Implications and Relationships between Transportation Infrastructure and COVID-19

by

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Abstract

The COVID-19 pandemic has affected every city throughout the world in monumental ways with transportation being one of the sectors severely impacted. Radical changes were globally brought to cities, profoundly transforming the way local communities and cities function. COVID-19 has had a profound, far-reaching impact on the way we look at transport, requiring transit agencies, transportation departments and experts to revisit the role they play in fulfilling mobility options.

COVID-19 has demonstrated the importance of public spaces in cities. As the pandemic has exposed vulnerabilities of cities, a post-pandemic urban city that has diverse transportation options with the proper safety measures and infrastructure in place will be exceptionally well positioned to achieve sustainability, economic and environmental improvements that benefit those residing within the communities. The way we live is shaped by our infrastructure - the public spaces, building codes and utilities that serve a city or region. Studying the movement of people and activities during this time, it is time to create an evidence-based recovery plan to react to people's natural behaviour, accommodating social distancing, and providing all modes of transportation to be safe and accessible.

Successful cities will find ways to design spaces everyone can access that include active transportation options to travel to and from multiple areas throughout the city. We now have the chance to be forward-thinking, resetting our cities to a green economy that is more cycling and pedestrian-friendly and neighbourhood-based, and includes fundamental public spaces suitable for all users. These changes in our living style, are calling planners and city officials to bring and allow new perspectives in the way of life in urban environments. Urban planning and design must respond to these changing habits and build on the fact that public and accessible space is not only desirable but a natural necessity for all people.

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I also would like to thank my advisor, Sarah Flicker, who has been extremely supportive and understanding in guiding me in the right direction. A special thank you to all those who took time out of their busy lives to allow me to conduct a research interview with them to hear their opinions and views on numerous questions relating to the topic of research.

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To my MES Cohort of 2021, what an interesting two years we have had together! Unfortunately, COVID-19 limited time we could have spent together, but we still supported one another throughout the whole process and made great friendships. Good luck to everyone on their future endeavors. Thank you to all my Professors, the Faculty of Environmental Studies, and anyone who helped me directly or indirectly through this challenging and rewarding journey.

Foreword

This major paper has been submitted to the Faculty of Environmental Studies (FES) in order to fulfill the Master in Environmental Studies (MES) Planning program requirements. This major paper is an extension of the themes of my plan of study. My Area of Concentration for my plan of study is planning for urban sustainability and sustainable transportation planning for growth management. With the unprecedented events of the global pandemic COVID-19 beginning in late 2019, combined with my interest in community health and climate change mitigation, my area of concentration has veered towards transportation-related pandemic planning. This paper has allowed me to view transportation planning through the lens of emerging technologies combined with pandemic responses and measures to help forecast the implications that COVID-19 has had on multiple modes of transportation. Although the Plan of Study has evolved throughout my enrolment in the MES program, my interest in sustainable transportation planning has grown allowing me to successfully pursue a paper in this field.

The topics engaged with in this paper are directly aligned to those outlined in the plan of study:

- Component 1: Urban Planning/Transportation Planning
- Component 2: Community Health
- Component 3: Climate Change Mitigation

This paper brings together all three of the learning components identified in my Plan of Study. The way that the MES program is situated in terms of being interdisciplinary has enabled me to merge urban and regional planning, community health, and climate change mitigation while allowing me to find newborn interests in transportation and planning in a post pandemic urban

environment.

Lastly, this paper has allowed me to intertwine practise and academia together into a single project to examine the implications on various modes of transportation in a post-COVID-19 environment. This research paper allows for discussion and conversation around the future of transportation, cities and urban planning as a practise in a world where pandemic planning will be standardized. The suggestions and conclusions made in this paper serve to fulfil the goals of my area concentration and could also be used as suggestions for policy makers and planners when creating and making transportation related decisions.

List of Abbreviations

COVID-19	Coronavirus Disease
GHG	Greenhouse Gases
GTA	Greater Toronto Area
MTA	Metropolitan Transportation Authority (New York City)
TTC	Toronto Transit Commission
WHO	World Health Organization
APTA	American Public Transportation Association

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Chapter 1: Introduction

Transportation is at the heart of any economy. It enables communication, trade and other forms of exchange between people, that in turn establishes civilizations. In general, transportation networks improve overall accessibility (i.e., improving a business' ability to provide goods and services, and people's ability to access education, employment and services). Proper transportation network also reduces transportation costs for transit users in terms of travel time, vehicle operating costs, road and parking facility costs, accident and pollution damages, which eventually increases economic productivity and development. Through history, transportation systems have helped connect growing nations around the world via rivers, roads, canals and railroads which moved travelers and agricultural and manufactured goods between farms, towns and cities.

