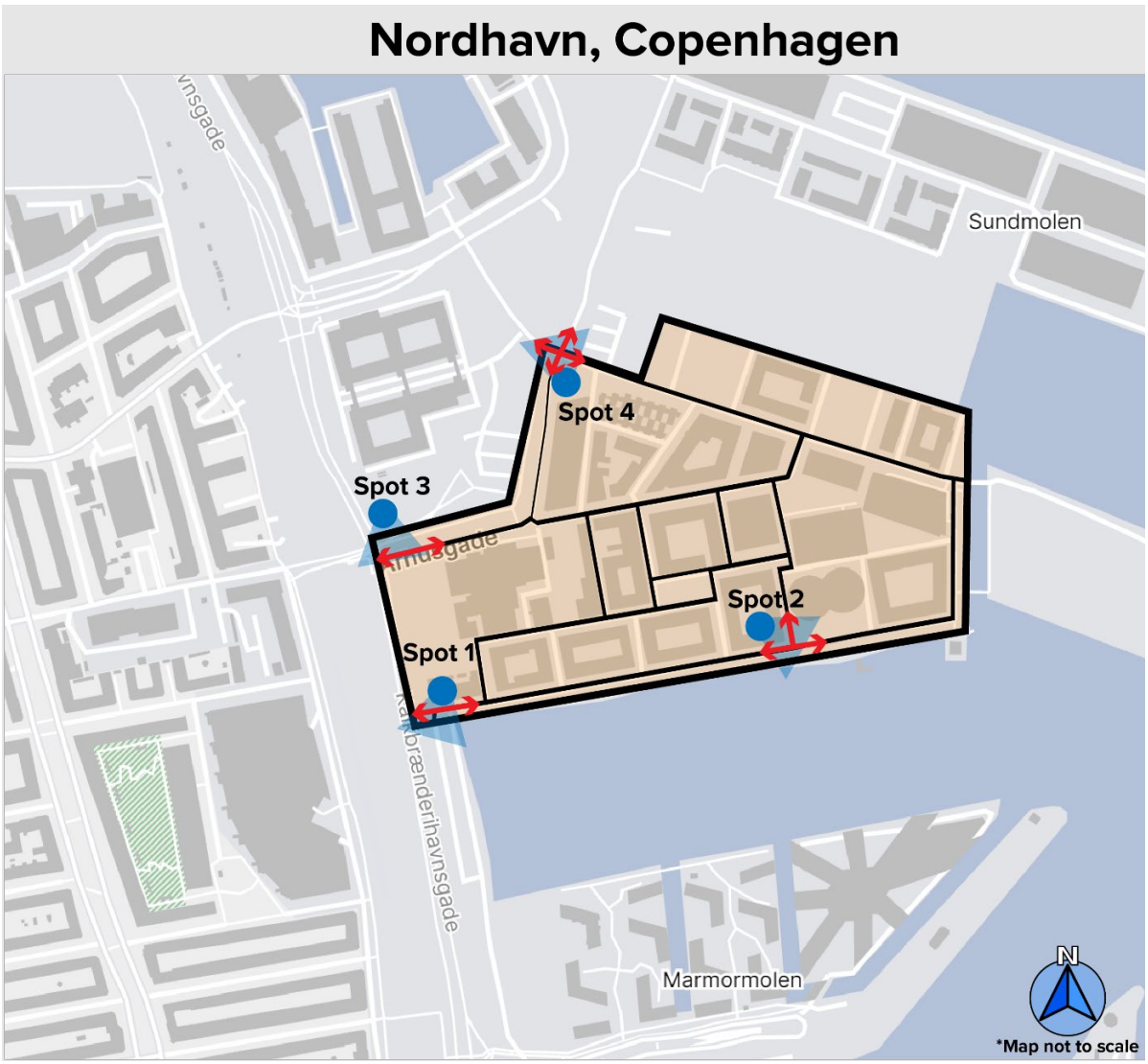

Figure 9: A map of the four locations in Nordhavn for mobility counting.

This counting was assigned to us by the SIMS team to give us experience and insight on the challenges faced when studying mobilities in the field and how such data can be used to produce findings. We used the data from the two sites to make comparisons of the different mobility methods that are being used to access these sites. In addition to comparing the sites to each other, we analyzed the data within each site to notice mobility trends based on weather or time of day. Unfortunately, we did not collect enough data to draw definitive conclusions about mobility trends based on weather in either area. We could not attribute any notable change in numbers as being purely the result of certain weather, but it did show the daily fluctuations of different modes of traffic in the areas and hopefully suggest what outcomes may be associated with weather changes, or other factors. The second limitation associated with the counting procedure was the possibility of double counting and not knowing how this might have affected the data. The spots in Nordhavn may have

resulted in counting the same bicycle traffic since the bicycle lane seen from spot 3 led to spot 4. This also could have been happening in Folehaven but the spots did not overlap and were not as comparable.

Lastly, we conducted semi-structured interviews with local people in Folehaven and Nordhavn to learn more about the modes of transportation they use to get to and from the respective sites and the reasoning behind their choices (see Appendix A-4 for the protocol). While we could not get a representative sample of residents in either area, we wanted the insight from these interviews to serve as an example of how different people approach their mobility decisions—what factors define their choices, how these factors change across different demographics, and especially how their choices might change between different areas. Our inability to speak Danish limited our ability to conduct these interviews, especially in Folehaven where many residents were not as experienced in English as most Nordhavn residents were. This barrier impacted the ability to carry out full interviews with many locals. The weather also challenged the chances of finding willing interviewees as it was a cold day with a mixture of rain and snow. The inclement weather limited the number of responses we received because people were less likely to be outside and even less likely to want to take the time to answer questions. Another drawback was the time at which we conducted the interviews. We went out mid-week and mid-morning, meaning that many people within the areas had either already left for work or were already working. We found that many people were busy and did not have the time to stop and talk to us.

3.2 Understand Mobility Strategies in The City Of Copenhagen

The second objective was to understand alternative mobility strategies currently being utilized in the city of Copenhagen. We wanted to learn what methods have been successful thus far and what benefits these methods provide for the communities of Folehaven and Nordhavn. The following research questions addressed this objective:

1. What are the prominent strategies used in the focus areas and the city at large?
2. How effective have these strategies been and are there limitations to these strategies?
3. Which modes of mobility are most used in each of the focus areas and why?
4. Which mobility needs are met well, and which are not?

To understand the current mobility strategies used in Copenhagen, we applied four methods used by the SIMS team:

- **Urban Drifting** was used to capture the subjective experience in the two sites. This method originated in mid/late nineteenth century Paris from the word "flâneur," which translates to "urban wanderer" (Daniilidis, 2016). Urban drifting is conducted by walking around in a built environment without a particular destination. It is an exploratory way of recording and mapping the various elements that distinguish a certain area such as its visual aspects, paths, edges, nodes, landmarks, and districts (Lynch, 1979). These elements are noted based on their visibility, strength of image, connections, and disconnections.
    - Paths: Channels in which an observer moves such as a street, sidewalk, or walkways.
    - Edges: Linear elements not used for walking such as railroads, walls, or fences.
    - Nodes: Points of interest like a primary junction or a street corner that has an important presence.
    - Landmarks: Reference points in the urban landscape—they can be as simple as a sign or statue (Lynch, 1979).
- **Mobility Counting** involved three 45-minute sessions throughout the day, the morning session from 8:15am - 9:00am, the afternoon session from 12:15pm - 1:00pm, and the evening session from 4:00pm – 4:45pm. Additionally, there were four different spots that were chosen to measure the various mobilities of these locations, they can be seen in Figures 6 and 7.
- **Local Interviews** provided more insight into the modes of transportation locals use to get to and from the respective sites and the reasoning behind their choices.
- **Structural Spatial Analysis** was used as an integrative step that pulled together the data collected from the other three methods to make meaning and generate visual representations.

Upon the first visit to each site, we employed the urban drifting method and walked around for 30 to 40 minutes taking supplemental field notes (see Appendix E for the drifting field notes). The Ph.D. students from the SIMS project instructed us to remain impartial to each of the focus areas, meaning that we did not conduct any preliminary research or mapping before entering either site. This allowed us to authentically discover prominent elements in Folehaven and Nordhavn and determine how the built environment affected mobilities. Urban drifting also allowed us to understand the effectiveness and limitations of the mobility strategies for these focus areas. However, we were challenged by the initial misunderstanding of how much background knowledge we should enter each focus area with. We believed that knowing almost nothing about the sites before drifting was key to unbiased results. Unfortunately, the unfamiliarity proved to be a problem in Folehaven. We

did not familiarize ourselves with its borders before we drifted, which led to two of the four group members wandering out of the Folehaven area.

After completing urban drifting in Folehaven and Nordhavn, we followed the counting procedure developed by the SIMS project team in each focus area. We completed three days of counting at Folehaven and Nordhavn to learn about the volume and types of traffic commonly entering and exiting the areas at different times of day (see Appendix B for the mobility counting protocol). We primarily counted cyclists, pedestrians, cars, scooters, mopeds, and buses. This allowed us to create graphics to visualize how mobility trends differ between the two areas and helped us draw further conclusions about which modes of mobility were most common.

To understand the choices made about mobilities in the areas we utilized semi-structured interviews with people in each area (see Appendix A-4 for the protocol). This was an opportunity for us to learn about the modes of mobility used by the local people living and working within Folehaven and Nordhavn. We conducted stop-and-talk semi-structured interviews in both focus areas, asking the interviewees general questions about their mobility habits. We drew on questions from the Aalborg University's SIMS team to bolster the interview questions. Unfortunately, as discussed in the last section, we were unable to conduct as many interviews as we had wished.

The final method we used to gain knowledge about alternative mobility strategies was through structural spatial analysis. Spatial analysis is a method that combines the data collected from the previous methods to generate meaningful visual representations of each area. The structural spatial analysis allowed us to combine the drifting, interview, mobility counting, and field observation methods to map out transportation infrastructure, amenities, and resources in and around each area. This allowed for an easy comparison between the two areas and helped in drawing meaningful conclusions about mobility and equity in the city of Copenhagen, and map out specifically the neighborhoods of Folehaven and Nordhavn. Furthermore, we learned what methods have been prominent and what benefits they provide for the communities.

3.3 WPI Mobility Justice Lab Recommendations

The third objective was to suggest how the WPI Mobility Justice Lab could approach the sustainable and equitable mobility goals of both WPI and the City of Worcester. We wanted to gauge interest in sustainable and equitable mobilities at WPI and suggest ways the Mobility Justice Lab can get involved in both city projects and projects at WPI. The following research questions addressed this objective:

1. What are the areas of overlap between Mimi Sheller's interests and the interests of the City of Worcester that the WPI Mobility Justice Lab can explore?
2. What research methods could the lab replicate in Worcester for mobility research?
3. How can the WPI Mobility Justice Lab promote greater interest in sustainability, equity, and mobilities within the WPI community?

To make suggestions for the WPI Mobility Justice Lab's approach, we sought to understand Sheller's interests and goals for the lab. This was done through a semi-structured interview with Sheller on the field of sustainable mobility justice as well as her vision and expectations for the lab. This interview protocol can be found in Appendix A-5. We also investigated the possible needs outside of WPI that the Mobility Justice Lab could help fill by interviewing Worcester City officials.

To learn more about Worcester's mobility needs and the future of transportation in Worcester, we spoke with Luba Zhaurova, Director of Projects for the Department of Sustainability and Resilience, Stephen Rolle, Assistant Chief Development Officer for Planning & Regulatory Services, and Brian Pigeon, Senior Transportation Planner. This interview protocol can be found in Appendix A-6. Through this interview, we hoped to understand the city's thoughts on how the Mobility Justice Lab might collaborate with the city to improve sustainability and equity in mobility practices. Information collected through these interviews helped us produce recommendations that could provide WPI students with projects as well as valuable deliverables for Worcester. Additionally, we utilized information and knowledge from the SIMS project at Aalborg University to suggest what methods might be feasible for the Mobility Justice Lab to reproduce in Worcester.

Finally, in order to recommend how to increase the reach and effectiveness of the WPI Mobility Lab, we sought student input to understand how to increase the reach and effectiveness of the WPI Mobility Lab. To gain this insight, we conducted focus groups of WPI students that were traveling and studying in Denmark with us at the time (see Appendix A-7 for the protocol). The objective of these interviews was to survey participants on their existing knowledge of transportation equity, their awareness of and involvement with WPI-affiliated organizations relating to sustainability, and how to spark student interest in the field of sustainable and equitable mobilities. However, because these groups comprised of five to six participants, it allowed for more dominant personalities to take over the thoughts and opinions of the conversation and left little room for more introverted individuals. Another limitation was that the entirety of this group was in the same project cohort as us in Copenhagen, and therefore shared unique personal experiences regarding transportation compared to other WPI students.

3.4 Relationship Between Aalborg University and WPI

The fourth objective was to describe how a symbiotic relationship between AAU and WPI can be developed in the future. We wanted to gain an understanding of how these universities can learn from one another and how collaboration can benefit both the Worcester and Copenhagen communities. The following research questions addressed this objective:

1. What does each university wish to gain from working with the other?
2. What research topics could be of interest to both universities?
3. How might Aalborg and WPI collaborate on future projects?

To describe how a symbiotic relationship with AAU can be developed and utilized in the future, we conducted semi-structured interviews with Malene Freudendal-Pedersen and Mimi Sheller. The semi-structured interview with Freudendal-Pedersen focused on her research experience in the mobility field and how she envisions AAU and WPI interacting in the future. The interview protocol can be found in Appendix A-1. This interview allowed us to gain better insight into the current mobility project work at AAU's Department of Planning and to investigate the potential for future research collaboration. However, we were only able to conduct a semi-structured interview with Freudendal-Pedersen and no other AAU faculty. This limits the extent to which we can confirm that a symbiotic relationship between the universities is applicable in other departments besides the Department of Planning.

Additionally, we conducted a semi-structured interview with Mimi Sheller to address these research questions with a focus on her vision of the Mobility Justice Lab and how she sees future interaction with AAU. This interview allowed us to understand the WPI Mobility Justice Lab's interest in collaborating with AAU and how extensive this relationship could be. The interview protocol can be found in Appendix A-5. With Sheller being the founder of WPI's Mobility Justice Lab and the motivation behind the project, we sought to understand her views of this relationship in order to make constructive recommendations. One drawback to this method is that the only input we received was from Sheller and it limited how much we can describe the future of this relationship.

Ultimately, the Freudendal-Pedersen interview and the Sheller interview provided us with an understanding of information that can help build this symbiotic relationship. After both interviews were completed, we conducted an analysis that consisted of reviewing interview notes and recordings of each interview to find an overlap of what was said on the future of the relationship between each organization. Additionally, we looked for what was going to be most beneficial for both universities.

4. Findings

This chapter lays out findings regarding sustainable transportation in Copenhagen, mobility research, the future of the Mobility Justice Lab at WPI, and the relationship between WPI and Aalborg University (AAU) going forward. We will present an analysis of mobility in Folehaven and Nordhavn, a comparison of these two locations, examine findings for the WPI Mobility Justice Lab and discuss opportunities for continued collaboration with AAU.

4.1 Mobilities in Folehaven

In this section, we describe the area of Folehaven and present our findings on the usage of various transportation modes in and around Folehaven. We also examine how the design and structural environment of the neighborhood contributes to the observed mobility flows and patterns.

Folehaven is a neighborhood located in the Valby district in the southwestern part of Copenhagen. Folehaven was constructed in the 1950s and its older design consists of non-profit housing and single-family homes. Seen in Figure 8, the roughly triangular region is enclosed on all sides by three major roads: the O2, Route 151, and Viggerslevej. Folehaven is approximately a 30-minute train ride away from the Copenhagen center.

The communal spaces of Folehaven stand out from the uniformity of the residential houses. As shown in Figure 11 below, a school, church, library, playground, and petting zoo sit at the heart of the area and are easily accessible to the entire neighborhood by bicycle or on foot. Bike racks line the street between the library and playground and benches sit along the paths around the playground. A small plaza is tucked in beside the O2, the busiest road bordering Folehaven. The plaza holds a modest grocery store, pizza shop, second-hand store combined with a cafe, and a money transfer store (Figure 10). A central courtyard between the stores offers a bike storage rack and some picnic tables. We identified the plaza, school, library, church, and playground areas to be landmarks and nodes that residents—mainly children and teenagers—would frequent.

Figure 10: A picture of the small plaza in Folehaven.

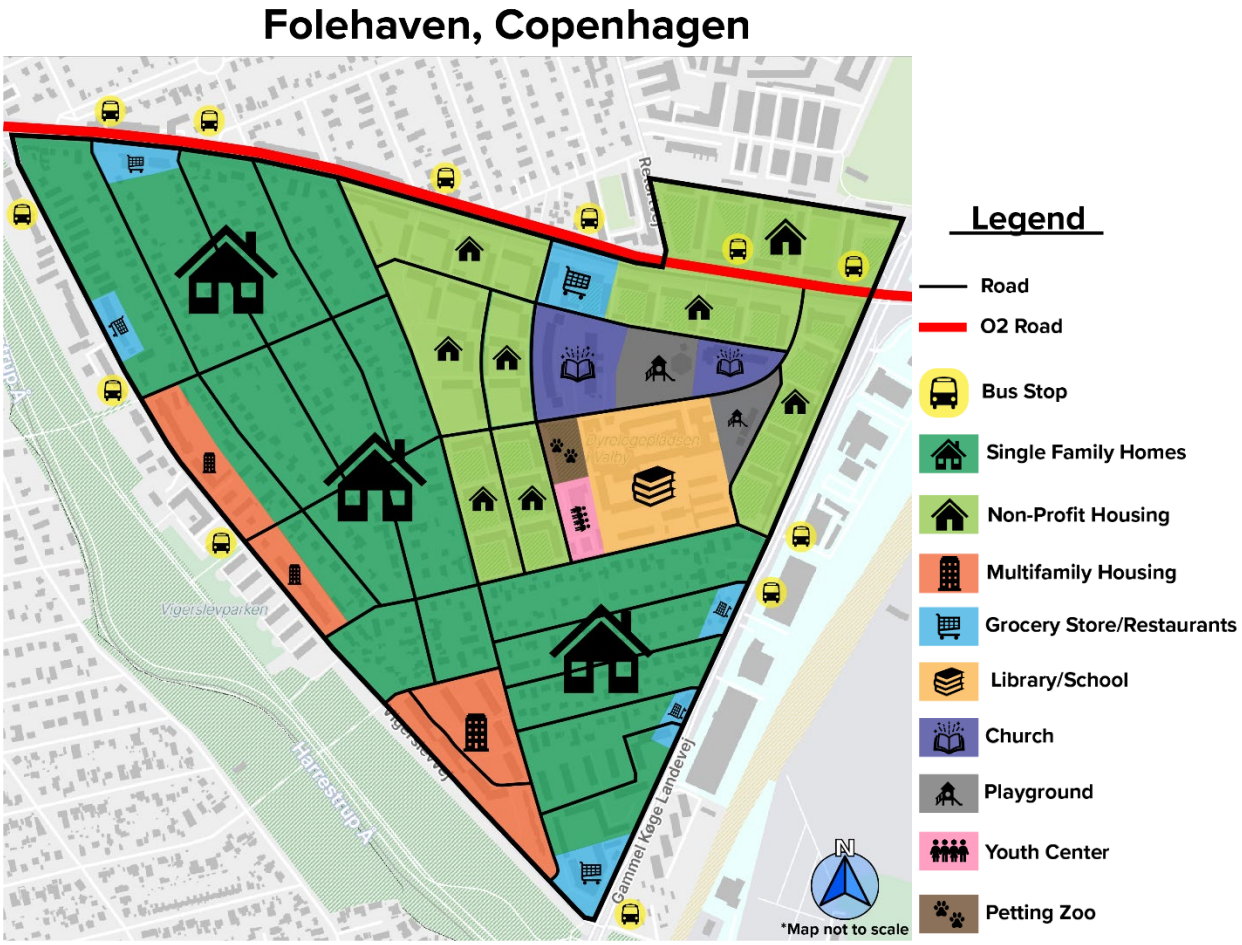

Figure 11: Structural spatial analysis map of Folehaven indicates various elements in the area.