However, the unprecedented shutdown of almost all industrial activities resulting from the COVID-19 pandemic has led people questioning how and what the future of urban and transportation planning will look like around the world post COVID-19. Globally, governments have taken several different approaches in allowing people to travel safely, efficiently and economically. COVID-19 is having a significant impact on, among many other things, the way civilization gets around.

The transportation sector is one of the sectors hit hard by COVID-19 as everything in life requires mobility and access through various transportation networks. The multi-dimensional nature of the pandemic has left an indelible mark on the outlook of the cities and has led to rethinking cities' development in different dimensions including social, economic, environmental and transport. The crisis imposed by COVID represents an opportunity to change course and re-set priorities for urban planning. At this point, no one knows exactly when or how cities will return to a way of life that resembles normalcy. This creates significant uncertainty that affects everyone

from housing advocates to major employers, government officials and transit operators. This alone gives the opportunity for urban planners, policymakers, and government officials to use this time to reflect and find viable solutions to allow cities to grow in the right direction that will be safe, sustainable, affordable, economically competitive while at the same time, being resilient to future pandemics or related disasters.

This paper will explore different measures and alternatives for safe and healthy transportation within cities post-COVID-19. This will be done through integrating transportation infrastructure with urban planning to analyze sustainable, high functioning, efficient post-pandemic transit measures. This paper will analyze the differentiated impacts by multiple transportation modes including automobility, active transportation, and public transit while also examining the measures global cities are implementing on the road to successful recovery. In doing so, each mode of transportation will have both a City of Toronto context and comparison to another global city in terms of transportation response and reaction to the global pandemic of COVID-19. This paper will also examine the importance of positive political leadership when implementing policies or strategies to better help the populaces.

In order to formulate precise and appropriate transportation conclusions, the topic will be viewed and analyzed through environmental, social, public health, and political lenses by closely examining relevant researchers, "big thinkers" and scholars' work to help guide the future of transportation in a post-COVID setting. The aim of this investigation into the implications of transportation post-COVID-19 is to understand the ways in which transportation systems and community development changes and what could be done to allow future transportation development to be viable, efficient, safe and economical.

Chapter 2: Research Method and Framework

A mixed-method exploratory and qualitative research design was used to conduct this research. An exploratory approach was used because literature on this given topic is new to the world. The central driving theme will be transportation pandemic planning while contemporary literature, emerging studies and published media on transportation post-pandemic life will be examined to gain knowledge of the relatively new topic while learning what professionals are saying. This research takes an interdisciplinary approach, engaging with concepts and frameworks from urban-transportation planning, public health, climate change mitigation and politics directly aligning to the Plan of Study laid out in the Foreword.

While keeping up to date with emerging scholarly articles, the initial investigation involved conducting qualitative research in the form of semi-structured interviews with professional key leadership stakeholders within the public and private sector to hear various differentiated opinions and beliefs on the issues at hand. These research interviewees consist of key leadership stakeholders from academia, the governmental public sector and the private sector. These research interviews occurred during the months of February and March of 2021 as research was being conducted to help piece together the foundation of the study. The research conducted for this major research paper was subject to the approval of a risk assessment and to the approval of are search protocol for interviewing human participants. Both were approved by FES (Faculty of Environmental Studies). For those who were recorded, consent was obtained via communication by email prior to the informal interview with the participant. In total, 8 key leadership stakeholders were interviewed and asked similar questions out of a list of questions that were created in relation to the research topic. Although, no information was quoted directly from these informal interviews,

the information received was use as base for the in-depth research that was required for this paper. Example of the questions asked are as follows:

2.1. Interview Questions:

1. Will working from home be the new norm? What impacts do you feel this will have on housing and transportation? Do you feel people will continue to work from home and avoid commuting?
2. Is digital commuting here to stay or will people want to get back to normal life and have social interaction with one another?
3. Should public transport systems be prioritized for certain journeys or types of workers and other trips continue to be suppressed? Will this, however, enable a viable economy in the city to function?
4. What do you think governments could do in order to allow public transport to be less fare box dependent and make it more attractive for users to use it more often?
5. Will maintaining transit services to ensure equity in our communities be important?
6. Do you feel active transportation will need to be incorporated in all aspects of community development? Do you feel active transportation is a viable way to get around?
7. Do you think people will permanently switch to more individual modes of travel, like bikes or cars avoiding public transport services?
8. How have you and/or your business/place of employment been affected by this pandemic?
9. What would you like to see change/stay the same in the new urbanism of planning and development in a post COVID-19 environment?
10. With the advent of COVID-19, how should urban planners address this kind of pandemic? How do you feel the built environment will be designed moving forward?