Folehaven's older design caters to more unsustainable mobilities such as personal cars. Folehaven is an older suburban area with a low-density layout and the three large multi-lane roads that surround the neighborhood. Compared to much of Copenhagen, the area has reduced access to public transportation, serviced only by bus stops along those three major roads. Inside the neighborhood, the buildings are laid out in a repeating grid pattern with matching L-shaped, four-story apartment buildings.

The nearest train station, Ny Ellebjerg, was moved farther away from Folehaven in 2007 and now has a multi-platform design that is difficult to access and maneuver around. Ny Ellebjerg's current location is roughly a five-minute bike ride or a 15-minute walk away from the closest edge of the neighborhood and requires travelers from Folehaven to cross a busy intersection of two multilane roads. Ny Ellebjerg also has two separate platforms, one for the F-Line and the other for the A and E-Lines (Figure 12). The A and E-Lines' elevated platform sits at the end of a shared pedestrian and cyclist path, making riders climb a large set of stairs or use the elevator to reach the tracks. The F-Line

platform is below this, accessible by either crossing the tracks using the A and E-lines' platform or by travelling out and around the area. A map of Folehaven with the current location of Ny Ellebjerg can be seen in Figure 13 below.

Figure 12: Ny Ellebjerg station (present-day).

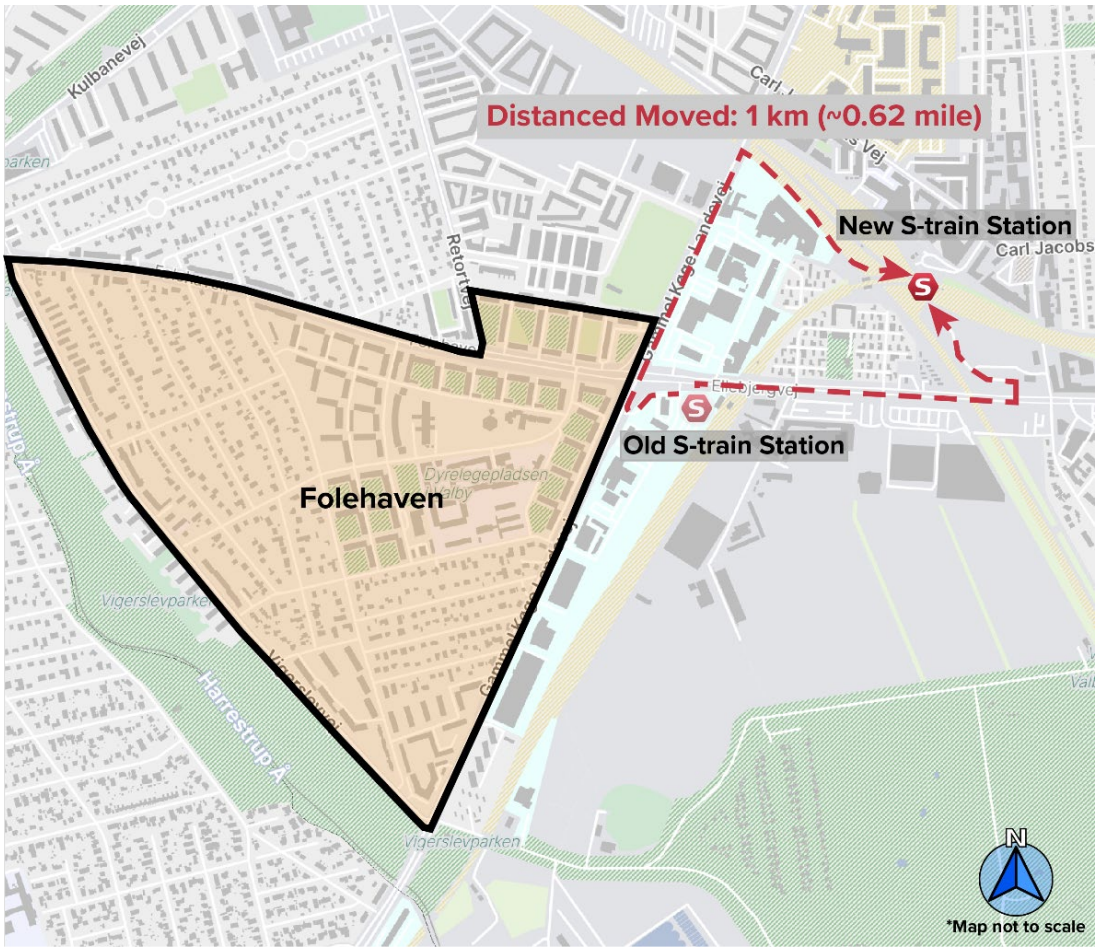

Figure 13: A map showing where the old S-train station used to be in relation to Folehaven and the current location of the new station. The possible routes to the station are shown in red.

Limited access to public transportation results in many Folehaven residents selecting cars for travel into and out of their neighborhood. Entering or leaving the Folehaven area requires joining or crossing one of the busy, boundary-like major streets. Multiple near accidents were observed on these streets, which highlighted the danger not just for children or the elderly, but for anyone using any form of transportation. Mobility counting also revealed a high percentage of car use across the four spots in Folehaven, where 50% to 79% of travelers used a car. Car traffic accounted for at least half of the total volume of traffic through the spots, suggesting how reliant Folehaven is on the automobile.

Despite the challenges of using public transportation to and from Folehaven, a grocery store employee at the Folehaven grocery store (located in the market area) stated how heavily she relies on and trusts the public transportation system for her commute. She utilizes the S-train and buses to deliver her from roughly eight kilometers away to the grocery store. However, she acknowledged “Ny Ellebjerg station is hard to get to from

[Folehaven] because it's isolated down a long path and it's elevated, which makes it hard to access."

Although more accessible than the S-train, bus usage around Folehaven was very limited relative to the total number of travelers in the area. Within the 30-minute counting sessions focused on bus stops, there was a limited number of people (often fewer than 10 people per stop, per session) who used the observed buses around Folehaven. Unfortunately, it was challenging to make comparisons between each spot and session as there was substantial variation in the number of buses that stopped per spot and between the spots themselves. More importantly, it was impossible to determine in most cases if the users of the buses were entering or leaving the area of Folehaven and not something else nearby. Before getting on a bus or after getting off, most travelers walked along one of the major roads which did not definitively show that they were coming from or heading to Folehaven specifically.

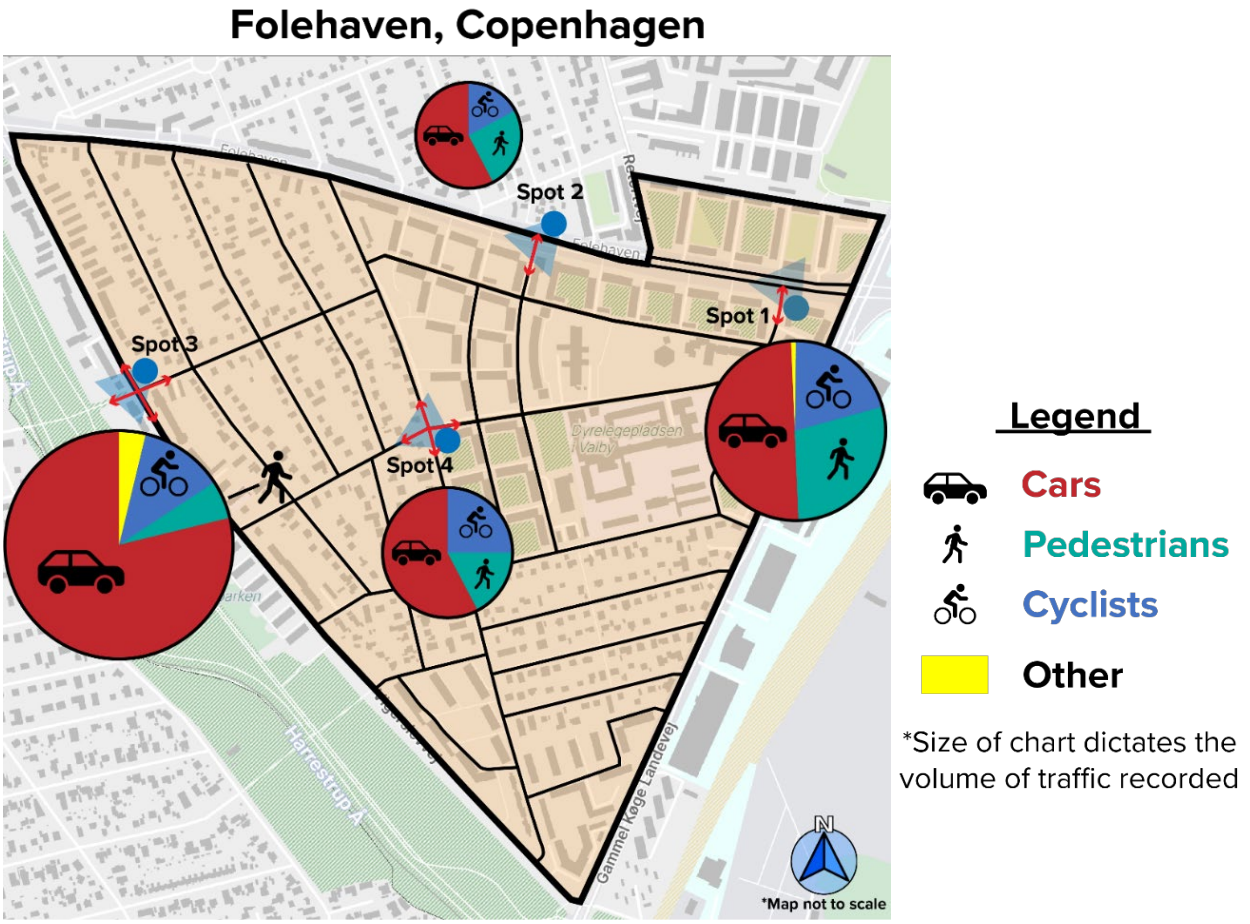

Figure 14: Daily average of mobilities recorded at each spot in Folehaven.

Mobility counting data suggests that cars are the favored mobility in Folehaven, followed by bicycles. We observed varied activity levels across the three time periods and across the four counting spots, but cars were consistently the dominant mode for travel. This can be seen in Figure 14. Folehaven is a car-dominant area due to its lack of public transportation infrastructure and the area's current built environment. The daily totals across all three days from the counting data reflect this trend. Figure 14 depicts the average daily mobility counts in Folehaven. The size of each pie chart is proportional to the average daily mobility count at each site, respectively. As can be seen, cars were the dominant mode of mobility across three days of observations.

The three major roads that enclose Folehaven are a major barrier to any mobility entering or leaving the area. Often, pedestrians would end up jaywalking across these major roads because moving to safe crossing points was inconvenient. Even at the crosswalks, the pedestrian lights would only be green for a brief period, leaving slower walkers stranded on the median. The roads stay very busy throughout the day, so this danger is constantly present. Figure 15 shows a picture taken by a team member of the busy roads around Folehaven on a typical day.

Figure 15: A picture taken by a team member of the busy roads around Folehaven on a typical day.

Folehaven's inhabitants largely require mobilities that take them to activities outside of the area and back, whether that be work, grocery shopping, or something else. This suggests that while roads inside the neighborhood are relatively suitable for sustainable transportation, such as pedestrian and cyclist traffic, the roads and infrastructure that lead to resources outside of the area play a bigger role in defining residents' mobility habits. In her interview, AAU Ph.D. student and SIMS member Malene Rudolf Lindberg discussed how innovative mobilities technologies cannot just be thrown at

a problem and expected to fix it. People's needs vary by region, culture, and so much more. In Folehaven's case, a comprehensive solution will need to improve their overall mobility or provide them access to the existing mobility infrastructure that does not reach them currently.

Structural stories also play a major role in how people justify their mobility choices. A structural story can be thought of as anything that a person uses to conclude that a certain mode of transportation is optimal (or not) for their purposes. Another interviewee, the owner of a smørrebrød shop, presented a structural story supporting her car-dominant mentality. She explained that she travels by car daily to drop her kids off at school and make the journey to her shop because she trusts the car to meet her needs in terms of timeliness and reliability more than the Metro or S-train. Also, she said that she has to make runs to the grocery store to gather food for her store, which her car is the most effective for. Interestingly, she told us about how much she biked as a child and how she still enjoys biking very much; she just does not feel like she has the time for it because of the demands of her children and job.

4.2 Mobilities in Nordhavn

Mobility in Nordhavn exemplifies sustainable ideas that are supported by infrastructure. The most apparent findings regarding mobility can be split into three main categories: physical infrastructure, public transportation access, and neighborhood attraction. Below we discuss findings for each category.

The range of businesses and amenities available in Nordhavn draws people to the area. We focused on the existing, developed region between two streets, Sandkaj and Helsinkigade (see Figure 9) since the remainder of Nordhavn outside of this region was shrouded in scaffolding or tarps. Nordhavn is a dense, modern neighborhood designed around the concept of sustainability. The area is up-and-coming and is an attractive location for new developments and amenities. The ground floors of many buildings are occupied by restaurants, cafes, grocery stores, and small businesses while the upper floors are dedicated to apartments. There were many instances where pedestrians would enter Nordhavn from and later exit with a purchase from a shop or restaurant. In addition to Nordhavn's many business offerings, the Sandkaj boardwalk was found to be another strong attraction for both residents and visitors looking to relax. We noticed that the boardwalk's traffic increased later in the day when people were out of work, and with nicer weather.

Figure 16: A picture taken in the field of the buildings in Nordhavn.

Nordhavn was designed to offer access to multiple forms of public transportation. Despite being a new neighborhood in Copenhagen, Nordhavn is afforded an S-train station, two Metro stations, and a bus stop as can be seen in the structural spatial analysis map below (Figure 17). At the mouth of the main street—Arhusgade—sit the Nordhavn Metro station entrances, and across the O2 is the Nordhavn S-train station which is a 5-minute walk from the Metro station. The Orientkaj Metro station provides riders with a stop in the less developed region of Nordhavn.

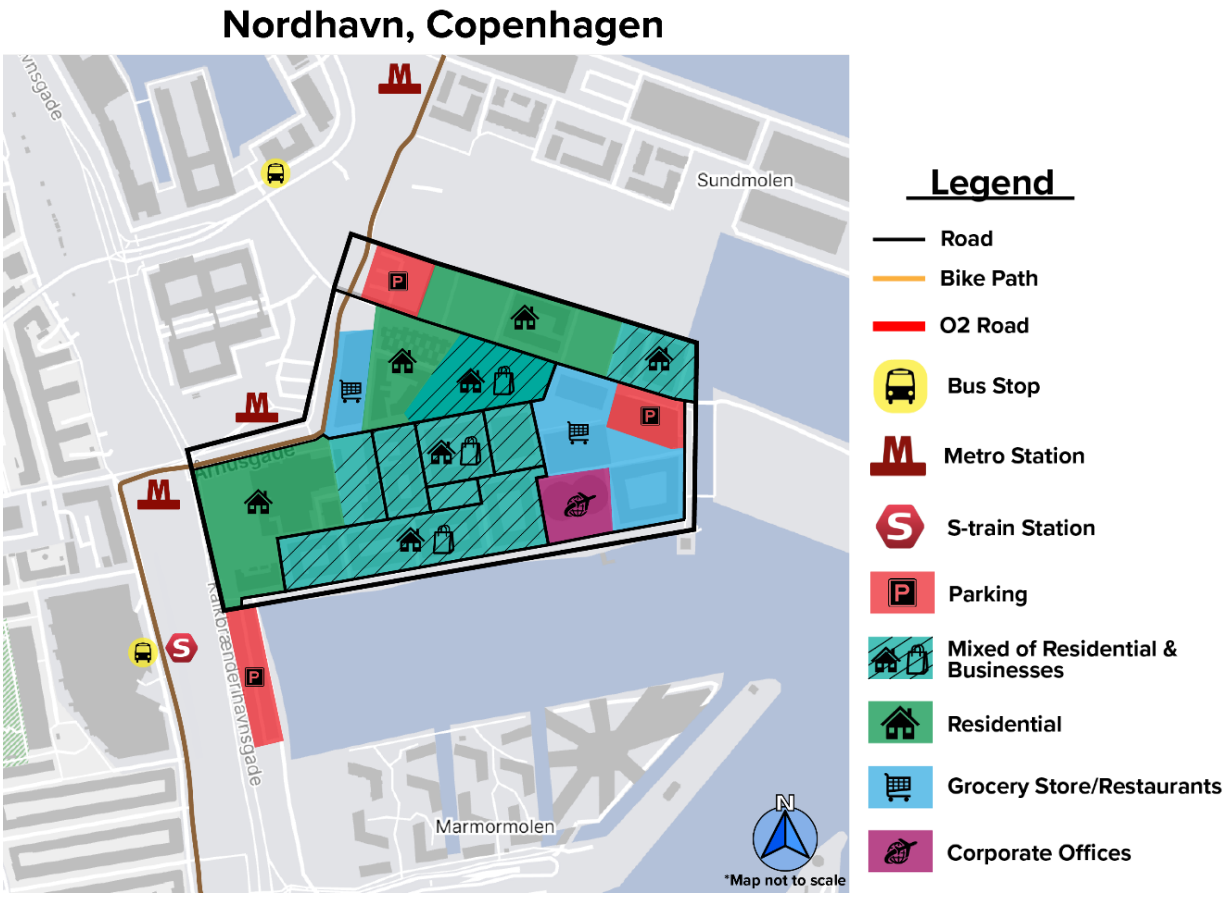

Figure 17: Structural spatial analysis map of Nordhavn indicates various elements in the area.

The bus stop, Metro stations, and S-train station locations are indicated on the map. The map also displays the location of designated parking areas, mixed-use buildings with businesses on the street level and residential space on the upper levels, apartment buildings, grocery stores or restaurants, and the office building containing the German Embassy.

Nordhavn's physical infrastructure gets people out of their cars and moving through the area by foot or bike. The streets in Nordhavn lead to dedicated parking structures that make it easy for travelers to park and leave their vehicle. Smaller side streets in Nordhavn contain obstacles that make them less friendly to cars.

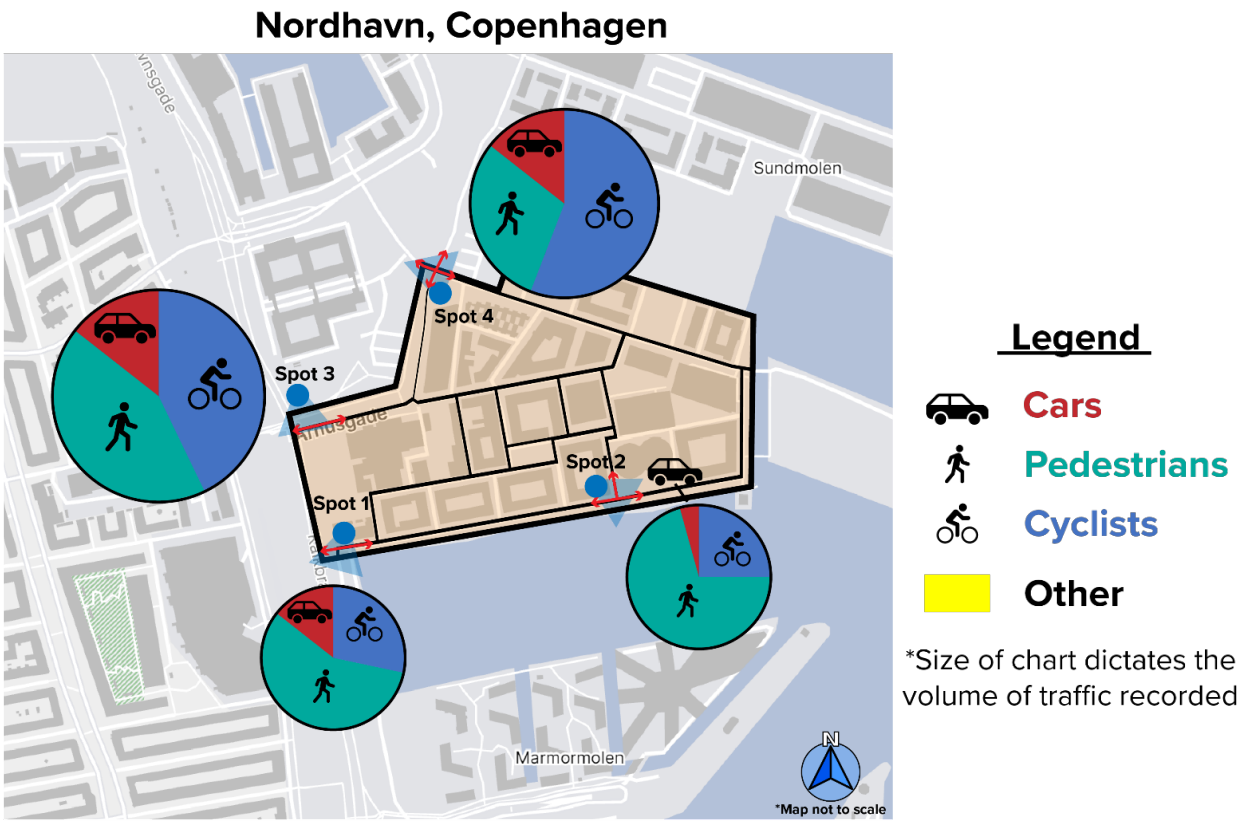

Figure 18: Average daily totals in Nordhavn at each mobility counting spot.

Mobility counting data suggests that bikes and walking are the favored mobilities in Nordhavn. In Figure 18, the size of each pie chart represents the average daily volume of traffic counted at each spot. As can be seen, the pedestrian and cyclist traffic dominated each of the four mobility counting spots in Nordhavn.

Notably, Nordhavn's side streets and connecting pathways appear designed to favor the movement of bicycle and foot traffic and discourage car use. The Sandkaj boardwalk counting spots were only accessible by these side streets, and there was a far lesser percentage of car traffic than on the main road spots. These streets are made from bricks and contain obstacles like trees, benches, and sculptures that force drivers to move slowly or choose alternative routes. Street parking is scarce, but down the main road is an above-ground parking garage that helps accommodate the neighborhood's parking needs, in addition to other private underground parking garages available to select residents. Implicitly forcing traffic into the parking garages encourages people entering Nordhavn to park their cars and proceed through the neighborhood on foot or bicycle.

Providing access to public transportation and sustainable mobility increases people's willingness to utilize them. Two of the interviews conducted highlighted this aspect of accessibility to and from Nordhavn. One interview was with a Nordhavn resident

who was walking home after picking up groceries from the local Netto grocery store. She explained that she utilizes public transportation when leaving Nordhavn since the proximity of the Metro and S-train station allowed her to easily exit and return home without relying on a car to move around. Depending on how she is feeling, she may combine cycling and public transportation by cycling to either station from her home. This interview highlighted that providing people with reliable alternatives to car transportation—like easily accessible public transportation—impacts their mobility choices.

Furthermore, another interview conducted with an individual who works in a local poke shop reinforced the impact Nordhavn's public transportation infrastructure has on people who enter the area. Since this individual does not reside in Nordhavn he commutes to work five days a week and prefers to bike to work. However, he uses the Metro exclusively in the winter and in other seasons if the weather is not ideal. He goes to a school that is four kilometers away and he frequently takes the Metro in the morning and walks back home in the evening. When asked about combining different modes, he expressed an aversion to the concept, stating that it is easier to just stick with one mode.

4.3 Comparison of Mobilities in Folehaven and Nordhavn

In this section, we compare and contrast the focus areas of Folehaven and Nordhavn. A close look is taken at the difference in transportation themes in the areas and potential causes, such as the built environments, wealth, and image of the respective neighborhoods.

Nordhavn is much better supported by public transportation than Folehaven. Nordhavn has two Metro stations as well as an S-train station, both of which are very close to the area's center. The Nordhavn Metro station has entrances that go underground on both sides of a major road (the O2) so that pedestrians can safely access the Metro or simply cross the road without doing it on the surface where there is traffic. The roads also have traffic lights to enhance safety when crossing. This is unlike Folehaven, where the area lacks a Metro station and an easily accessible S-train station. From the closest point in the neighborhood, Folehaven's nearest S-train station, Ny Ellebjerg, is 1km (0.62 miles) away, whereas Nordhavn's S-train station is around 100-200m away. A similar distinction goes for the bus stops in Folehaven, with all of the bus stops located on the boundaries of the area, requiring residents to cross the busy four-lane roads with limited traffic lights to enhance safety. While Folehaven is a lower-density area compared to Nordhavn, the amount of public transportation available to each area shows an inequity in mobility access.

When comparing the layout of each area, it is noticeable that Nordhavn facilitates the use of bicycles and pedestrian traffic more effectively. Nordhavn's mobility advantages come from its recent development, which has taken place almost entirely within the past decade, and the image of the neighborhood as a wealthy area. Nordhavn promotes and encourages alternative forms of transportation such as walking and biking by having limited on-street parking and a centralized parking garage to get people out of their cars. Additionally, most roads are narrow and make it more challenging for cars to use. Cars are also limited in the number of streets they can drive down as there are plantings and obstacles that deter cars from driving. There are also large sidewalks and a dedicated bike path that passes through the area. When making a comparison of the average mobilities seen over the three days, it is easily seen in Figure 19 that Folehaven is dominated by cars whereas Nordhavn is dominated by pedestrians and cyclists. Overall, it is evident that the idea of sustainability has been incorporated into planning of the area of Nordhavn and leads to more sustainable and equitable mobilities.

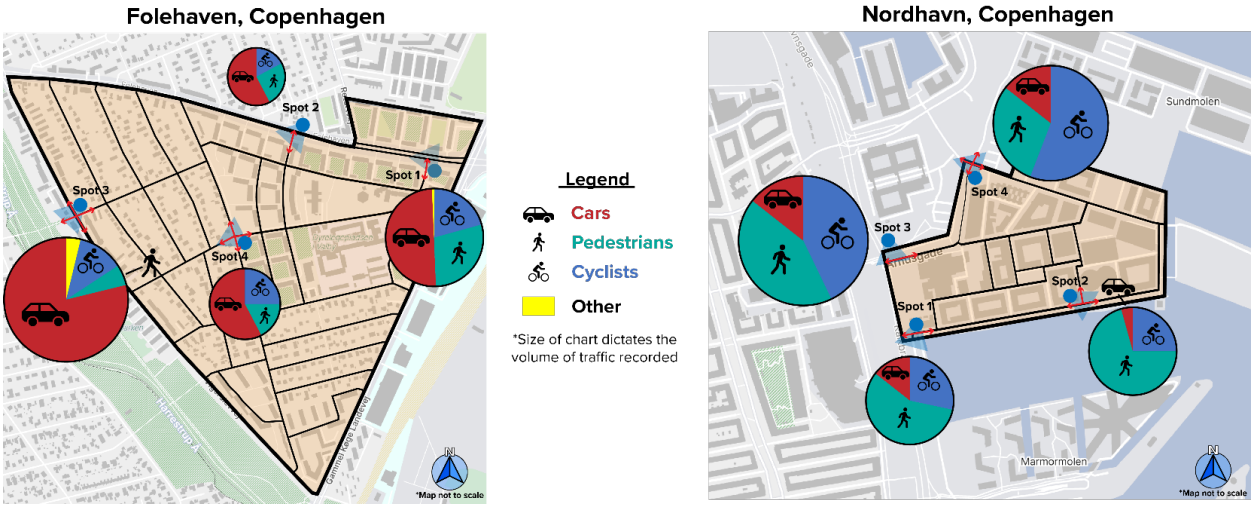

Figure 19: Average daily totals in Nordhavn at each mobility counting spot.

Folehaven represents the opposite end of the spectrum regarding suitability and equity with its infrastructure dating back to the 1950s when planning was focused around the automobile, and sustainability and equity were not accounted for. At the time of development for the area, the idea of sustainable and equitable mobilities as well as alternative forms of transportation were not incorporated in the planning of the area. Because of this, there is a noticeable difference when accessing and moving throughout Folehaven. Where Nordhavn has bike friendly and car-free paths, Folehaven has long roads with small sidewalks and limited bike lanes, both encouraging the idea of using personal vehicles. There is not much incentive to get people out of their car and this has created inequity in the fact that it remains unaddressed to this day.

Figure 20: Picture of a typical road in Folehaven.

Figure 21: A picture of typical road in Nordhavn.

Mobilities in Folehaven primarily serve to move residents out of the area while Nordhavn mobilities move a lot of non-resident visitors into the area. This difference appears to be evident in the location and quality of mobilities infrastructure in

each location. Folehaven's relative lack of amenities and visitors compared to Nordhavn results in a lower interest in improving Folehaven's mobilities. Nordhavn, meanwhile, enjoys residents with higher income, a significantly higher number of amenities, and a substantial amount of people entering the area for work and leisure. The economic promise of Nordhavn has likely influenced the city's willingness to invest in its mobilities infrastructure and the mobilities' effectiveness at moving people into, out of, and around the area.

The perception of each area affects the interest from private companies in developing their mobilities to be more equitable and sustainable. SIMS member and Ph.D. student Nikolaj Grauslund Kristensen pointed out that Folehaven is on Denmark's list of "vulnerable neighborhoods." This is an "official term for a district in Copenhagen which according to the Danish government has social problems, and usually has a majority population of 'non-Western' ethnicities" (Rosendal Jensen et al., 2015 & Almene Boliger, n.d). This contributes to a negative perception of the area. Malene Rudolf Lindberg, a member of SIMS and a Ph.D. student, brought up how the SIMS project highlighted a key challenge to improving mobilities in Folehaven. She stated that all their project partners (such as car sharing services) pulled out of Folehaven but remained in Nordhavn because they foresaw a profitable future there. This demonstrates the inequity that exists based around the perception of the area. Getting equitable mobilities into areas like Folehaven to match those of neighborhoods like Nordhavn is difficult to do, but failing to do so leaves areas with insufficient mobility access.

4.4 Opportunities Within Worcester

In this section, we discuss opportunities within Worcester for transportation improvements. Along with these descriptions, we present methods and strategies from Copenhagen that may be repeatable in Worcester.

Worcester's current infrastructure makes it challenging to incorporate better public transportation. Worcester officials Luba Zhaurova, Stephen Rolle, and Brian Pigeon classified the city as a larger but lower density city with many different neighborhoods. This layout requires widespread public transportation service in order to cover the region, yet only a proportionally small number of people utilize it. Despite the size of Worcester County, only two public transportation services are available in the region. The Worcester Regional Transit Authority (WRTA) is a private bus company that receives limited federal funding for the significant area it serves. In Worcester, the average interval between WRTA buses at stops on major routes is 60 minutes, whereas Copenhagen's A-buses typically service stops every 15 minutes (*Comprehensive Regional*

Transit Plan Update 2020, 2021; *Rejseplanen*, n.d.). The Massachusetts Bay Transportation Authority's (MBTA) commuter rail—commonly referred to as "the T"— runs between Worcester and Boston and does not provide any mobility within Worcester.

Having a new Department of Transportation can guide Worcester to more sustainable and equitable mobilities. The city officials explained that a new Department of Transportation and Urban Mobility is being proposed in July of 2022, hopefully to be established soon after. They all expressed great interest in moving Worcester mobilities in a sustainable and equitable direction but detailed the barriers that they have encountered so far in their efforts. One such barrier is how the city collects transportation data and how it is used. This is an area where researchers from the WPI Mobility Justice Lab maybe be able to assist the city.

Understanding the behaviors, patterns, and needs of residents in an area are critical to improving its mobilities. The methods used in Copenhagen by the SIMS project have the potential to be replicated in Worcester. Counting and close analysis of the flow of mobilities in small regions or neighborhoods followed by spatial analysis and interviews to establish the reasoning behind the movements in the regions could offer a lot of insight that can be applied beyond the focus area.

Utilizing mobile methods could also be a valuable way to understand the perspectives of residents in the area being studied. Some examples of mobile methods include walk-and-talk or ride-and-talk interviews where the interviewer (the person doing research) joins the interviewee to travel with them on foot or in a car to experience what the interviewee is talking about as it is being discussed. By moving with the subject, the researcher becomes a part of the subjective experience, and this allows for a greater understanding of their motives.

Rudolf Lindberg further solidified the importance of user experience in mobility research. Combining quantitative data with qualitative data creates a more thorough understanding of what decisions people in an area of study are faced with in their day-to-day lives and the way that mobilities appear to these people in the context of their decisions. By picking areas that are likely to have a discrepancy in mobility justice, these methods become more effective at bringing equity issues into the light and helping to ensure that they are given consideration while tackling the challenge of sustainability. Worcester officials stated that roughly 30% of Worcester citizens do not have access to an automobile. For such a car-dominated area, this is a significant population that is forced to use public transportation.

Educating the public about mobilities could help with a sustainable and just transition in Worcester's mobilities. City officials expressed interest in educational

components in addition to physical infrastructure improvements. Enabling people to be more aware of how they move and reframing their perspectives of different modes of transportation would ease the acceptance of physical changes and increase the likelihood of their use, especially in place of private cars. Grauslund Kristensen explained that the incorporation of residents into transitions like this has been termed "horizontal empowerment." The limitation of dedicating resources to educate community members on the benefits of sustainable and just mobilities is that while they may become more aware and informed, it does not guarantee that they will make the switch.

Worcester can take inspiration from Copenhagen's focus on smaller, "low-hanging fruit" projects. Copenhagen has gradually implemented and framed mobility changes in such a way that they were able to snowball into one of the world's leading examples of a sustainable city. Malene Freudendal-Pedersen, Professor of Urban Planning at Aalborg University, emphasized Copenhagen's ability to bring about changes in transportation by not fighting car industry giants head-on. Rather, Copenhagen conducted small-scale "sneaky" changes that leveraged other projects or found other ways to adjust traffic patterns and street designs without drawing a lot of attention. Trying to phase out the car in one motion may frustrate travelers because they will feel their movement is inhibited, while politicians and companies that benefit from the automotive industry will oppose the change for financial reasons.

Transportation project prioritization models commonly have a bias toward building roads in both the U.S. and Denmark. Worcester city officials and Professor Freudendal-Pedersen cited current sustainable transportation evaluation criteria as being biased toward road building or expansion projects because it weighs the elimination of idling traffic heavily. Typically, the system determines that the easiest solution to congestion is to increase the size of a road or build additional roads. Worcester may be able to replicate the alternative ranking system Copenhagen uses that prioritizes sustainability projects by using health, wellness, and stress outcomes to evaluate the merit of potential projects.

4.5 Opportunities for the Mobility Justice Lab

In this section, we identify potential areas of research or general action for WPI's Mobility Justice Lab. We also present findings regarding ways in which awareness regarding the Mobility Justice Lab can be spread and interest can be generated.

Worcester's eight universities and the city's government stand to benefit from collaboration. Zhaurova, Rolle, and Pigeon agreed that local universities and their

researching power could be a great resource to the city government. More specifically, WPI has a project-based curriculum and a focus on applied research that makes it a promising partner for the city. The key is getting capable students and researchers matched up with projects that suit their level of expertise. Undergraduates might not have the necessary skills to make a serious impact on the projects and Worcester officials do not have time to spare closely monitoring students.

Actively engaging with the WPI community can increase attention towards mobility justice. Students said that they would be more inclined to join a mobility project labeled with "justice" over "sustainability." However, they also had a harder time defining "mobility justice" rather than "sustainable mobility." This suggests that the topic of mobility justice may still be unknown to the WPI community and society at large, and that newcomers will require an introduction to the field. To bring in these newcomers and give them the introduction they need, the WPI students suggested that a detailed description with a clear definition of mobility justice would make them more likely to inquire about a mobility justice project. They added that they are more likely to participate in an activity if their friends or acquaintances are participating too.

There are a handful of existing clubs and departments at WPI that may want to get involved with the Mobility Justice Lab due to shared interests. Such clubs include the Green Team, Rotaract Club, American Academy of Environmental Engineers and Scientists, and the American Society of Civil Engineers. Apart from these clubs, the Civil and Environmental Engineering Departments, the Office of Sustainability, and the Social Science and Policy Studies Department might also be good pools to draw students from.

4.6 Opportunities for Collaboration Between AAU and WPI

In this section, we examine the interest and potential for future collaborations between AAU and WPI. We speculate at the nature of these collaborations based on interviews and the areas of study where we imagine future projects taking place.

WPI students can learn a lot by immersing themselves in Copenhagen's mobilities. As we experienced, AAU and Copenhagen have many examples of both sustainable and equitable mobilities and methods used to study them. Undergraduate students from WPI could benefit from investigatory projects similar to this, while graduate students and faculty could collaborate on research projects that address broader issues and use more sophisticated methodology. Perspectives from the United States combined with Danish perspectives can generate well-rounded research findings and recommendations.

Blending these viewpoints can be beneficial for both sides by building on existing skills or learning new ones.

AAU students and researchers can learn from studying U.S. transportation. The American transportation system needs a lot of work and presents different challenges than in Europe. This must be tackled to achieve more sustainability and equity in mobilities worldwide. Malene Freudendal-Pedersen indicated that a future collaboration between AAU and WPI would be a promising opportunity for both universities to learn from one another. Coming from diverse backgrounds, cultures, and exposure to different perspectives, there is a lot of room for comparison for students and researchers. They would receive the opportunity to experience the culture and facilities of U.S. transportation, apply methods in a new setting, and possibly learn new methods as well.

If funding permits, higher level collaborations could take place between WPI researchers and AAU researchers. There appears to be interest on both ends for future joint projects between WPI and AAU faculty. However, Sheller acknowledged that funding for such projects can be challenging because government funding tends to be supplied with the aim of improving the area that it originates from. For example, U.S. funding will support projects in the U.S., and Danish or European funding will support projects in Denmark or Europe respectively. Finding funding for joint projects is not impossible, but it may require more effort and coordination from the researchers.

5. Recommendations

This chapter lays out recommendations regarding the WPI Mobility Justice Lab and future collaboration between WPI and Aalborg University (AAU). We discuss how the WPI Mobility Justice Lab can leverage existing resources on the WPI campus to make a positive impact at the university and the role the lab could play in improving transportation in the city of Worcester. We will then switch focus to what collaborations between AAU and WPI could look like in the future and what both universities could stand to gain.

5.1 Recommendations for the Mobility Justice Lab At WPI

We recommend that the Mobility Justice Lab engage with the WPI community through events, marketing material, and courses. We have identified that people are not as familiar with mobility justice as they might be with other topics of sustainability. Therefore, the lab's efforts in this area should be designed to increase the community's knowledge and interest in the mobilities field.

We recommend that the Mobility Justice Lab propose opportunities to collaborate with clubs and departments on sustainable and equitable mobility events and projects. We have noted that there are existing clubs and departments that relate to sustainability and social justice issues, however, none of these currently focus on mobility.

We also recommend that the Mobility Justice Lab look to sponsor students that are looking to start a mobility-focused club on campus.

5.2 Recommendations for the Mobility Justice Lab in Worcester

We recommend that the lab reach out to Worcester city officials to discuss how the lab can get involved. Worcester's new Department of Transportation and Urban Mobility has the potential to generate projects that the Mobility Justice Lab can assist with to help improve mobilities in the city.

We recommend the lab's involvement in Worcester city projects be prioritized at the graduate and the faculty level. We believe that graduate students and faculty can tackle more advanced topics or methods and provide more effective deliverables than undergraduate students.

We recommend that city officials and the lab set predetermined goals and deliverables for undergraduate-level projects, with dedicated time to regularly check in and advise the students. Establishing these criteria prior to the beginning of the project may also help attract students that demonstrate strong interest in the project area, and strength in the necessary skills.

We recommend that the lab repeat methods used by the SIMS researchers in Copenhagen in divergent neighborhoods of Worcester. If the Mobility Justice Lab were to work with the city of Worcester, we believe that understanding the needs and thinking of an area's residents is vital to recognize and solve their travel demands. These methods include mobility counting, field observations, local interviews, and spatial analysis.

We recommend that the lab focus on small, low-hanging fruit projects within Worcester. This may be difficult because the projects the lab takes on will largely rely on funding, but these smaller projects may better suit the scale of the lab in its early stage. Such projects should be easier to accomplish, which would grow the name of the lab and create real change sooner in Worcester.

5.3 Recommendations for Collaboration with AAU Going Forward

The final area of recommendation is for the Mobility Justice Lab's future collaboration with Aalborg University, based on the fact that both universities have expressed interest in growing this partnership.