11. In your eyes, what will cities look like in a post-COVID-19 setting? What will the future of development look like? What will stay the same? What will change? What will be different?

Note: Questions varied depending on the occupation of the interviewee and due to time constraints of the various stakeholders.

The data was transcribed and compared, and it was obvious to see the different responses from people who either worked or are retired from different sectors of employment and or service. This investigation has created an understanding of the opinions of highly recognized stakeholders who are involved in different processes of the planning, development and public health practises. This information was used alongside the research conducting from the numerous articles, reports and papers written on the new topic. A brief professional biography on these exceptional individuals is located in the appendices at the end of the paper.

Chapter 3: Rethinking Urban Planning and Cities in a Post-COVID World

3.1. Overview

Cities are home to most of the world's population and are centers of economic growth and innovation. Allowing for safe transport post-pandemic will forever be important to continue to allow cities to be key business hubs of innovation. The multi-dimension nature of the pandemic has left an indelible mark on the outlook of urban areas and has led to reconsidering cities development in several dimensions. This crisis may at the same time, be looked at as an opportunity to build better and more sustainable societies and cities which allow for more accessible and efficient transportation infrastructure. The pandemic, alongside the restrictions and lockdowns, have imposed time to reflect and think about long term solutions while dealing with short term problems at hand. Many factors play into investigating the implications on various modes of transportation especially as the design of cities and societal trends will change moving forward. An examination of the forecasted urban trends will help layout conclusions while examining the differentiated modes of transportation that people rely on every day.

Cities are centers of growth, innovation and wealth formation, but also hotspots of high-density areas that entail air and noise pollution, lack of green space, and extremely high population concentrations. Cities around the world are trying to find measures to best cope with COVID-19 implications and pandemic planning will now become a norm when developers, urbanists and municipalities alike are looking at creating and designing future developments. The pandemic in combinations of the subsequent lockdowns has generated interest across city thinkers for creating safe and attractive spaces for people to live, visit and gather. The field of planning will rightfully need to use this time to contemplate and possibly recalibrate the post pandemic future to create communities that can be more resilient to future pandemics or similar urban disasters.

Adequate infrastructure in cities plays an undeniable role in the formation and growth of a city and the economy. It can determine where and how our city grows, and that is what makes this topic of research so important. The pandemic has shown us that a healthy population requires reshaping society, and cities are where this process should start (Goldin and Muggah, 2020). COVID-19 has shown that today's cities struggled to cope with infectious diseases. Past pandemics as well as war and disasters inflicted chaos and influenced substantial cultural, political and urban design changes; however, none of them succeeded in denting the role large cities have in society (Florida et al., 2020). Yes, there is constant discussion on building sustainable and resilient cities, but in a post-pandemic environment, the lens of public health will have to be ever more incorporated into the design. Many high-risk zones of COVID-19 infection tend to occur in areas with larger population densities. Social distancing is more challenging in high-density areas featuring crowded spaces allowing for more people to be closer to one another.

For many, COVID-19 has been an unprecedented event and has felt like the first time spaces and global movements of goods and people have risen to the threat of disease. Through the examination of historical urban planning and development measures, it has been clear that disease had shaped cities where some of the most iconic developments in urban planning such as London's Metropolitan Board of Works and mid-19th century sanitation systems, were developed in response to public health crisis (Klaus, 2020). Now in the 20th century, COVID-19 is joining a long list of infectious diseases that have left enduring marks on urban spaces throughout major cities across the world. While the risk of death with COVID-19 is lower than Ebola or SARS, its transmission is much higher, and that is what makes it more challenging globally. With COVID-19's delayed onset symptoms, the situation has been more complicated as the infection may not be spotted right away. Similar to the 1918 Spanish flu epidemic, which infected 500 million and killed up to 50

million, the question remains if our cities were ever designed to prepare and cope with such fast-paced increases of infection. As the majority of the world's population already lives in urban areas, it is evident that health has shaped the history of cities. But will cities now define the future of global health and economic development (Bollyky et al., 2017)?

"Cities were once the most helpless and devasted victims of disease, but they become great disease conquerors". - Jane Jacobs, The Death and Life of Great American Cities.

Many authors including Roger Keil, Creighton Connolly and S. Harris Ali argue that outbreaks such as COVID-19 start in and spread from the edges of cities allowing COVID-19 to be a story of peri-urban and rural-to-urban connections (Keil et al., 2020). One important examination they make is when the outbreak has finally ceased and travel bands are lifted, we still need to understand the conditions under which new infectious diseases emerge and spread through urbanization. Infectious disease outbreaks including COVID-19 are global events which need to waken public health reforms and allow for more sustainable and healthy urban design measures within high populous areas. The future design of cities will have to incorporate better allocation of pedestrian areas and open spaces as there is more of a need for areas where effective physical distancing is able to occur in the time of a pandemic. Cities need to allocate more space to active transport modes and open/public spaces for people to get outdoors. This may require redesigning streets to accommodate the needs of pedestrians and cyclists better. This could be done by providing ample green and open spaces in order to meet the outdoor exercise and recreation demands of citizens (Honey-Rosés et al., 2020). Future designs need to be resilient and pedestrian friendly that are different to previous design choices cities have been using. The importance of public outdoor recreational spaces including parks, riverfronts and greenways has become

particularly evident during the COVID-19 pandemic. Being stuck in a lockdown, working from home, or quarantining for extended periods of times has made city dwellers gather at their nearest public green spaces as soon as restrictions allowed them to do so, which created large crowds of people congregating at the same public space. Even though health officials state that people can only get infected by COVID-19 through exposure to respiratory droplets, the risk of infection still remains high where large amounts of people gather. Therefore, there will be no choice but to balance the risk of infection with the physical and mental benefits these spaces are expected to confer (Bereitschaft et., 2020).

As society continues to experience high rates of urbanization, urban regions globally will need to develop innovative design measures and methods that will confront emerging future infectious diseases without drastically relying on governmental direction which has proven to be chaotic. This includes allowing safe and reliable measures of transportation for all users throughout the world. The increase of urban population will continue to pose new challenges to the control of future outbreaks. Professional planners, urban researchers and scholars alongside the public health experts, need to create designs which will be better suitable to prevent and mitigate future disease outbreaks mainly in high-dense areas such as cities.

The pandemic is expected to fundamentally alter how cities are managed/governed in the future. In this regard, actions taken within the next few years are important in determining whether post-COVID cities will be developed and managed in a more sustainable manner. As cities start to recover, their main priority will probably be economic development. However, it is essential to make sure that in addition to economic development, social and environmental dimensions of sustainability will also be considered (Sharifi, A., & Khavarian-Garmsir, A. R., 2020).

In relation to this research paper, the future of urban design of public spaces in cities directly relates to transportation. One of the ways in which COVID-19 has spread so destructively and aggressively is via transportation. Wuhan, which is one of the largest Chinese cities and a major transportation node with national and international connections was the first infection spot for COVID-19. Due to these linkages and connections of goods, the virus quickly spread globally and continued to infect countries throughout the world. With safe and sustainable transport of goods and people, future viruses can be better detained earlier, potentially helping reduce the spread of infectious diseases globally and throughout communities.

3.2. Housing and Employment Trends

It is evident that dense urban environments have been showing trends of population decline while suburbs and exurbs and smaller scale cities have seen increases. City dwellers tend to look for more personal space and more private amenities, which can be found easier outside the city (Florida et al., 2021). For example, the New York Times reported increases in numbers of households moving from New York City to suburbs in March and April 2020 (Hughes, 2020). Many young professionals as well as young couples have opted out of living in smaller condos and apartments withing the cities and have moved to larger homes for similar pricing away from the city as working from home has been the new norm. If remote work remains the norm, many of these out-movers may not return (Hart, 2020). It has been one of the most observable changes which occurred as a result of the COVID-19 pandemic that shifted the arrangements of many employees to work from home across a variety of occupations. The economic and social shock presented by COVID-19 has likely reshaped perceptions of individuals and organizations about work and occupations as focuses change within the employment world. Economic shocks have a profound impact on the way people live and work, how businesses operate, and how industries and