We recommend mainly focusing on graduate and faculty level research and collaboration. We see it as being the most effective. Undergraduate projects across the two institutions require more structure and guidance throughout the life of the project.

We recommend that for collaboration at the undergraduate level the two institutions create a plan of action that details the specific actions that need to be accomplished beforehand. Clearly establishing these criteria prior to the beginning of the project may also help attract students that demonstrate strong interest in the project area, and strength in the necessary skills.

Based on discussion with Mimi Sheller, WPI students could benefit from drawing on the AAU Department of Planning's strong sociology background, experience collaborating with engineers, and the value of working with a world leader in sustainability, Copenhagen. Looking in the other direction, Sheller sees AAU students expanding their perspective and challenging themselves with the transportation culture in the United States. To a much

higher degree than Copenhagen, Worcester and the rest of the U.S. remains entrenched in personal vehicles. As Professor Freudendal-Pedersen, Danish students will bring very critical thinking to projects in the U.S., to the benefit of themselves and their project.

In conclusion, a lot can be learned from Copenhagen's exemplary mobilities but getting out on the ground in a target area is necessary to properly identify effective strategies to transition the area in a lasting way. People are at the heart of mobilities and applying methods that understand their needs and thinking produce truly comprehensive mobility solutions that lead to a more sustainable and equitable future.

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Appendices

Appendix A: Interview Protocols

Appendix A-1: Semi-Structured Interview With Malene Freudendal-Pedersen

- Professor in the Department of Planning, Researcher on SIMS project

Introduction:

Thank you for agreeing to speak with us! Do you mind if we record this interview?

Questions:

- How do/would you inspire others to get involved in the field of mobilities?
  - How do you generate interest from graduate students to complete their work in your department, at Aalborg?
- How do you change people's attitude toward mobilities in a sustainable direction?
  - What methods can be used to inspire people to look at sustainable/equitable mobilities in a new or different way?
- We spoke with members from Worcester's planning department (and similar departments), and they were curious what Copenhagen uses as criteria for decision-making regarding projects (Worcester currently uses Envision Sustainable Infrastructure System) and what they use as a metric for success?
  - If you have any, what have your experiences been translating findings from your research into government projects?
  - Or, what have you experienced working with/for the government on mobility-related projects?
- How do you think mobility justice plays a role in sustainability?
- What are the biggest challenges or barriers to implementing sustainable and equitable mobilities in a city/adapting existing mobilities to become more sustainable and equitable?
- In what ways can you see Aalborg and WPI interacting in the future, if any?
  - How do you envision groups or researchers from WPI being useful for Aalborg?
  - How do you see Aalborg students and researchers being useful for WPI (and what can they (the students from Aalborg) get out of doing projects/research with WPI?

Extra Questions:

- What recent noteworthy mobility-related projects have you been a part of?
  - What are some innovative or interesting research methods that you have utilized while studying mobilities?
- What have been some of the barriers that you have experienced
  - (Maybe more specifically in SIMS???)
- What surprises or unexpected outcomes have come up in your mobilities research? How did they influence your future research plans?

- What direction do you see mobilities in Copenhagen taking in the near future?
- What impact do you hope your research will have made in the next 5 years?
- What are the best examples of sustainable mobilities from your research?
- What are the best examples of equitable/just mobilities from your research?

Closing:

Do you have any questions for us or anything you'd like us to make note of or look into (regarding our project)?

If we have any clarification questions or follow-up questions, is it okay if we email those to you? Thank you for taking the time to do this interview!

Logistics:

To record this data, we will take hand notes during the interview, as well as record the audio using a cell phone or recording device.

Primary Q: John
Secondary Q: Kyle
Note-takers: Kayla and Pete

Appendix A-2: Semi-Structured Interview With Malene Rudolf Lindberg

- Ph.D. Fellow in the Department of Planning, Member of SIMS Project

Introduction:

Thank you for agreeing to speak with us! Do you mind if we record this interview? As you know, our project is focused on studying sustainable mobilities and mobility justice in the hopes of assisting the SIMS project here and bringing our findings back to our university and Mimi Sheller.

Back in the U.S., we are trying to learn more about the current state of mobilities at our university, WPI, and the surrounding city, Worcester. We are looking at transportation in Copenhagen as an example for ways in which Worcester can become more sustainable and equitable, so that everyone in the city will have the opportunity to benefit from effective mobilities.

Questions:

- What motivated you to get into the study of mobilities?
- How do/would you inspire others to get involved in the field of mobilities?
- What mobility related projects have you been a part of?
    - What are some innovative or interesting research methods that you have utilized in your research on mobilities?

- What are the biggest challenges or barriers to implementing sustainable and equitable mobilities in a city/adapting existing mobilities to become more sustainable and equitable?
- What surprises or unexpected outcomes have come up in your mobilities research? How did they influence your future research plans?
- How does mobility justice play a role in sustainability?
- We spoke with members from Worcester's planning department (and similar departments) yesterday and they were curious what Copenhagen uses to determine criteria for decision-making (Worcester currently uses Envision Sustainable Infrastructure System) and what they use as a metric for success?
    - If you have any, what have your experiences been translating findings from your research into government projects?

Extra Questions:

- What impact do you hope your research will have made in the next 5 years?
- What are the best examples of sustainable mobilities from your research?
- What are the best examples of equitable/just mobilities from your research?
- What direction do you see mobilities in Copenhagen taking in the near future?
- Can you describe the spatial analysis methods more?

Closing:

If we have any clarification questions or follow-up questions, is it okay if we email those to you? Also, we can send you our report before it is published if you would like to review it and/or we can send you a copy after it is published. Thank you for taking the time to do this interview!

Logistics:

To record this data, we will take hand notes during the interview, as well as record the audio from the interview using an audio recorder, or an app on one of our personal phones.

Appendix A-3: Semi-Structured Interview With Nikolaj Grauslund Kristensen

- Ph.D. Fellow in the Department of Planning, Member of SIMS Project

Introduction:

Thank you for agreeing to speak with us! Do you mind if we record this interview? As you know, our project is focused on studying sustainable mobilities and mobility justice in

the hopes of assisting the SIMS project here and bringing our findings back to our university and Mimi Sheller.

Back in the U.S., we are trying to learn more about the current state of mobilities at our university, WPI, and the surrounding city, Worcester. We are looking at transportation in Copenhagen as an example for ways in which Worcester can become more sustainable and equitable, so that everyone in the city will have the opportunity to benefit from effective mobilities.

Questions:

- How did you get into the study of mobilities?
- What are some innovative or interesting research methods that you have utilized in your research on mobilities?
- What are the biggest challenges or barriers to implementing sustainable and equitable mobilities in a city/adapting existing mobilities to become more sustainable and equitable?
- What surprises or unexpected outcomes have come up in your mobilities research? How did they influence your future research plans?
- How does mobility justice play a role in sustainability?

Extra Questions:

- What impact do you hope your research will have made in the next 5 years?
- What are the best examples of sustainable mobilities from your research?
- What are the best examples of equitable/just mobilities from your research?
- What direction do you see mobilities in Copenhagen taking in the near future?

Closing:

If we have any clarification questions or follow-up questions, is it okay if we email those to you? Also, we can send you our report before it is published if you would like to review it and/or we can send you a copy after it is published. Thank you for taking the time to do this interview!

Logistics:

To record this data, we will take hand notes during the interview, as well as record the audio from the interview using an audio recorder, or an app on one of our personal phones.

Appendix A-4: Structured Interviews With Local Residents

Introduction:

Hi, do you have a few minutes to answer some questions for my research project?

Thank you for agreeing to speak with me! I am a university student from the United States working on a project studying transportation here in connection with Aalborg University. My team is trying to better understand what forms of transportation are preferred by Danes and how they are utilized. Your answers will be anonymous and only viewed by myself and my three team members.

Questions:

1. What neighborhood do you live in? (doesn't have to be too specific)
    - If you are comfortable, can you point to it on a map (general area/nearby store)?
2. Where do you travel to most often?
    - For what purpose (work, friends, etc.)?
3. Do you utilize public transportation for any of these trips?

A. IF YES:
    1. How often?
    2. How do you travel from home to the station?
        - Every time (is weather/something else a factor)?
    3. How do you travel from the station to your destination?
        - Every time (is weather/something else a factor)?

B. IF NO:
    1. What transportation mode do you use for these trips?
    2. Why do you not use public transportation?

1. What is the most frequent multi-modal combination you use? Why?
2. When traveling 5 km or less, what's your ideal form/combination of mobilities?
    1. What about for over 5 km?
3. What is your experience with moving from one form of transportation to another?
    1. How are these shifts with a bike?

Closing:

Those are all the questions I have for you. Do you have any questions for me?

Thank you so much for taking the time to do this interview! Have a great day.

Logistics:

To record this data, we will take hand notes during the interview and use a tablet to mark points on a map.

Appendix A-5: Semi-Structured Interview With Dean Mimi Sheller

- Dean of the Global School, Founder of the WPI Mobility Justice Lab

Introduction:

Thank you for agreeing to speak with us! Do you mind if we record this interview? As you know, our group is studying sustainable mobilities and mobility justice in the hopes of assisting you with your vision of founding a Mobility Lab here at WPI. We are also working with faculty and graduate students here at Aalborg University in Copenhagen on the Sustainable Innovative Mobility Solutions (SIMS) project.

Our research centers around the intersection of sustainable and just mobilities. We are mostly looking at transportation and how it can become more sustainable and equitable, so that everyone on the campus and around the city will have many opportunities to benefit from the same mobilities.

Proposed Questions:

Priority Questions:

- What is the status of the WPI Mobility Justice Lab?
- What scope/region do you see the Mobility Justice Lab addressing (WPI, Worcester, the U.S.)?
- What do you see the Mobility Justice Lab having accomplished in five years?
- How would you describe the role mobility justice plays in sustainability?
- What are some interesting or innovative methods that you have utilized in your research on mobilities?
- How would you like to continue to work with Aalborg in the future?

Extra Questions (if time allows):

- What mobility solution (more focus on walking, cycling, shared mobilities, MaaS, etc.) do you currently believe has the most potential for Worcester?
- What are the best examples of sustainable mobilities from your research?
- What are the best examples of equitable/just mobilities from your research?
    - If there is an overlap between the examples of sustainable and just mobilities, follow up about those examples if possible

- Are there other universities you would like to work with?
- Do you have any other active mobility-related projects, and if so, what are they?

Closing:

Do you have any questions for us or anything you'd like us to make note of or look into (regarding our project)?

If we have any clarification questions or follow-up questions, is it okay if we email those to you? We will also send you our report before it is published if you would like to review it and we will send you a copy after it is published too. Thank you for taking the time to do this interview!

Logistics:

To record this data, we will take hand notes during the interview, as well as record the audio and video (if there is any) from the interview using the built-in Zoom or Teams recording feature.

Appendix A-6: Semi-Structured Interview With Worcester City Officials

- Luba Zhaurova: Director of Projects, Department of Sustainability and Resilience
- Stephen Rolle: Assistant Chief Development Officer - Planning & Regulatory Services
- Brian Pigeon: Senior Transportation Planner

Introduction:

Thank you for agreeing to speak with us! Do you mind if we record this interview? Our group is studying sustainable and equitable mobilities in the hopes of assisting with the founding of the Mobility Justice Lab at WPI. We are also working with faculty and graduate students in Copenhagen at Aalborg University on their Sustainable Innovative Mobility Solutions (SIMS) project. Our research centers around the intersection of sustainable and just mobilities. We are mostly looking at transportation and how it can become more sustainable and equitable, so that everyone on our campus and around the city will have opportunities to benefit from the same mobilities.

Proposed Questions:

Priority Questions:

- How would you describe your roles in the city?

- You mentioned in your talk at WPI in February that the city is creating a Department of Transportation, can you tell us any more about its timeline and goals?
- How does the city currently, or plan to collect transportation data?
    - Not just ridership, but accessibility to different modes and nodes where people can transfer to other modes
    - Follow-ups:
        - How does transportation data get used?
        - What type(s) of data is/are most useful?
- What are some innovative alternative mobilities that you could see being applied to in Worcester? (Are there any?)
- What are the main barriers that oppose improvements, or even just the maintenance of, mobilities/transportation in Worcester?
- Are there any plans or thoughts on how to promote alternate mobility for Worcester citizens within the city?
- How familiar are you with the concept of equitable mobility?
    - Give them a description if they aren't: Equitable mobilities provide accessible, sustainable, and integrated options that empower people of all socioeconomic backgrounds to have physical mobility and freedom.
- What mobility-related projects are currently being worked on, or are planned, in the city?
    - How are these projects moving mobility in an equitable direction in Worcester?
- How do you think Worcester citizens can be incorporated into the development of sustainable and equitable mobilities in Worcester? (Is this a realistic possibility?)
- What sort of research or otherwise assistance could local universities like WPI offer to aid and accelerate the progress of Worcester transportation in a sustainable and equitable direction?

Extra Questions (if time allows):

- How might Worcester move away from being so centered around private car ownership? (If it hasn't been answered by an earlier question: is this a goal of current efforts or are there other priorities before this would be attempted?)
- What is the status of the "Complete Streets Policy" from 2017? (approved 2018 by MassDOT)
- Are there any cities Worcester is trying to model its transportation network after?

- Are you familiar with or interested in the idea of test/"open street" days where alternative mobility modes are accommodated specially so residents can try them out?
    - For example, closing certain streets to cars or modifying traffic within a certain area to encourage bicycle use.
- Do you have any experience with the Regional Bicycle or Pedestrian Compatibility Indices, published by the Central Massachusetts Metropolitan Planning Organization (CMMPO)?
- Is there anything from the Worcester Now plan that you think could be relevant to our project?

Closing:

Do you have any questions for us or anything you'd like us to make note of or look into (regarding our project)?

If we have any clarification questions or follow-up questions, is it okay if we email those to you? We can also send you our report before it is published if you would like to review it and we can send you a copy after it is published too. Thank you for taking the time to do this interview!

Logistics:

To record this data, we will take hand notes during the interview, as well as record the audio and video (if there is any) from the interview using the built-in WebEx recording feature.

Appendix A-7: Semi-Structured Interviews/Focus Groups With Wpi Students

Introduction: Thank you for coming to help us with our project, with the interest of keeping this short, we'll get right into the questions.

Questions:

- Does anyone mind if we record this?
- Can everyone please go around and say their major?
- What do you think transportation equity looks like?
    - Do you think transportation in Worcester is equitable? Why/why not?
- Are any of you active on campus in any way relating to sustainability? (clubs, classes, etc.)

    - Are you aware of any clubs/classes relating to sustainability?
- What would get you interested in a sustainability project at WPI? (Would it need to be related to your major?)
- Would you be more likely to join a project labeled with sustainability or justice? Why?
- What do you think would get WPI students more interested in mobility justice?
    - What could WPI do to expose students more to mobility justice?
- How much interest do you think mobility justice projects at WPI would get? First in IQPs? MQPs? In general?

Bonus question:

- Where did you rank our project and why?

Closing: Do you have any questions for us? Thank you for taking the time to do this!

Appendix B: Mobility Counting Protocol

	Morning (8-8:45am)	**Afternoon (12-12:45pm)**	**Evening (4-4:45pm)**
Cyclists			
Pedestrians			
Cars			
Scooters			
Moped			
Bus			

Spot 1: Count the traffic in and out of Folehaven at Kirsebærhaven intersection with Folehaven road.

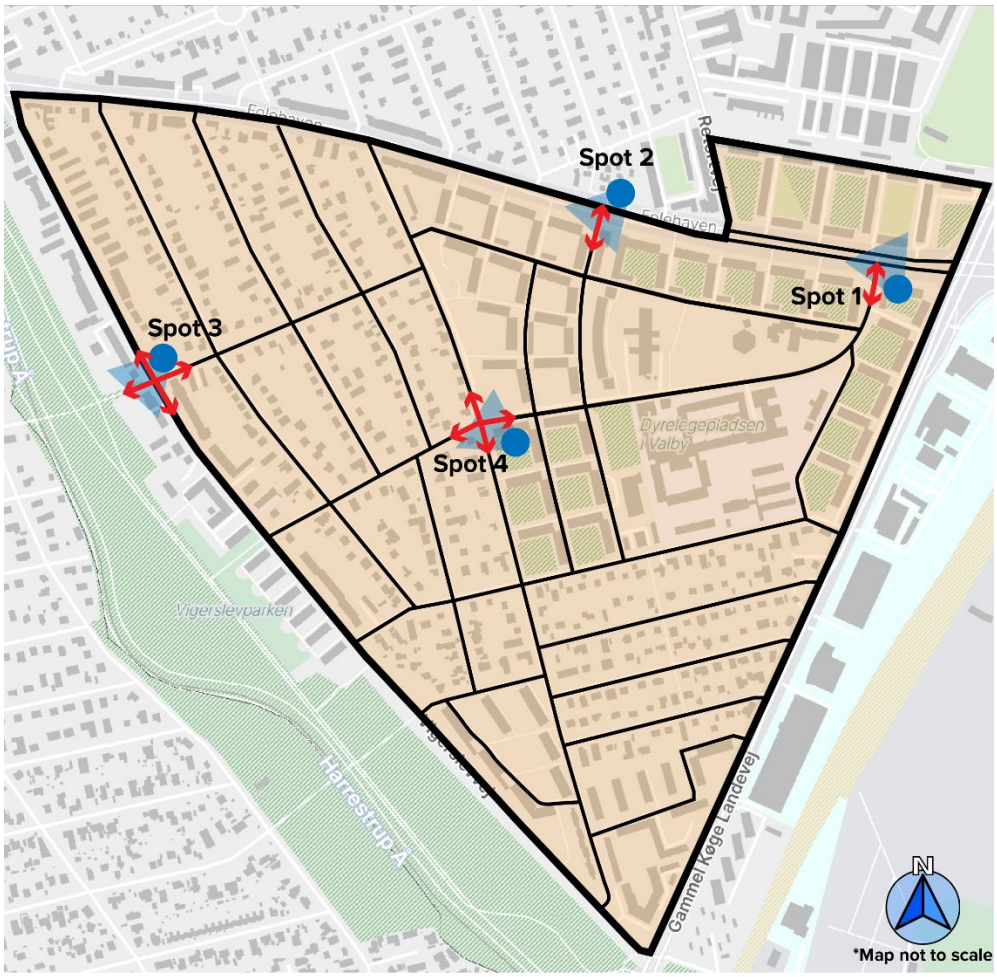
Spot 2: Count the traffic crossing the bridge and enter or leave Vinhaven (the road). Also take notes of how the public space is used during the day.