societies conduct themselves (Kramer, 2020). The impact of the COVID-19 pandemic is widespread and may result in permanent changes in many occupations. The question going forward will be whether working from home outlasts COVID-19, or would things go back to pre-pandemic patterns of work when cases drop, and more residents become vaccinated. Through the various research interviews conducted, the overall conclusion of the influential stakeholders spoken with was that although working from home will be more common, generally people are missing human interaction and often in time, collective human interaction is needed to secure deals and/or to make group decisions. Social interaction is critical for mental and physical health, and it is needed to appreciate the value of making and maintaining social connections with colleagues, friends and family (Brody, 2017). In relation to examining transportation in a post-COVID-19 environment, many suggested the need to shift peak working hours and create schedules where a few days of the week will be in the office while other days will be working from home. This will also allow for less pressure and stress on the different transit modes and could potentially reduce rush hour traffic and decrease the large number of people being crammed together at the same time.

Through exploration of home prices, there has been trends of increases amid COVID-19 implications which has caused housing to become even more unaffordable. Housing stability or the ability for individuals to have a stable, affordable, and quality residential home is a global phenomenon that is sensitive to economic market conditions, such as significant declines or increases in economic activities (Jones et al., 2020). The pandemic also caused interest rates to decrease significantly as Canada now has a five-year fixed mortgage rate at 1.99 percent that is the lowest it has been in Canadian history (Foran, 2020). Global pandemics are notorious for inciting short- and long-term economic challenges (Jordà et al., 2020), and the COVID-19 pandemic is not

an exception. Many city dwellers realize that they may be restricted to one place for a relatively prolonged period of time and being able to work from home has allowed for many seeking rural housing and escaping city centers (Asquith, 2020). This has sparked a demand in single-detached, semi-detached, and townhouses with an increase in demand and pricing. At the same time, it has allowed for a decrease in demand for condominium and apartment-style living in the midst of the pandemic. Low mortgage rates in Canada have allowed residents to purchase their first property or move/ upsize to a different property. Real estate prices in many Canadian cities have climbed to all-time highs during the pandemic (Mace, 2021). That being said, according to a poll from Royal Bank of Canada released in April 2021, 36 per cent of non-homeowners under the age of 40 have given up on ever buying a home. The Pandemic has created challenging ownership conditions due to the increased demand of housing. Residential mobility patterns are often characterized through the lens of push-pull factors that determine whether a person will relocate, but the effect of these factors is greatly enhanced from the implications that come with a global crisis (Jones et al., 2020). The uncertainty around the hot real estate market combined with the uncertainty around working from home post-pandemic causes undetermined results in both the future of housing and employment while creating implications on the different modes of transportation. Proximity to transportation infrastructure (highways and public transit) influences residential real estate values (Haider et al., 2000). Also, changes in employment schedules and an increase in remote working will have altering effects on rush hour and peak times for multiple transit systems.

3.3. Environmental Trends

COVID-19 is as a rare example where the world witnessed cleaner air quality, cleaner water and a reduction of greenhouse gases while many high pollution sectors came to a halt for a

short period of time. Cities have always tried to develop sustainability plans that call for air quality improvements and GHG reductions, promoting and indorsing public transit given the large share of emissions, come from transportation across urban activities (Chester et al., 2016).

As transit use hit a historic low in 2020, there were noticeable effects on air pollution - effects cities would like to see continue in a post-COVID world. Unfortunately, as the economy quickly began to open up, people who had access to a personal automobile decided to resort to it due to the common belief that it is safer than travelling using public transit and being surrounded by large groups of people. Many people who didn't have this choice were pressed to public transit use for mobility purposes, whether they deemed it safe or not. These people have no choice but to use public transit because they don't have access to an automobile. Accommodating safe public transit systems will forever be important for those who don't have access to automobiles and need to travel for work. Therefore, at the moment, research on what needs to be done to keep people out of their cars and what government and transit professionals need to do in order to encourage people to get back to using public transit is essential. A further analysis of these possibilities are explained in Chapter 5 which addresses public transportation systems.

Zambrano et al., 2020 found that there is a significant association between contingency measures and improvements in air quality, clean beaches and environmental noise reduction globally, caused by people staying home (Zambrano et al., 2020). Air pollution has dramatically reduced since governments ordered citizens to stay at home to help contain the spread of COVID-19. Many industries and manufactures had to halt, further resulting in reduced greenhouse gases.