Spot 3: Count the traffic as illustrated on the map

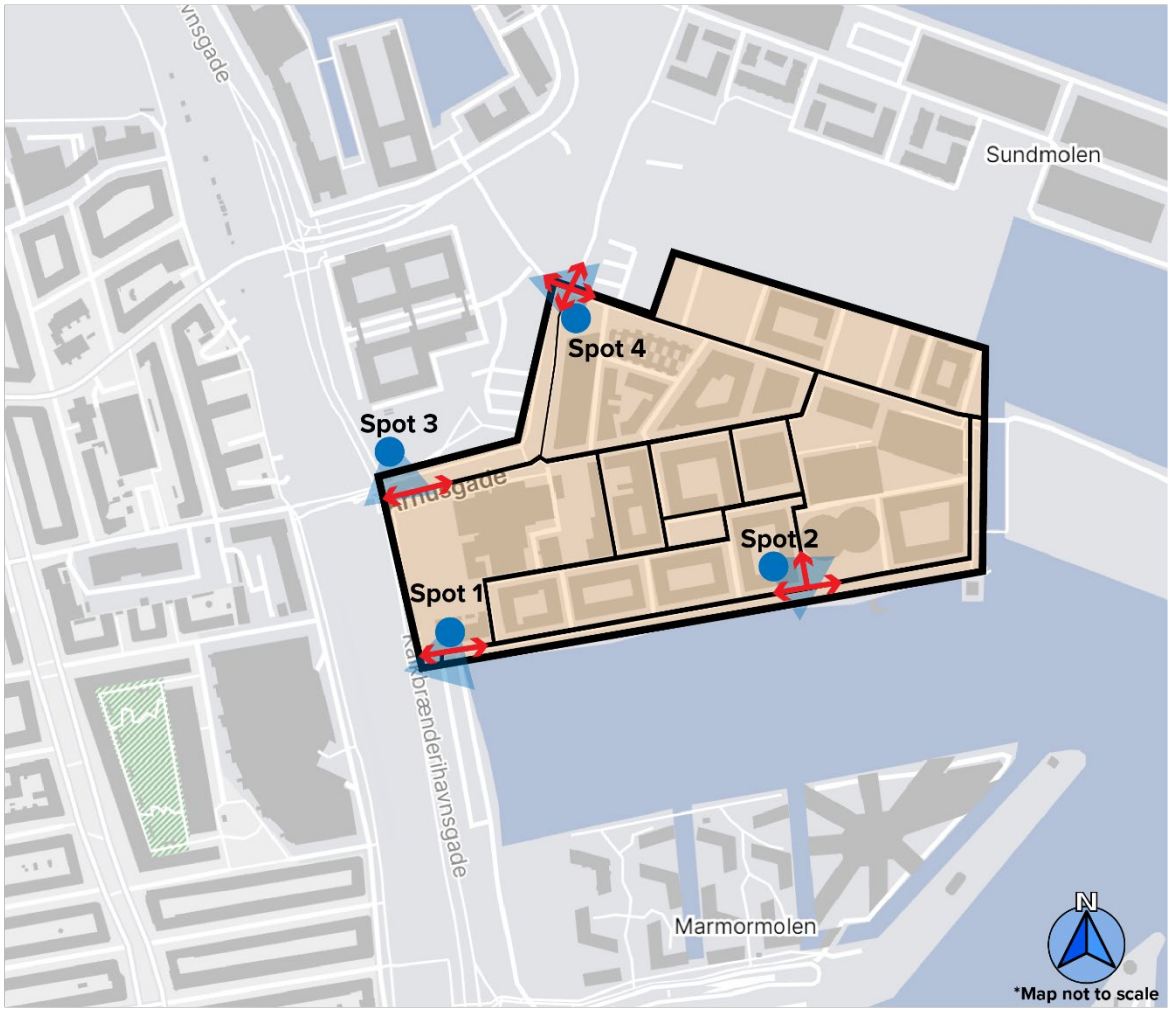
Spot 4: Count the traffic as illustrated on the map.

The spots are selected as these are all enter/exit point of Folehaven, and (spot 4) to get an idea of the mobilities in Folehaven). Supplement with field notes.

Folehaven, Copenhagen



Nordhavn, Copenhagen



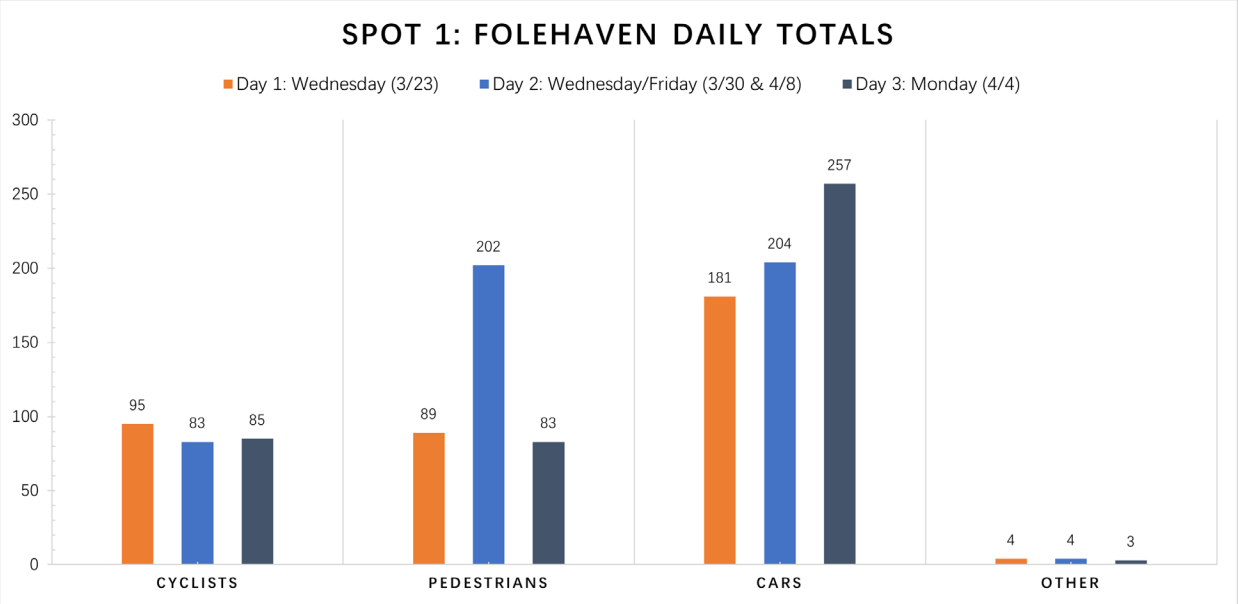
Appendix C: Findings and Graphs

Daily Totals: Spot 1, Folehaven

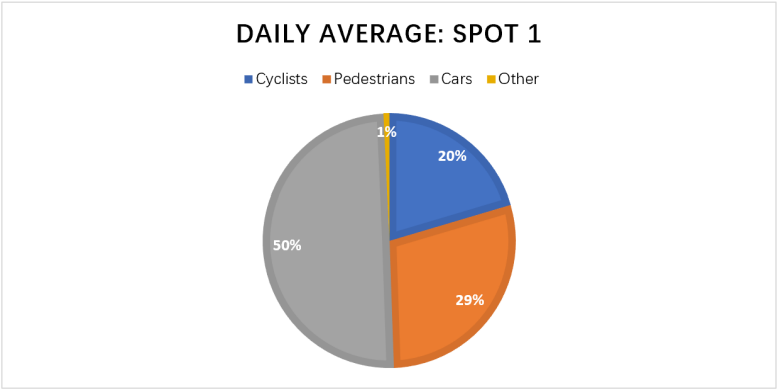
	Day 1: Wednesday (3/23)	
	Type	Number
Spot 1	Cyclists	95
	Pedestrians	89
	Cars	181
	Other	4

Day 2: Wednesday/Friday (3/30 & 4/8)	
Type	Number
Cyclists	83
Pedestrians	202
Cars	204
Other	4

Day 3: Monday (4/4)	
Type	Number
Cyclists	85
Pedestrians	83
Cars	257
Other	3



Daily Averages	
	Average
Cyclists	88
Pedestrians	125
Cars	214
Other	3
Total	429

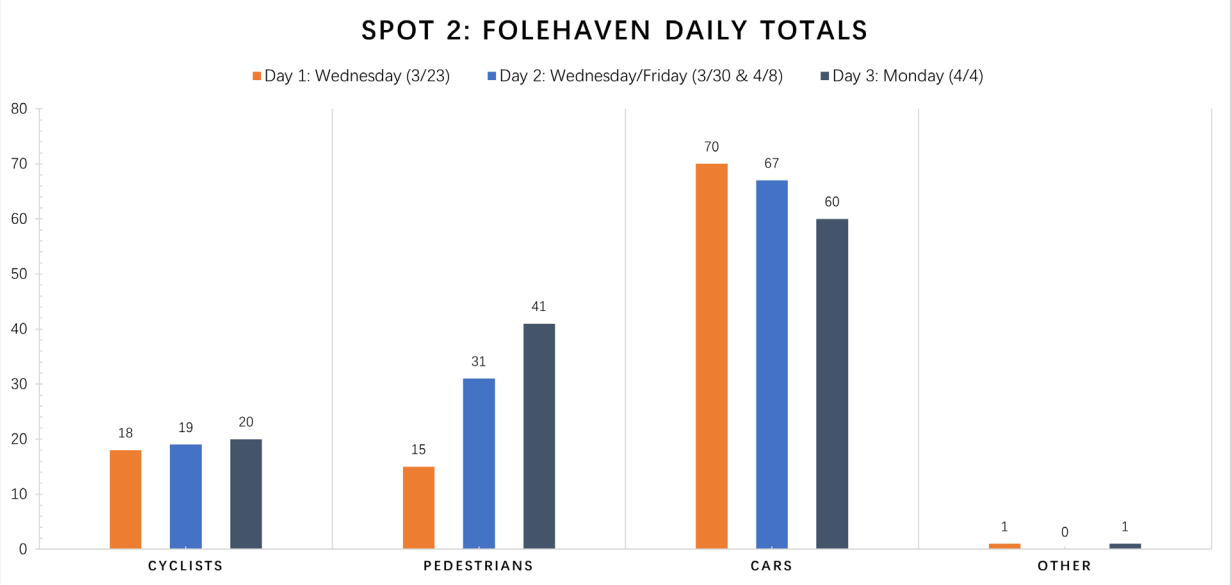


Daily Totals: Spot 2, Folehaven

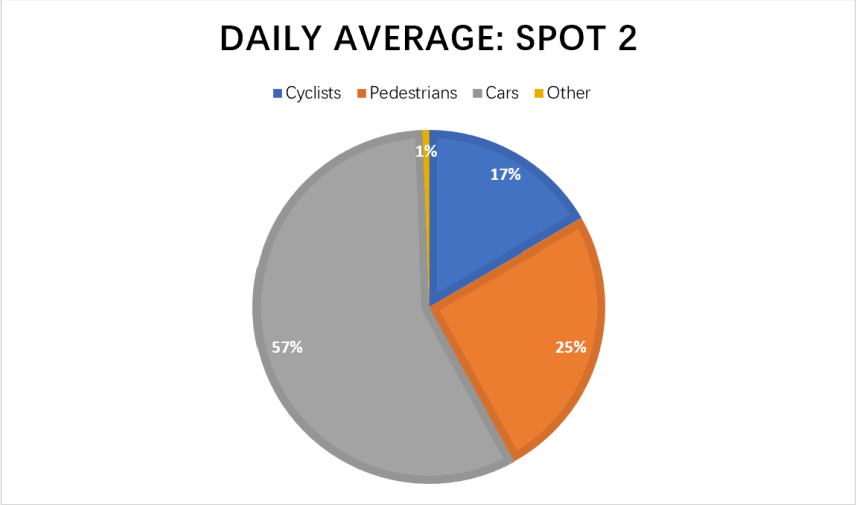
	Day 1: Wednesday (3/23)	
	Type	**Number**
Spot 2	Cyclists	18
	Pedestrians	15
	Cars	70
	Other	1

Day 2: Wednesday/Friday (3/30 & 4/8)	
Type	**Number**
Cyclists	19
Pedestrians	31
Cars	67
Other	0

Day 3: Monday (4/4)	
Type	**Number**
Cyclists	20
Pedestrians	41
Cars	60
Other	1



Daily Averages	
Cyclists	19
Pedestrians	29
Cars	66
Other	1
Total	114

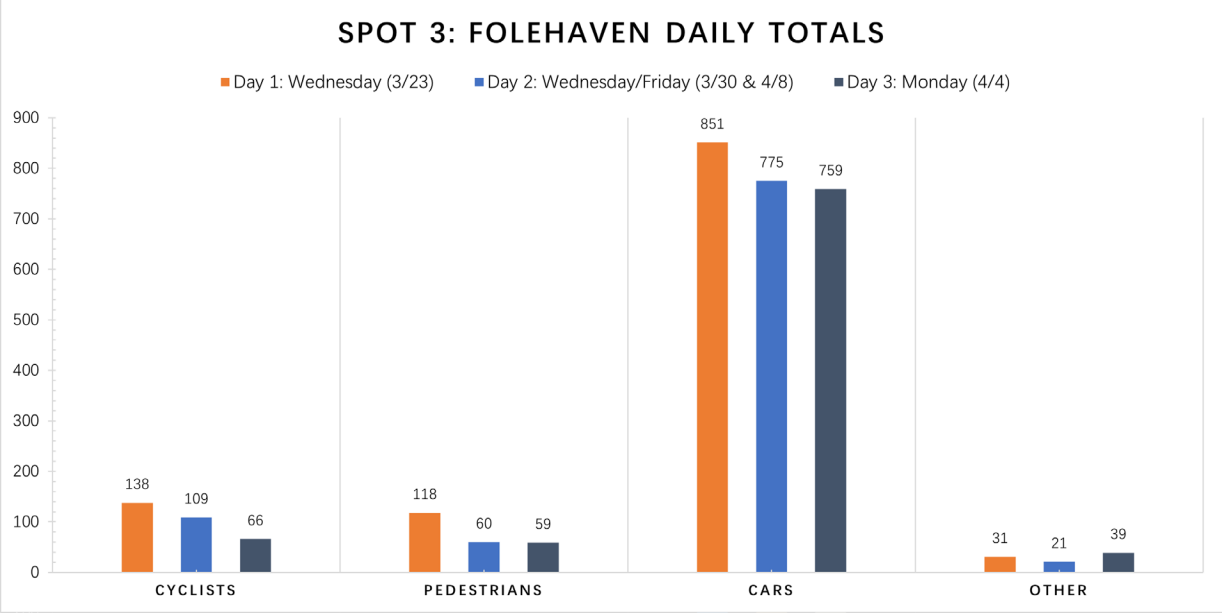


Daily Totals: Spot 3, Folehaven

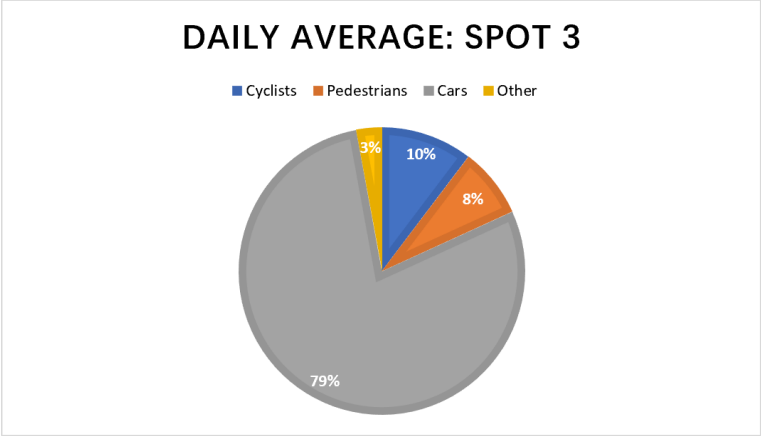
	Day 1: Wednesday (3/23)	
	Type	Number
Spot 3	Cyclists	138
	Pedestrians	118
	Cars	851
	Other	31

Day 2: Wednesday/Friday (3/30 & 4/8)	
Type	Number
Cyclists	109
Pedestrians	60
Cars	775
Other	21

Day 3: Monday (4/4)	
Type	Number
Cyclists	66
Pedestrians	59
Cars	759
Other	39



Daily Averages	
Cyclists	104
Pedestrians	79
Cars	795
Other	29
Total	1007

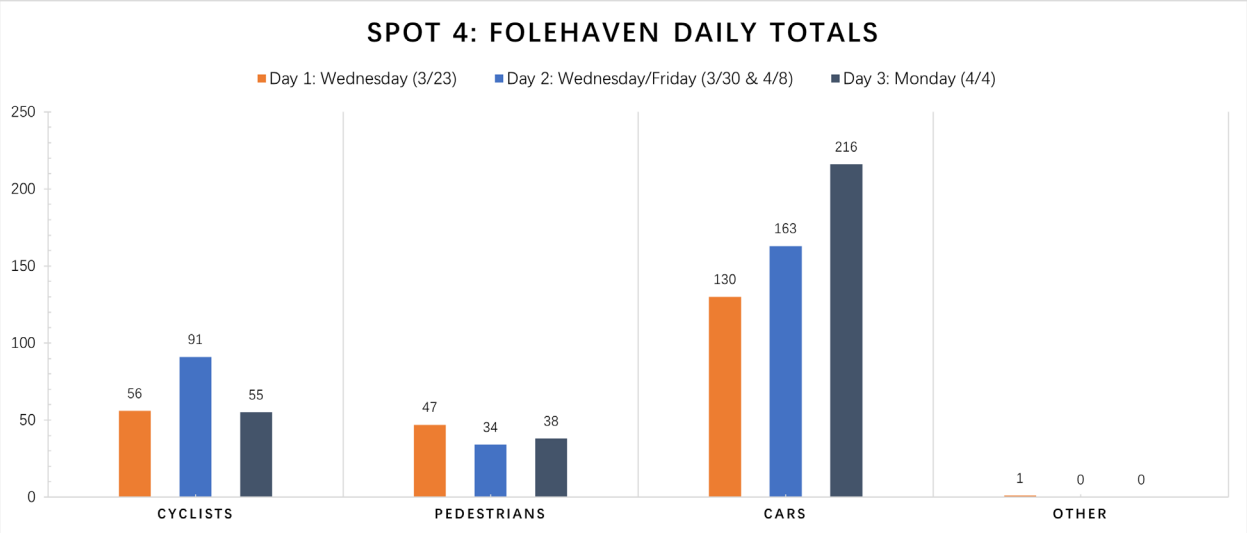


Daily Totals: Spot 4, Folehaven

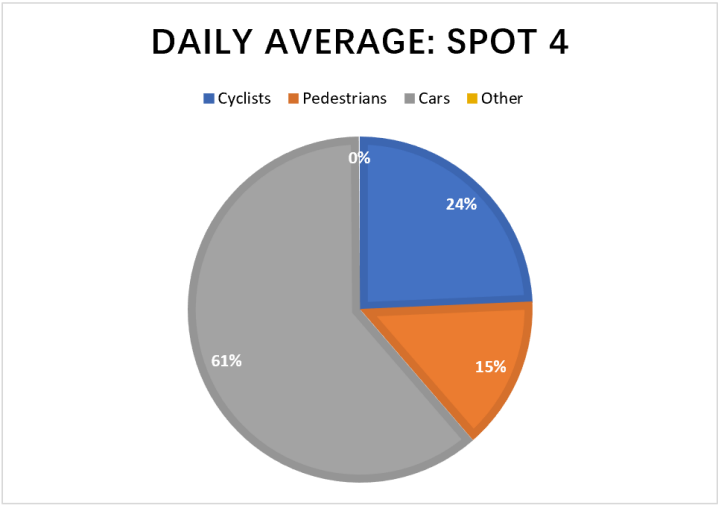
	Day 1: Wednesday (3/23)	
	Type	Number
Spot 4	Cyclists	56
	Pedestrians	47
	Cars	130
	Other	1

Day 2: Wednesday/Friday (3/30 & 4/8)	
Type	Number
Cyclists	91
Pedestrians	34
Cars	163
Other	0

Day 3: Monday (4/4)	
Type	Number
Cyclists	55
Pedestrians	38
Cars	216
Other	0



Daily Averages	
Cyclists	67
Pedestrians	40
Cars	170
Other	0
Total	277

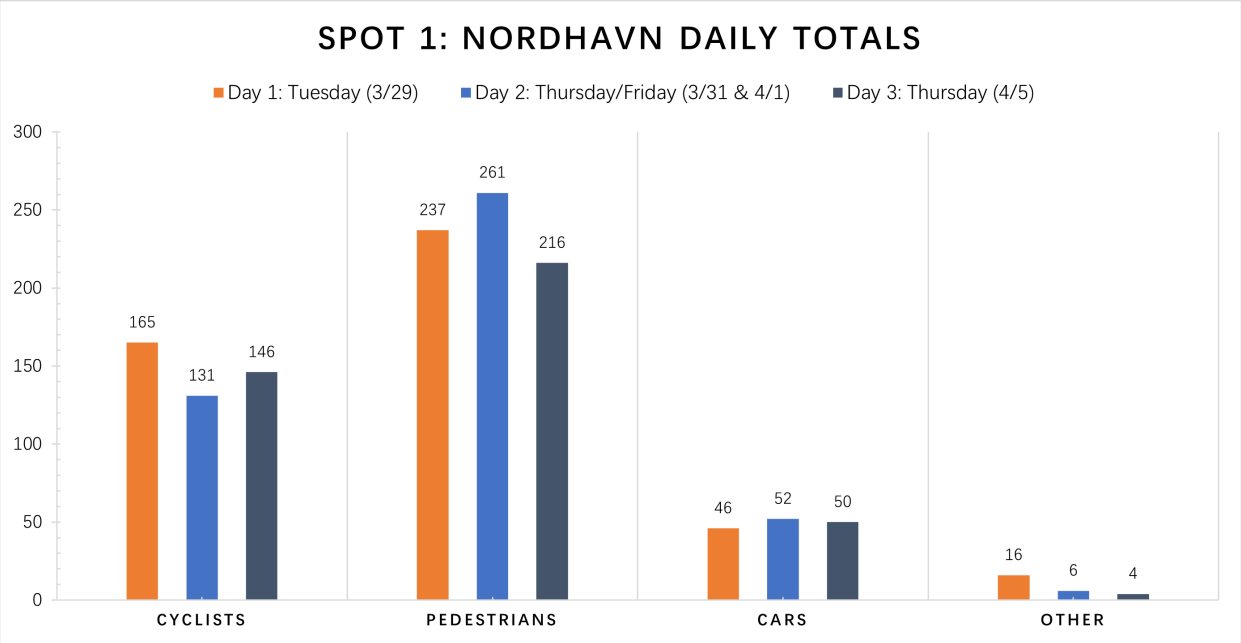


Daily Totals: Spot 1, Nordhavn

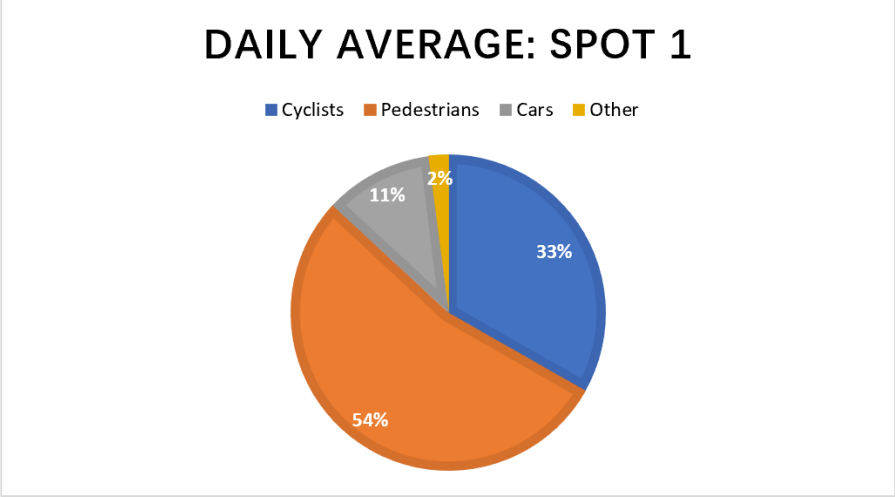
	Day 1: Tuesday (3/29)	
	Type	Number
Spot 1	Cyclists	165
	Pedestrians	237
	Cars	46
	Other	16

Day 2: Thursday/Friday (3/31 & 4/1)	
Type	Number
Cyclists	131
Pedestrians	261
Cars	52
Other	6

Day 3: Thursday (4/5)	
Type	Number
Cyclists	146
Pedestrians	216
Cars	50
Other	4



Daily Averages	
Cyclists	147
Pedestrians	238
Cars	49
Other	9
Total	443

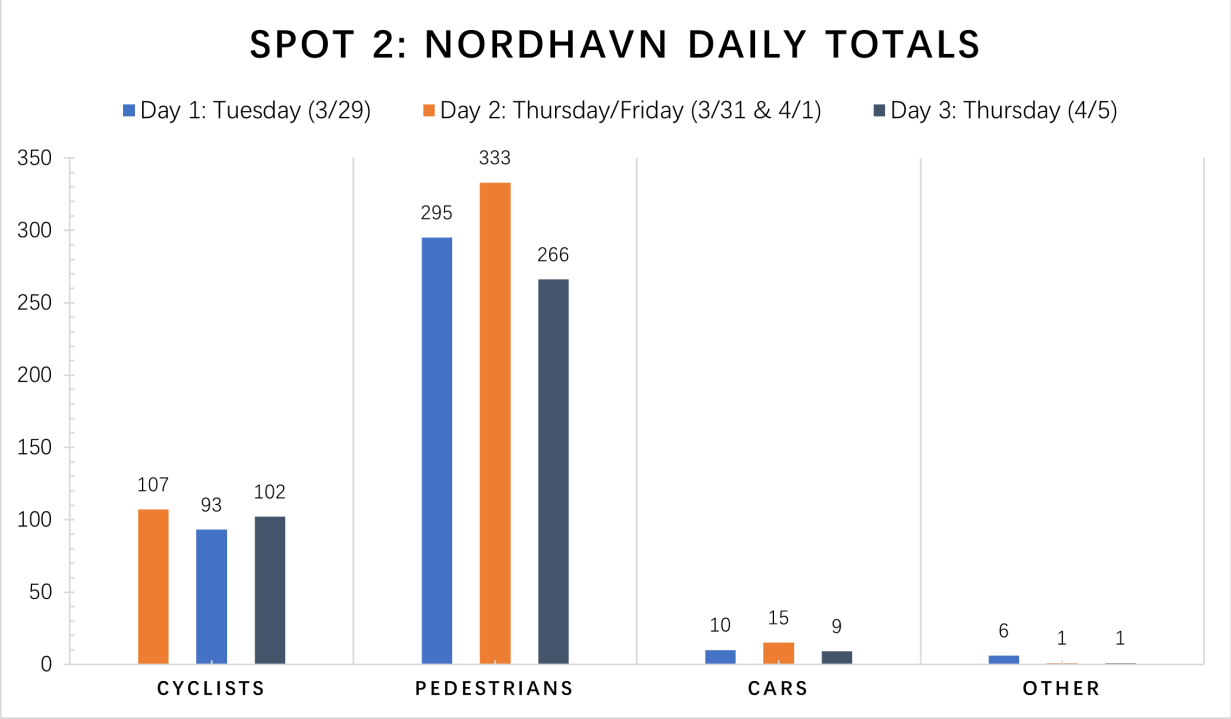


Daily Totals: Spot 2, Nordhavn

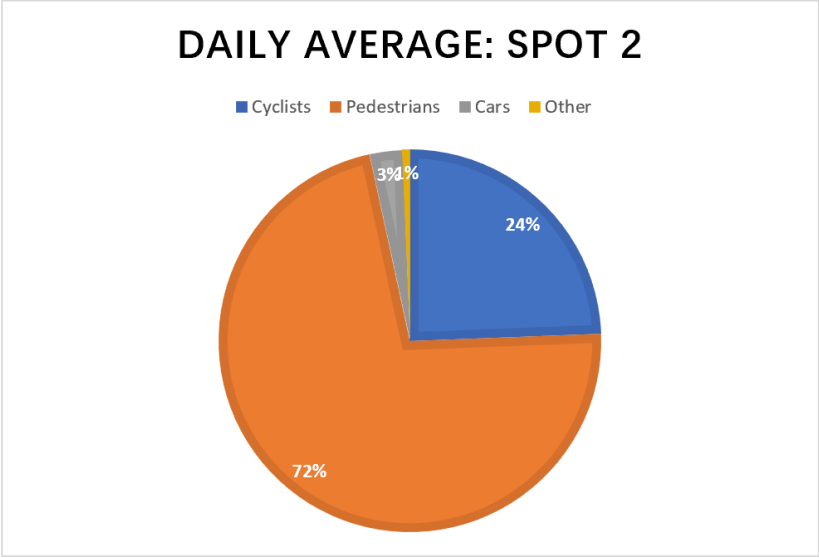
	Day 1: Tuesday (3/29)	
	Type	Number
Spot 2	Cyclists	107
	Pedestrians	295
	Cars	10
	Other	6

Day 2: Thursday/Friday (3/31 & 4/1)	
Type	Number
Cyclists	93
Pedestrians	333
Cars	15
Other	1

Day 3: Thursday (4/5)	
Type	Number
Cyclists	102
Pedestrians	266
Cars	9
Other	1



Daily Averages	
Cyclists	101
Pedestrians	298
Cars	11
Other	3
Total	413

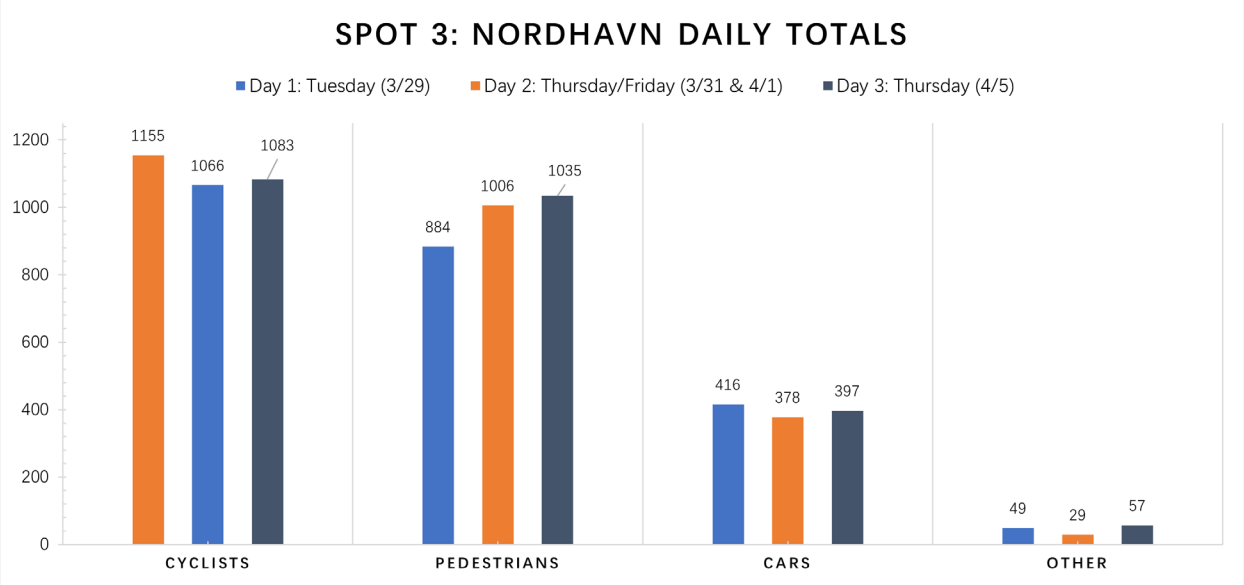


Daily Totals: Spot 3, Nordhavn

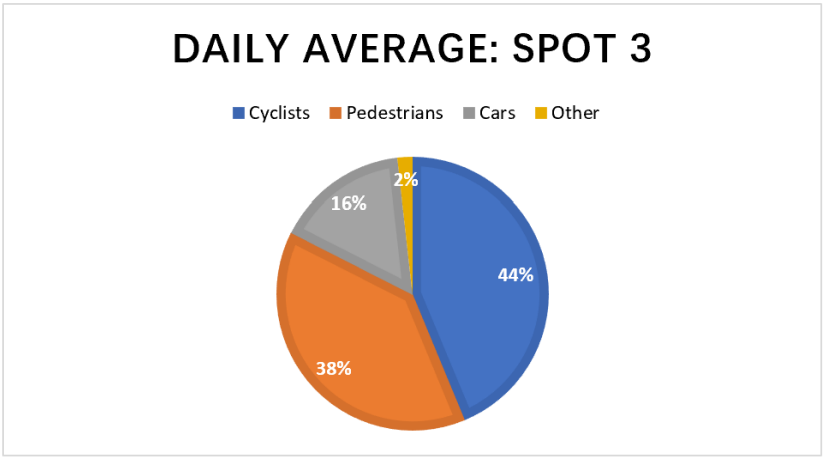
	Day 1: Tuesday (3/29)	
	Type	Number
Spot 3	Cyclists	1155
	Pedestrians	884
	Cars	416
	Other	49

Day 2: Thursday/Friday (3/31 & 4/1)	
Type	Number
Cyclists	1066
Pedestrians	1006
Cars	378
Other	29

Day 3: Thursday (4/5)	
Type	Number
Cyclists	1083
Pedestrians	1035
Cars	397
Other	57



Daily Averages	
Cyclists	1101
Pedestrians	975
Cars	397
Other	45
Total	2518

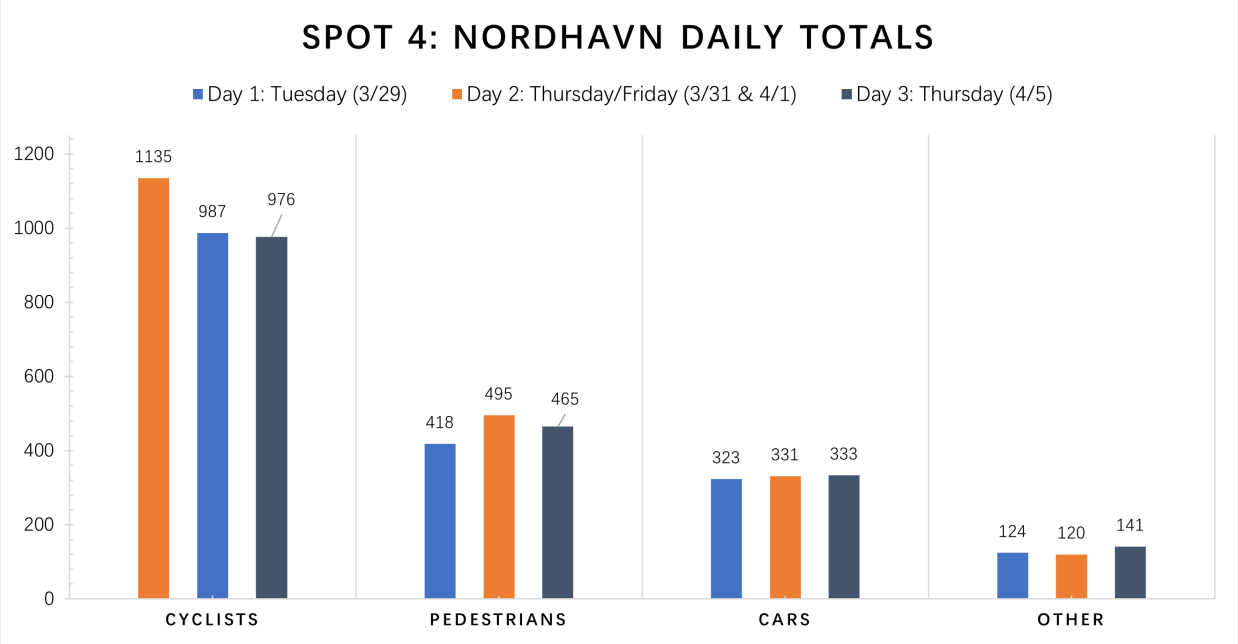


Daily Totals: Spot 4, Nordhavn

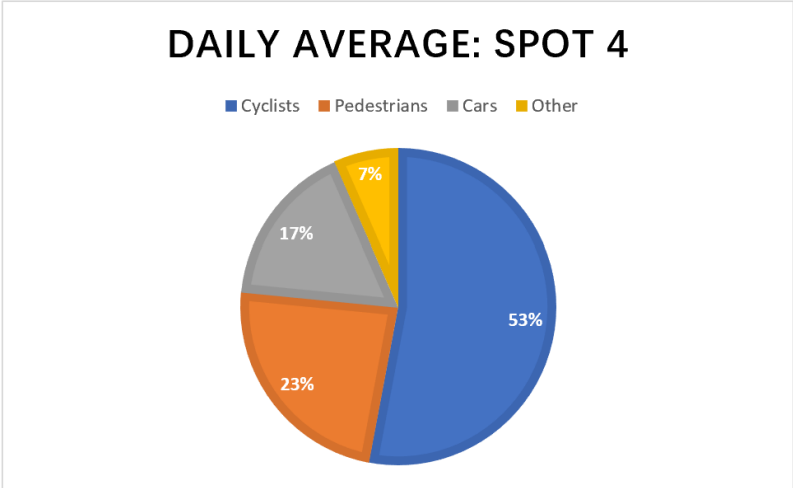
	Day 1: Tuesday (3/29)	
	Type	Number
Spot 4	Cyclists	1135
	Pedestrians	418
	Cars	323
	Other	124

Day 2: Thursday/Friday (3/31 & 4/1)	
Type	Number
Cyclists	987
Pedestrians	495
Cars	331
Cons. Veh.	120

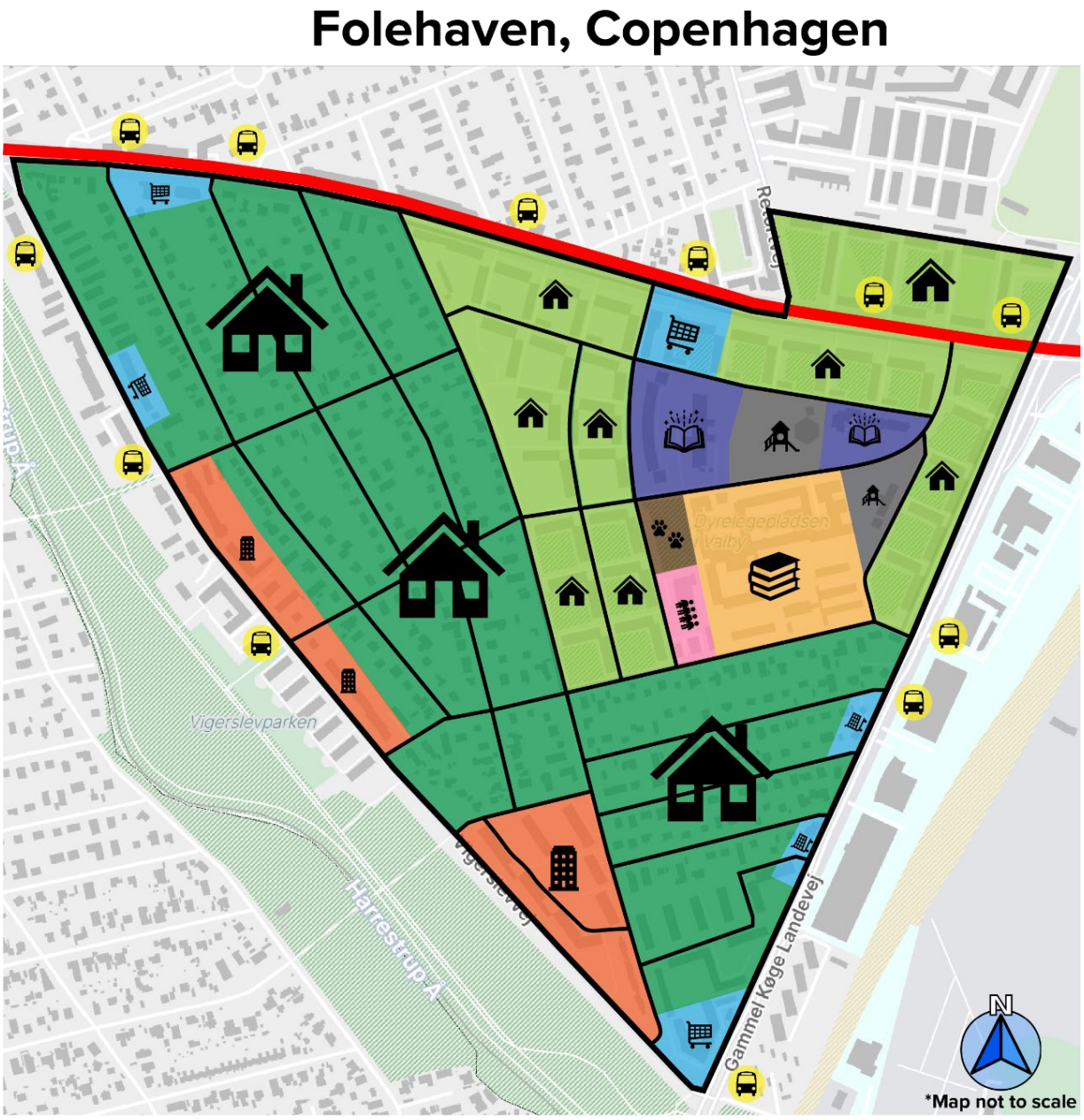
Day 3: Thursday (4/7)	
Type	Number
Cyclists	976
Pedestrians	465
Cars	333
Cons. Veh.	141