Planning for climate change adaptation and focusing on planning cities that promote community health and allow residents to transport using active and healthy modes, will be extremely important moving forward. Finding ways to encourage populations to use sustainable

modes of transportation will remain substantial to society as we have witnessed extreme increases of climate change in the past few years which has to be reduced significantly. Rume et al., 2020 completed a study to explore the positive and negative environmental impacts of the COVID-19 pandemic. The study found that the pandemic situation significantly improved air quality in different cities across the world, reduced GHG emissions, lessoned water pollutions and noise and reduced pressure on the tourist destinations, which assisted with the restoration of the ecological system (Rume et al., 2020).

3.4. Social Behaviours

The world health crisis of COVID-19 has not only had impacts on humanity economically, but also socially. The pandemic has shown to have effects on human behaviour issues such as panic buying and noncompliance with government orders in following the law due to fear, and uncertainty (Ling et al., 2020). Ling et at., 2020 has demonstrated that these behaviours need to be incorporated into government policymaking as human behaviour becomes altered in the midst of a pandemic. Holistic governmental measures need to be incorporated while complying to the behaviours of the public. This will allow for a decrease of infection. Simon Dien et al., 2020 have examined the mental health agenda for COVID-19 and found that many negative implications exist due to COVID-19 as mental health has decreased for many during these times (Dein et al., 2020). “The worldwide pandemic has resulted in the world being turned “upside-down” where many of our “normal” social behaviours have undergone dramatic changes” (Dein et al., 2020). The scientific analysis of COVID-19 has been dominated by medical and pharmaceutical questions surrounding the vaccination and risk minimisation, but the social aspect of the disease needs to continue to be examined by social scientists globally to help many with mental illnesses resulting

from the pandemic, new norms generated by the pandemic, and the realization that the post-COVID-19 culture is here to stay.

No city globally has escaped the deadly spread of COVID-19. Furthermore, the virus has had profoundly uneven impacts on different groups of people, even within the same city (Goldin and Muggah, 2020). Those who do not have access to a wide range of health services and do not have the option to work from home, relying on working in dense factories and depend on public transit, have higher potential exposure to the virus. Marginalized neighbourhoods have struggled to contain the spread of COVID-19 and socioeconomic factors (not always physical geography) are a key determinant of contagion risk particularly in the built-up areas of developing countries where population densities are high (Goldin and Muggah, 2020). Similar inequalities in income, health, education, and virtually every other metric of wellbeing persist in most metropolises around the world. COVID-19 will widen these disparities further still and post-pandemic measures need to be implemented to reduce these negative impacts. Even though the pandemic has had massive economic and environmental impacts, the effects on society can't be underestimated. Fancourt et al., 2020 created a study of over 45,000 respondents focusing on the psychological and social experiences of adults living in the UK during the COVID-19 pandemic. The findings of this report are as follows: many adults appear not to be following government recommendations to exercise, people with diagnosed mental and physical health conditions are not exercising and experiencing more limited engagement with others, older adults are going on more walks but experiencing less socializing and going out of the home and meeting friends or family has been generally avoided (Fancourt et al., 2020). Encouraging physical activities and social connections in ways that adhere to government recommendations on social distancing and isolation will be important to supporting mental and physical health moving forward. These trends and behaviours are important when

examining and contemplating sustainable transit infrastructure post-COVID-19, because even though some may think life will soon get back to normal, society as a whole will still need to be careful, and many will have the COVID-19 way of life engraved in their everyday lifestyles. Decision makers and government officials will need to be conscious of these trends and behaviors when implementing future transit policies, because these all have the ability to affect the way in which many choose to get around in a post-pandemic world.

Chapter 4: Implications and the Future of Automobility

4.1. Overview

Over the long term, COVID-19 could have sustained influence on automobility, driving changes in the economic environment, regulatory trends and consumer behaviour. Cost and convenience will play key role when customers choose transport modes. “Automobility is a complex amalgam of interlocking machines, social practices and ways of dwelling which have reshaped citizenship and the public sphere via the mobilization of modern civil societies” (Sheller et al., 2000). A long-term shift in favour of the private cars would have major consequences for transport planners and city authorities where efforts to reduce congestion and pollution have been focused largely on persuading people out of their cars and onto public or active transit instead. Through forecasting normalcy in a non-pandemic society, multiple viewpoints exist whether automobility will accelerate or deaccelerate going forward. Hu et al., 2020 found that changing transportation mode will lead to traffic worse than before. Congestion will increase as the number of cars increase on the road, while many cities will drop in transit usage. Their report predicts that cities with large transit ridership are at risk for extreme automobile traffic unless transit systems can resume safe, high throughout operations quickly (Hu et al., 2020).