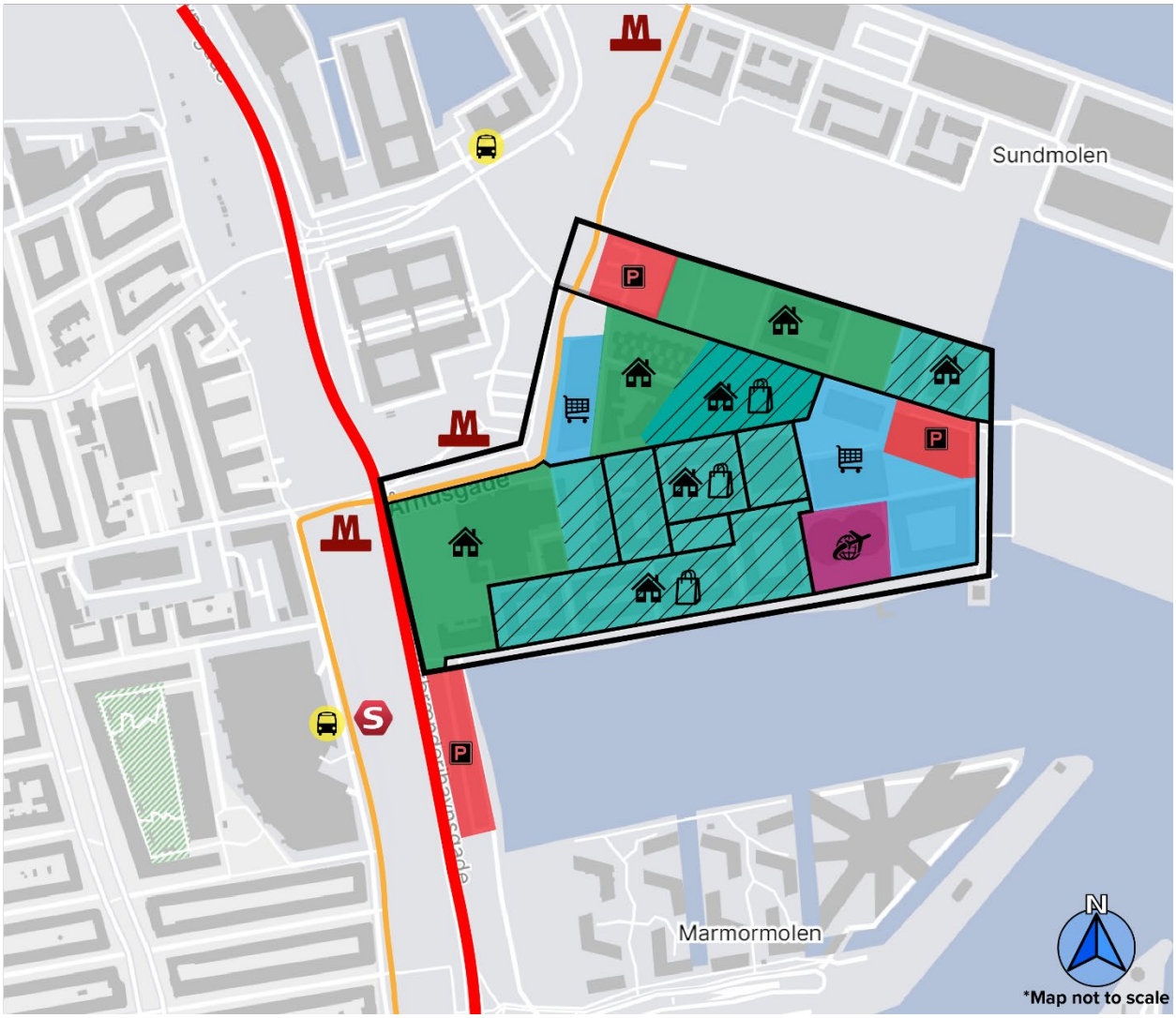
Daily Averages	
Cyclists	1033
Pedestrians	459
Cars	329
Other	128
Total	1949



Appendix D: Spatial Analysis



Nordhavn, Copenhagen



Legend

- Road
- O2 Road
- Bus Stop
- Single Family Homes
- Non-Profit Housing
- Multifamily Housing
- Grocery Store/Restaurants
- Library/School
- Church
- Playground
- Youth Center
- Petting Zoo

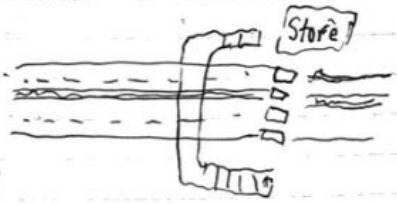
Legend

- Road
- Bike Path
- O2 Road
- Bus Stop
- Metro Station
- S-train Station
- Parking
- Mixed of Residential & Businesses
- Residential
- Grocery Store/Restaurants
- Corporate Offices

Appendix E: Field Notes

Folehaven Drifting 3/81/22
3:10 - 3:55

First thoughts:
- the main road that splits Folehaven was difficult to cross unless near a light or crosswalk



- in the neighbor hood above the road was fairly nice and quiet, sidewalks were all paved and maintained
- the below neighborhood had dirt sidewalks that were paved up until 1 point
- Limited public transportation stops within the neighborhoods meaning you'd have to walk or bike to them
- used to have a local shuttle/bus that would be used by older folks to get to main transportation

Really good quote from Maas Paper

"The authors conclude that the car "as an entity" is not about to disappear, and therefore the challenge "is to find better ways of utilising the car and still move forward to achievable sustainable outcomes". pg. 2 bottom left side,

(blue) Folehaven Spot 3 counting 3/23 8:15-9:00

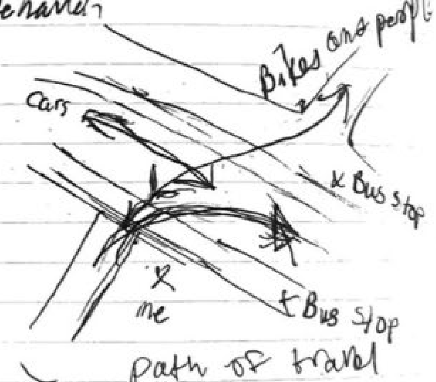
morning 8:15-9:00 am ≈ 36°-40°F Sunny	Cyclists : 52 pedestrians : 37 cars : 269 Scooters : 1 moped : 0 Bus : 8	Afternoon 12:00-12:45pm ≈ 55°F	Cyclists: 26 pedestrians: 32 Cars: 264 Scooters: 0 moped: 3 Bus: 6	Evening	Cyclists: Pedestrians: Cars: Scooters: moped: Bus:

temp: 36°-42°F sunny, clear

Morning Notes minimal cars going in/out

Bus times
8:34
8:45
9:00

- more people commuting to work
- Bus stopped on opposite side
- Primarily single passenger use of cars ≈ 85%.
  - most cars coming in or out turn right towards naan
  - most cars going in have family, out are single workers
- Construction appeared at 8:40 am in middle margin
- x3 Drivers ed car came out of Folehaven
- A lot of pedestrians walking dogs towards path
- majority of people walking got the bus



Afternoon Notes

cars
in: ~~||||~~ |||
out: ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |

- much quieter than the morning
- not as many from path
- high independent car use again
- 3 younger folks walked out from Fole and waited for bus
- talked to older gentleman about how cars go around the buses when stopped he said they are crazy
- Still 3 scooters next to me, 2 Voi, 1 Lime
- more people casually out during lunch time, walking dogs, stroll, bike ride

(Red) Folehaven Red Spot Counting 3/23/22 9:30-10:00

. on and off buses
. in meantime count cars, people, going into folehaven

Exit/Entering on and off

ped: 5
cycl: 4
cars: 16
scooters: 0
moped: 0
Bus: 5

Mc Ds ← 9:41 bus came 3 got on, 0 off
→ 9:42 bus, 2 ped got off and went to the other stop LoL

Morning Notes

~~Starting Counting going into Folehaven~~

• 1 ped walked out to the bus stop and got on going towards MD

← 9:53 3 got on, 0 off
→ 9:58 0 got on, 0 off (worker wearing orange)
← 10:00 pulled over noone on or off
10:02 2 ped came out and walked to bus stop

3/23/22 Evening Notes 2:15-2:45 pm, Sunny 49°f

Mc. D Bus ←	Other Bus →
2:22 1 on, 0 off	
2:29 1 on, 0 off	2:14 1 person on, 3 off (2 entered fole)
Exit/Entering	2:15 1 on, 1 off (entered fole)
Cyc: 8	2:20 0 on, 1 off (did not enter) went to other bus stop
Ped: 12	2:33 0 on, 2 off (entered)
Cars: 27	2:39 0 on, 5 off (all entered)
Scot: 1	
Mop: 0	
Bus: 7	

Exting/Entering Folehaven Notes

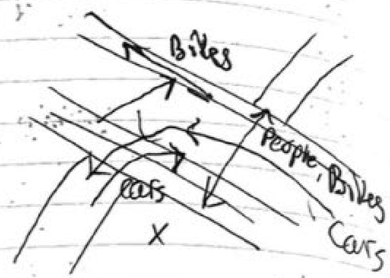
• 2 off bus
• 1 off bus
. handicap Van dropped off 1 person
. many taxis coming out, with families
111
. mix of cars leaving/entering
. noticed lots of drivers ed cars

•The cross walk across the street was hard for ped to cross as it was a busy road

Folehaven Spot Counting

Evening Notes 4:00-4:45 pm Sunny, Clear

CyC



Notes

Cars	Bikes	walking	Bus
in: 卌 卌 卌	in: 卌	in: |||	exit: 1
out: 卌 卌 卌	out:	out: ||	enter:

- mixed of runners now that work is out (more leisure activities)
- walking strollers, dogs
- a lot of cars entering and exiting now
- Cars leaving mostly contain family members
- only 1 bus stopped of the ones that passed

Interview w/ Nikol

- interesting methods
- qualative methods really
  - mainly based on semi-structed interview
  - mental mapping
    - more about social
    - 3 critice phases
    -

Tuesday 3/29/22 Nordhaven Counting / Spot 3 ...

Morning 8:15-9:00 overcast, cold little windy 37°f,
Cyclists: 602
Ped.: 139
Cars: 105
Const.Vec: 28
Scotters: 2
Moped: 2
bus: 0

45°f, Partly ~~Bloody~~ Sunny still cold
Afternoon 11:45-12:30
Cyclists:
Ped.:
Cars:
Const. Vech:
Scotters:
moped:
bus:

4:00
445-
Evening: 47°f windy, Sunny

Notes

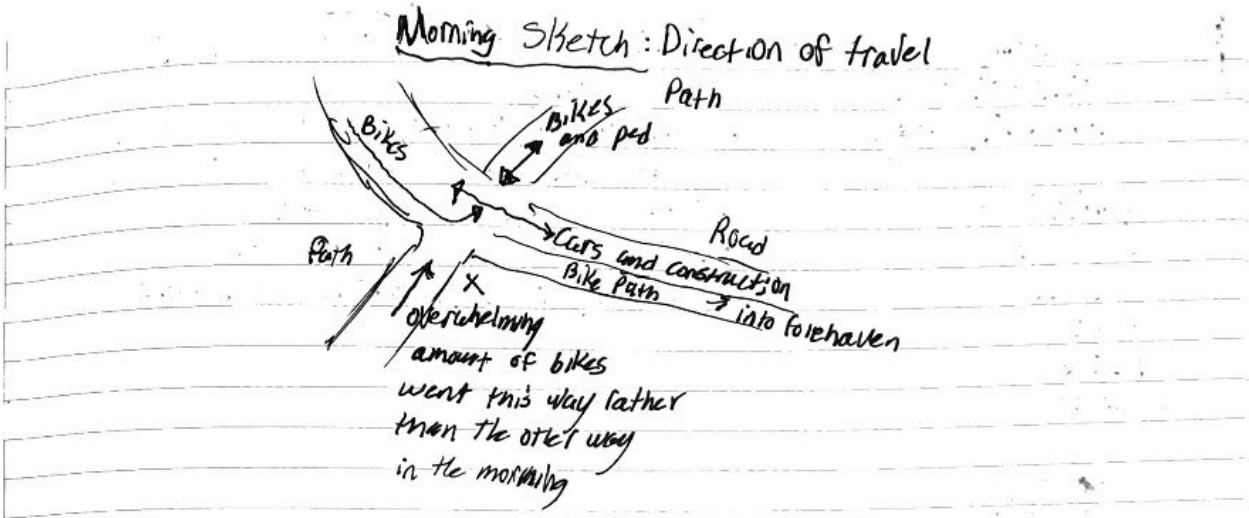
- Saw green mobily car coming out
- The cars that I were noticing coming in and out of Nordhaven were comparably much nicer to Folehaven, BMWs, Porsches, compared to economy budget cars
- a lot of people run the light when biking → almost 60%. I'd say Run the lights
- Main direction of travel cuts on the bike path to and from S-train station
- Some client into Nordhaven but rare.

~~Evening~~ Afternoon

- heavy construction noise
- construction vechiche blocking traffic and bike lane
- a lot of people walking, most going to store/w food
- Car use mainly single person
- Light cycle prioritizes ped and Bikes
-

Evening

- Traffic seems to favor opposite direction than morn
- more bikes carrying children than morning
- cars going in rather than out
- group of 10 runners
- Lots go car leaving Nord
-


Morning Sketch: Direction of travel
Path
Bikes and ped
Bikes
Road
Cars and construction
Bike Path
into Fairhaven
Path
overwhelming amount of bikes went this way rather than the other way in the morning

Folehaven: Day 2 collection Blue Spots

Morning
8:15 - 9:00am
Cold 36°f, Cloudy, windy

Cyclists: 58
Ped: 24
Cars: 230
Moped: 1
Bus: 6
Scotters: 0

Notes
- comparably to Nordhaven, there are more cars with kids and other people than Nordhaven
- Nordhaven had more single users
- Majority of cars leaving area
- 0 people got on/off at the 2 bus stops

Afternoon:
12:15 - 1:00pm
Cold, 38°f, snowing
Cyclists: 19
Ped: 13
Bus: 8
Cars: 262
Scotters: 0
moped: 1

Notes
- 1 ped walked out cars got on bus
- A good amount of work vans
- 12:46 1 person got off bus

Evening Canceled
Snow was coming down pretty hard, coming back on Friday,

Red Spots Folehaven 3/30/22

Passed by ||||

morning 9:45-10:15

Mc.D Bus ←	Other Bus →
9:51 1 on, 0 off	No buses stopped going this way
9:58 1 on, 0 off	
10:05 1 on, 0 off	

Exit/Entering

(tipped) · School field trip exited and got on bus
· Lucy walked out to bus stop and got on

Evening

Mc.Ds Bus ← 8	Other bus →
2:52 8 people on, 0 off 6 walked over, 2 transfered	2:46 2 off, 0 on both in Fole
	2:47 1 off, 0 on
2:52 · 3 on, 0 off All walked on	2:48 1 off, 0 on
	2:54 : passed
2:59 2 on, 0 off All walked on	

Note

· 1 person got dropped off by a friend in a car
· 2 people rode in with their bikes, then dropped them off at their house and proceeded to get on the mc. D bus

Thursday

Nordhaven Day 2 Counting 3/31/22

Morning: 8:15-9:00
31°F, Sunny, Cold

Cyclists: 505
Ped: 144
Cars: 98
moped: 1
Bus: 0
Scooters: 2
Construction: 37

Notes
- construction vechicles are causing major disruption in terms of flow.
- The traffic from construction vechicles was caused major disruptions in flow of bike paths, trucks blocking the intersection
- a lot of commuting by bike, major direction is rig

Notes

Afternoon 11:45-12:30
38°F, Sunny, Cold
(on spreadsheet)

Cyclists: 130
Ped: 161
Cars: 84
moped: 4
Bus: 0
Scooters: 5
Construction: 55

- much quiter in terms of bikes
- a lot of workers breaking for lunch
- again construction trucks are blocking road, and bike paths (see pictures)

43°F, Partly Cloudy Friday April 1st 4:00-4:45

Nordhaven Day 2: Evening Counting Only

Evening 4:00-4:45

Cyclists:
Ped:
Cars:
moped:
Bus:
Scooters:
Const Vec:

Notes
- more lesicure activities
- group of runners
- almost 0 construction going on.
- I've seen many green mobility cars coming in and out
- noticing a lot of people carrying pink boxes from path ←

Last Day counting

42°f Sunny, windy, Friday 4:00-4:45 Friday

- 2 kids walked out and took bus
- saw lets go car passby
- right now lot of cars leaving Folehaven, turning right
- 4 bike scotters now
- cars also dont yeild to ped at this cross walk
- need

Nikojli - urban sociology

++++ ++

Monday 4/11/22

Monday Meeting

- Structural Stories that justifies stories/reasons : use reports
- identify Clubs/organizations that fit ~~mobility~~ justice include in reports
- Nikolia can send us report for data, mobility analysis exam,
- Next week
- follow up with malane Wed. @ 1:00
- Transformative mobility
- Ask mimi about higher level of projects for graduate students,
- grants etc.

Transcribed:

Folehaven: Drifting, 3/21/22

First thoughts:

- The main road that splits Folehaven was difficult to cross unless at a light or near a crosswalk
- There was limited public transportation in the neighborhood meaning you had to walk or bike to them
- Used to have local shuttle/bus that would be used by older folks to get to main transportation like the train, but they stopped that service.
- The roads were fairly nice, and sidewalks were paved
- Parking for cars was apparent
- Paths: Pete and I used the sidewalks within the neighborhood to get around safely
- Nodes: the market where the store and pizza place were a node that we talked about as a reference point.
- Landmarks: the library is like the center of the town, banana man, market
- Edges: the main roads surrounding Folehaven, the bushes on either side of the sidewalks, fences to the playgrounds to the schools

Folehaven: Counting Day 1, 3/23/22

<u>Morning notes:</u>

- More people commuting to work
- Primarily noticing single passengers in cars ~80%
- Most of the cars coming in/out of Folehaven turn right on the main road
- Most cars going in have family, out are single workers
- Saw a lot of drivers ed cars
- A lot of the pedestrians I saw were walking dogs towards the path
- A majority of people walking that came out of Folehaven got on the bus
- Bus seemed to come every 10-15 min

<u>Afternoon notes:</u>

- Much quieter in the morning
- Not as many people were going to/coming from the path
- High independent car uses again
- 3 kids walked out of the neighborhood and got on the bus

- I talked to an older gentleman about what I was doing, and he told me that when the bus stops to pick people up, it blocks the road and cars behind it drive around the bus on the other side of the road. He said "they are crazy people!"
- At the spot I was standing at there was like a hub/drop off point for lime and via scooters. There were three in the morning and three in the afternoon, so no one was using them.
- Noticed that more people are casually out during lunch time, walking dogs, strolling, casual bike rides in the path

Evening notes:

- Mix of runners now that work is out (more leisure activities)
    - Walking strollers, walking dogs
- A lot more cars seemed to be entering Folehaven compared to the morning when a majority of them were leaving
- Cars that were leaving now had children and families inside going somewhere
- Only 1 of the buses that passed stopped
    - They only stop when they have someone getting on/off

Red spot counting (9:30-10:00 & 2:15-2:45)

- There was some sort of handicap van that entered the area and dropped off 1 resident to their house.
- I saw many taxis entering/exiting with families and multiple people inside
- There was a mix of cars exiting/entering
- Noticed a lot of drivers ed cars again
- The crosswalk on the main road was hard to cross
    - Especially later in the day to get to the bus stop as the main road was busy and the cars didn't yield to pedestrians

Nordhavn: Counting Day 1, 3/29/22

Morning notes:

- Saw Green Mobility and ShareNow cars coming in/out of the neighborhood
- The cars that I noticed coming in/out were comparatively nicer than those going in Folehaven
    - More high-end brands like Mercedes, BMW, Porsche

- A lot of people run the light when biking
    - I'd day like 60% of people run the light as no one else is coming and they seemed to be in a rush
- Main direction of travel was on the bike path towards the orientkaj stop
- Some bikes went into Nordhavn, but it was a rare occurrence

Afternoon notes:

- Construction work really picked up from the morning
- Heavy construction noises
- Construction vehicles blocked the road often when backing into the work sites causing traffic jam of pedestrians, bikes, and cars
- A lot of people during this time seemed to be walking and getting lunch, especially to the Many behind me
- Independent car use was higher compared to Folehaven
- It seemed as though the light cycle favored in the direction of the bike path as the cars waited longer at the lights than bikes

Evening notes:

- Traffic seemed to favor opposite direction than in the morning
    - More people were coming from Orientkaj direction and back towards the Meny
    - Same with cars, in the morning more seemed to be coming out than in, now more are going in
- More leisure activities seemed to be taking place in the afternoon
    - Group of 10 runners
- Saw LetsGo car leaving

Folehaven: Counting Day 2, 3/30/22

Morning notes: these notes are limited due to the weather affecting my ability to write in my notebook

- Compared to Nordhavn, there are more cars with kids inside the car
- Nordhavn has more single users
- The majority of the cars were leaving the area

Afternoon notes:

- 1 pedestrian walked out of Folehaven and got on the bus

- A good amount of work vans was coming in/out of the area
- 1 pedestrian got off the bus and walked into Folehaven

Evening notes:

- We didn't take any as we canceled this session and was made up

Red spots: Folehaven (3/30/22)

- 1 person got dropped off by a friend in a car
- 2 people rode in with their bikes, dropped them off at their house and proceeded to get on the McD's bus

Nordhavn: Counting Day 2, 3/31/22

Morning notes:

- Construction vehicles are causing major disruptions in the flow of people, cars, and bikes
    - Trucks block the intersections
- A lot of commuting by bike, major direction is towards Orientkaj

Afternoon notes:

- Much quieter in terms of bikes
- A lot of workers breaking for lunch
- Again, construction vehicles and others are parked and blocking bike lanes
- (See pictures)

Evening notes:

- More leisure activities
- Group of runners
- Almost 0 construction going on
- I've seen many green mobility cars coming in and out

Folehaven: Counting Day 3, 4/4/22

Morning notes:

- I did notice that the weather affected the number of cyclists and pedestrians I saw out and about
- Seemed as though there were way more cars than usual
- Wind and rain are a terrible combination

Afternoon notes:

- Refer to other notes, pretty much the same activity

Evening notes:

- One thing I noticed is that cars don't yield to pedestrians, and this makes crossing the road a little trickier
- Again, the trends in where people are going is the same
- Saw a LetsGo car pass by

Nordhavn: Counting Day 3, 4/5/22

Refer to previous notes.

John Martel's field notes

Folehaven (Spot 1, at intersection of Kirsebaerhaven with O2):

Counting Day 1, 3/23/22

Morning notes:

- Big group of school kids (high school-aged) at 8:13, didn't get counted
- Road noise-high
- 1 ShareNow car, 2 passengers at 8:22
- High number of small to mid-sized vans
- Turning into especially, and out of Kirsebaerhaven is challenging for cars (across 2 lanes)
- Number of passerby (cars, bikes, everything) slowed way down by 8:35/8:40
- Almost-car accident (from a bad lane change, not from turning)
- 1, then another 2 pedestrians entered only to get in a car and promptly turn around and leave
- Plenty of buses on the main road

- Some car and foot traffic related to bank/ATM on corner
- Traffic picked back up close to 9
- FLOW – disrupted, jarring, stressed/hurried, tense, jerky on the main road, and entering/leaving the main road

Red Spot Day 1, 9:30-10

- Observation is difficult
- Some people transferred buses (got off one only to get right on the next one)
- Very consistent high car traffic
- Moderate bike traffic (around 60 in the half hour by my count)

Afternoon notes:

- Warmer out, blue skies, people eating lunch outside
- Big street is quieter than the morning, but still busy
- Far slower than the morning (as of 12:06)
- FLOW - smoother, more relaxed, less stop-and-go, more space between cars
- Way fewer cyclists and pedestrians
- Definitely at least a few people going out, coming back

Red Spot Day 1, 2:15-2:45

- Warm-ish out, sunny, still a busy intersection
- Left stop (the one on Gammel Køge Landevej) is definitely the busiest
- Cyclist/pedestrian count is inaccurate
- 2:33 group of school kids get off at stop on Ellebergvej
- 2:38 big group gets off bus
- Couldn't see left stop because of cars a couple times

Evening notes:

- Cooling down (temperature) but still very pleasant out, sunny
- Main road back to stop-and-go, busy (people going home)
- Mostly passenger/smaller cars (not tons of vans like the morning)

Counting Day 2, 3/30/22

Morning notes:

- Cold
- Bike traffic seems comparable to day 1 here, despite the weather
- As of 8:27 seems like car traffic (on the near side) is lighter than day 1

- 8:30: huge crowd of school kids (count was at 5 before, 54 after, though I don't think I got the exact number of kids right), some people from this group were adults, seemed like chaperones for a field trip or something

Red Spot Day 2, 9:45-10:15

- Pretty consistent, albeit light, bus use across 3 of the 4 stops (I thought the one in front of McDonalds wasn't even in use because only 1 bus stopped there)

Afternoon notes:

- 12:24 school kids + chaperones returned (49 pedestrians again)
- Snowing at this point
- Far fewer cyclists than cars, but this matches up with day 1 when the weather was nice

Red Spot Day 2, 2:15-2:45

- Pretty quiet across all 4 stops

(DIFFERENT DAY, 4/8/22) Evening notes:

- Weather got too bad on the original day 2, so this is a separate day
- 4pm – heavy traffic on far side of the O2
- 4pm – plenty of people at ATM
- 4:01pm – ShareNow car enters (2 passengers)
- 4:05pm – guy pulls into Kirsebaerhaven in car to use ATM, turns around and leaves after
- 4:18pm – car traffic picks up
- 4:26pm - another ShareNow on the O2 (doesn't turn in)
- 4:28pm – another guy pulls in/out to use ATM
- 4:31pm – 3 kids with soccer balls come from intersection direction, enter Folehaven
- 4:30pm – a little sun shower (rain)
- 4:33pm – another guy in/out for ATM
- 4:34pm – cyclist in/out for ATM
- 4:38pm – pedestrian in/out for ATM
- 4:39pm – pedestrian in/out for ATM
- 4:39pm – bit of a line for the ATM
- 4:43pm – pedestrian in/out for ATM

Counting Day 3, 4/4/22

Morning notes:

- Pretty miserable weather, feels colder than the forecast says
- Traffic levels in line with previous days

Afternoon notes:

-

Evening notes:

- Rain let up over the 45 mins

Nordhavn (Spot 2, on Sandkaj by the Portland Towers):

Counting Day 1, 3/29/22

Morning notes:

- Doesn't seem like cars are even allowed through here
- Update: 8:13 am – a van just went through
- People are swimming
- 8:18am street sweeper goes through (counted as car)
- 8:24 truck thing counted as car
- Some construction noise, mostly birds
- Decent mix of work/leisure traffic (seems to lean more toward leisure, if I had to guess)

Afternoon notes:

- We had to do this slot slightly earlier than in Folehaven because we have course registration
- Comfortable temperature when the sun is out and if dressed properly
- 11:58 – one van goes by
- 11:59 – one cop car goes by
- A few people on the dock/boardwalk
- Mostly pedestrians, seem to be out on casual walks (maybe on lunch breaks)

Evening notes:

- Windmills are going, breezier than earlier
- Lots of birds tweeting, no more construction noise

- Few more people on the dock/boardwalk area than earlier
- As of 4:06pm, flow of traffic seems steadier (mix of people out for leisure and people getting home/heading home from work)
- A lot of mothers with very young kids
- 4:19pm – there is some construction noise after all (similar to earlier, from new building down to my left (I'm facing the water))
- 4:23pm – big group of runners (10-20)
- Wind makes it cold in the shade
- 4:37pm – 11 runners return (I recognize some of the same ones, maybe they're all the same?)

Counting Day 2, 3/31/22

Morning notes:

- Some kind of filming happening on the dock/boardwalk area—a handful of people hanging around observing plus the film crew and actors, but nobody is crowding around or anything
- Most people who stop to talk to the crew or watch just seem to be pausing on their way, not spending any real amount of time here
- Street sweeper at 8:46

Afternoon notes:

- Timing to avoid course registration round 2 for us and to stay consistent
- Very pleasant out, though cool
- Tons of birds, they seem to like hanging out in the bushes
- Filming crew is all gone now
- Some construction noise from across the water/might actually be from little hut things on the dock/boardwalk area
- A lot of people seemingly on lunchbreaks/aimlessly walking
- 12:29pm – big truck, presumably for construction

(DIFFERENT DAY, 4/1/22) Evening notes:

- A Friday now
- Relatively busy, but hard to say if a different day of the week with similar weather would be any less busy

Day 3, 4/5/22

Morning notes:

- Saw some city workers remove a bike rack from near the boardwalk/water and move it back closer to the big round towers, near another existing rack (not entirely sure why this was done)

Afternoon notes:

- Quite cold with the wind, would gust and make it unpleasant

Evening notes:

-

Kayla's field notes

Folehaven drifting

- Started my drift at the grocery store by the bridge
- Went right towards the McDonalds and took a right
- Ended up leaving Folehaven and drifting in the next neighborhood
- Everyone wearing headphones
- Even by the tracks the area was still very quiet
- Different then how it is in the inner city
- More trash
- Limited parking
- Diversity
- Ended up on the wealthier side of town, new developments, young families, nice cars, close access to the train

Folehaven counting morning 8:15-9:00 day 1

Spot 2: bridge and entering/leaving Vin haven

- Heavy car traffic on Folehaven street
- Both directions, but the traffic moves pretty consistently
- Something in the air getting on my notebook, smog?
- Street cleaners out
- Market is very popular
- Trucks using Vin haven to access the neighborhood
- Service cars that go in and exit shortly after

- Didn't see anyone use the bridge until 8:30
- She was crossing to bus stop
- All small sedan cars, no big SUVs or trucks
- Tiny tractor towing trash
- Traffic dying down by 9:00

Folehaven red spot 9:30-10:00 day 1

- Had to change counting location because the heavy traffic prevented me from seeing the bus stop across the street
- Was positioned to count two stops, but I don't think the other stop was operational because no buses stopped, and no one was waiting there
- This bus stop was used very frequently by people in the Folehaven neighborhood
- Some people would get off the bus and head across the street away from Folehaven, so this stop is utilized by both Folehaven residents and other neighborhood residents
- Busy intersection, mainly cars
- Cyclists were going by but not into Folehaven

Folehaven counting 12:00-12:45 day 1

- Lunch time, traffic is not as heavy as it was during rush hour
- Plaza is pretty popular
- This plaza must be a staple for the community because people are always going there
- Compared to the morning session there is very minimal foot traffic in the area
- Must be because people are already at work and not moving around
- Bridge is not being used frequently
- Some people choosing to cross the road illegally to get to the market
- Safety concern because the road is always congested and not designed for people to be crossing at random points
- A person got off the bus stop and used the bridge to get Folehaven

Folehaven red spot 2:15-2:45 day 1

- More foot traffic then earlier in the day

- Still very heavy traffic
- Behind the fence there is a sidewalk that runs parallel to the street and this walkway is always very busy
- A lot of activity in the neighborhood, kids going home from school or going somewhere with their friends
- 3 people got off and 6 people got on the bus

Folehaven counting 4:00-4:45 day 1

- Not many alternative modes entering/leaving
- Car dominated but a lot of walking
- Cyclist left Vin haven and used bridge to cross the street
- When the traffic is heavier people are more inclined to using the bridge to cross instead of jay walking
- Seeing more trucks at this time
- Using public space for bikes
- Saw a lot of people stopping at the market before they entered the neighborhood
- Stop lights change quickly and the traffic never build up too bad at my site
- Bridge is still not used as much as I thought it would be

Nordhavn couniting 8:15-9:00 day 1

Spot 1: end of boardwalk

- Sitting on a bench at the end of the boardwalk
- Street is not like a real street
- It's not designed for cars because there are many trees and obstacles that would make driving down it not easy
- People starting their commute to work
- A lot of people exiting the area
- People coming into the area for work
- All dressed very nicely
- Seeing people walking to corner parking lot and exiting the street in their car
- Seeing people entering in car and parking and walking into the area
- Saw a share now car being used and parked in the corner lot
- People taking the time for a picture of the water

Nordhavn counting 11:45-12:30 day 1

- Lunch time
- Good weather
- Lots of people out on their lunch break heading towards the stores further down the boardwalk
- Seeing people leaving with bags from the donut shop
- Not much car activity because people are more stationary during the day

Nordhavn counting 4:00-4:45 day 1

- Lot more activity on the boardwalk than at the previous times
- People out with their significant others admiring the water
- People out doing more leisurely activities
- Lots of people exercising

Folehaven counting 8:15-9:00 day 2

- Bad weather
- Not many people out
- Some people stopping to go to the store
- Greater number of cars than bikes probably because of the weather
- People using the bridge to cross in and out of Folehaven

Folehaven counting 12:00-12:45 day 2

- Really bad weather
- Snow and strong wind
- Lunch time but not as popular as the previous day
- Only saw 3 pedestrians and 4 cyclists probably because the bad weather makes these type of mobilities unattractive
- Bridge still being used but not a

Folehaven counting 4:00-4:45 day 2

- Different day for this session
- The day started rainy, but the weather cleared up once we got to the site
- Equal number of pedestrians and cars
- People pulling into Vin haven street and parking and getting out to go to the store

Nordhavn counting 8:15-9:00 day 2

- Sunny morning
- Lot of activity, everyone seemed excited to start their day
- People driving to parking lot and walking to work
- Limited parking makes people more inclined to alternative mobilities to enter the area
- Green mobility car being driven to this parking lot

Nordhavn counting 11:45-12:30 day

- The weather was very beautiful
- Boardwalk was very busy
- People taking the time to admire the beautiful day on their lunch break
- Greater car activity
- Cars can't directly pull in from the main road, so they enter from a side street

Nordhavn counting 4:00-4:45 day 2

- Beautiful sunny afternoon
- Lot of excitement on the boardwalk, people have a positive aura
- People coming back from work
- People leaving the area to go home
- People walking in and leaving with food

Folehaven counting 8:15-9:00 day 3

- Bad weather, rain, wind

- People starting their morning commute
- For bad weather there was not a lot of activity
- Cars and bikes were equal
- 4 people used the bridge

Folehaven counting 12:00-12:45 day 3

- Bad weather
- More presence of cars and almost no pedestrians
- Even for lunch time the plaza was not as popular as previous days

Folehaven counting 4:00-4:45 day 3

- Cold and rainy weather seems to deter people being outside
- Few people stopping at market before heading into the neighborhood

Nordhavn counting 8:15-9:00 day 3

- Lot of people on their way to work it seems
- Person using Green Mobility car

Nordhavn counting 11:45-12:00 day 3

- Lunch time is a popular time for people to come out to the boardwalk
- Boardwalk is good space for leisurely activities

Nordhavn counting 4:00-4:45

- People coming home from work it seems
- Lots of people walking to parking lot and leaving by car
- Saw the same person enter the area and then leave with donuts

Nordhavn drifting

- Entered the area from the main street
- Noticed right away that this area is very modern
- Street designed for bike lanes specifically
- Lots of noise from the construction
- It was a nice day so there was a lot of people sitting out by the boardwalk and walking

- No parking on most streets besides like one car
- The entrance road leads right to the parking garage
- Parking garage is in a centralized location so once people park their cars it's very easy
- Side streets are designed for walking
- Lots of construction and pictures of how this area will look after the construction is complete
- People walking around are all dressed in very nice clothes
- Lots of people with baby carriages

Peter's field notes:

Folehaven blue spot 4-day 1 morning

- Most people are travelling along kirsebaerhaven
- Most of the traffic was moving towards the library/school
- There were a handful of driving lesson cars
- People kept going in and out of the apartment building on the corner
- The busiest time was 8:30-8:45
- There were a handful of vans and work trucks that went by

Folehaven red spot 4-day 1 morning

- Only 2 people got on the bus, no one got off
- There was 1 pedestrian and 1 scooter that entered the neighborhood from the O2
- This spot was far down the main road from the area in Folehaven we were studying. I think the bus stop was the closest to the intersection of vigerslevvej and O2

Folehaven blue spot 4-day 1 afternoon

- More driving lessons
- Warmer than the morning, still sunny
- Someone from the house across the street asked me what I was doing
- Very quiet, low traffic after 12:30

Folehaven red spot 4-day 1 afternoon

- Nothing happened, no one went in/out, no one used the buses
- Moving spot somewhere closer to the focus area for next observation, I rode by multiple people waiting for the bus on my way back, closer to the bridge

Folehaven blue spot 4-day 1 night

- Flow of traffic opposite as it was in the morning (people going home, picking up kids)
    - This was moving out of Folehaven
- I didn't make a note of this before, but a good number of bikes have child seats on them (9/10 times there was a kid in it too)
    - The number of strollers, kid's seats, people walking/biking side-by-side with their kids was a lot higher
- 2 more driving lessons
- Still quiet, most of the traffic was in the first 15 minutes of observation

Folehaven blue spot 4-day 2 morning

- Traffic flow mainly into Folehaven
- A man from the apartment building on the corner left and came back in his car twice
    - The first time with his kid, the second time by himself
- I noticed a lot of people going by twice, would go into Folehaven (towards school) and back, both with and without kids
- People driving cars kept missing the left turn onto urtehaven

Folehaven red spot 4-day 2 morning

- Moved spot closer to Folehaven by the bridge
- Much more usage than before
- Only 4 people walked in/out

Folehaven blue spot 4-day 2 afternoons

- More driving lessons
- The same guy from the morning left and came back to get groceries, asked me what I was doing since we had seen each other so much
    - He left and came back again to pick up his kid from somewhere
- A lot of other people went grocery shopping

Folehaven red spot 4-day 2 afternoons

- Busier than the morning
- More people coming in/out of the neighborhood

Folehaven blue spot 4-day 2 night

- Really bad weather so we moved this one to another day (4/8)

- *On the day we did it the weather was much nicer
- *It was still relatively quiet

Folehaven blue spot 4-day 3 morning

- Really windy/rainy
- More cars than usual
- Very few pedestrians
- People were still biking though

Folehaven blue spot 4-day 3 afternoon

- Pretty much only cars
    - Going out of Folehaven
- Very windy

Folehaven blue spot 4-day 3 night

- Busiest it was all day
- Mostly leaving Folehaven
- The guy that left and came back in his car a lot of last time came back in his car again with his kid and groceries

*Too busy to take notes during the session, most notes come after

Drifting

- "Side streets" seem pretty exclusive to bikes and pedestrians, could drive a car down them but doesn't look like you're supposed to
- Apart from the main entrance by the metros and the boardwalk side, surrounded by construction
- Contemporary buildings
- Shops on ground level, apartments above, parking garage above netto
- The boardwalk is really nice, good views, relaxing place to sit
- When drifting I went to the donut shop and took it to the boardwalk to eat

Nordhavn day 1 morning

- Lots of construction
    - One truck blocked a lane of traffic (parked in the site perpendicular to street)
- Lots of people walking and on bikes, mostly going to Nordhavn

- Higher total number of people than Folehaven, but now there's easily more bikers/pedestrians than cars

Nordhavn day 1 afternoon

- Moved to a bench across the street
    - Was counting people coming from the metro station that weren't coming from Nordhavn, they just got off at that station
- Still a lot of construction

Nordhavn day 1 night

- Less construction
- More people leaving Nordhavn than the other times, but it's still a fairly even mix of leaving/entering

Nordhavn day 2 morning

- Busy with construction
    - At times there would be 1-2 trucks parked in a car lane queued to get into the construction site
- Traffic going in
- Bikers oddly common in groups of 7
- There were ~4 parking spots where people would park and then get in/out of their cars to go into Nordhavn, some were construction workers for the site that was right there

Nordhavn day 2 afternoons

- Construction workers taking lunch breaks walking around with food from grocery stores (mostly netto)
- Still busy with construction
    - At times there would be 1-2 trucks parked in a car lane queued to get into the construction site
- Traffic going in

Nordhavn day 2 night

- *Done on a different day due to scheduling, weather more or less the same just a little colder
- Noticed a lot of construction workers leaving on bikes, some had cars parked
- Traffic is still mostly going in, not as much of a mix as day 1

Nordhavn day 3 morning

- Big school group came by
- Almost all traffic is going in

Nordhavn day 3 afternoons

- Saw another big group, this was adults though
- Most traffic going in

Nordhavn day 3 night

- Same mix as day 2, fairly even but mostly going into Nordhavn
- A handful of people keep biking on the main road, they don't cross over to the bike lane
    - Assuming this is because they are staying on the main road and don't want to wait twice?
    - Biker would do this pretty much every time, just haven't noted it