For many, as long as physical distancing is needed to contain the virus, cars still have the power to keep people moving and living. With the pandemic, health considerations become important and often in time, the use of private cars or biking, walking, and micro mobility could outpace public transport (Hattrup-Siberberg et al., 2020). “Measures against COVID-19 (i.e., physical distancing measures) were found to generate negative impacts on public transport: i.e., significant modal shifts from public transport to car was reported by experts around the world” (Zhang et al., (2021). With car-sharing and public transit feeling risky, cars have been the popular

and common way for people to be transporting. Reducing the risk of infection is the primary reason why many travellers make certain transportation-related choices. The chart below demonstrates the aggregated results from China, France, Germany, Italy, UK and US done by the Mckinsey Center for Future Mobility demonstrating the key reasons for choosing a mode of transportation.

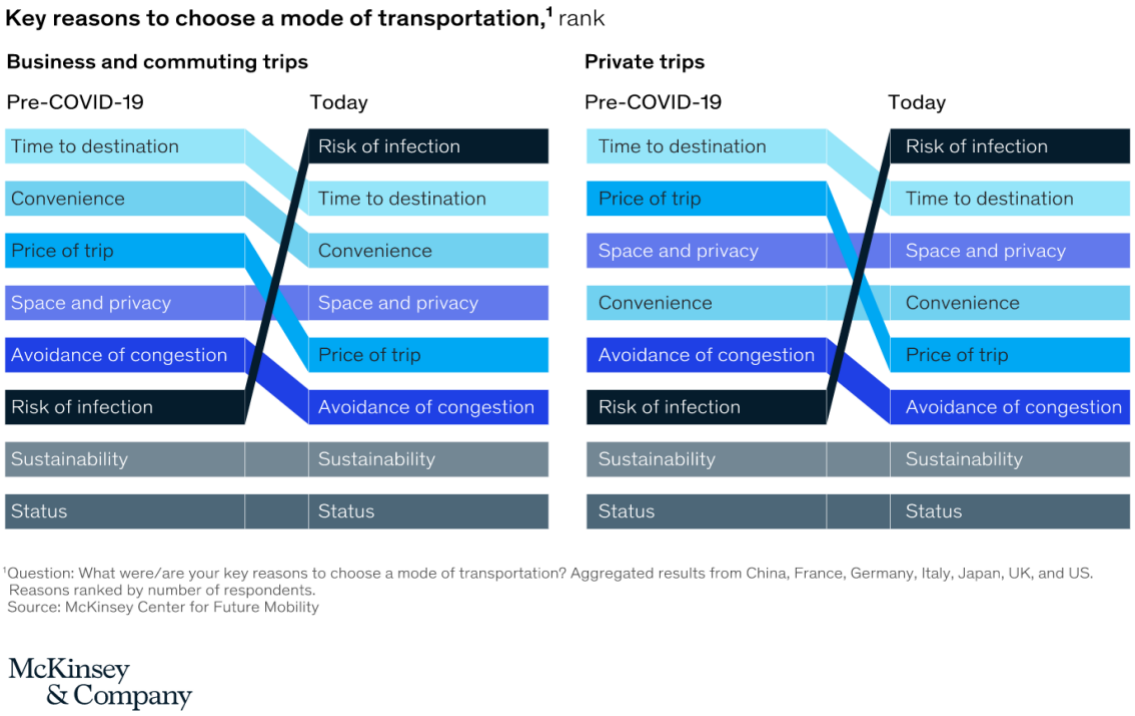

Figure 1: McKinsey & Company, 2020 (McKinsey Center for Future Mobility)

It is beyond our knowledge what the world will look like, or more importantly, if the way we travel will be the same again. Across the globe, car traffic is trending upwards and in some cases, above where it was before the pandemic. COVID-19 has led to an increase in car sales as people avoid mass transportation and are more sensitive to auto cost in the recession (Rosenbaum, 2020). For those with means, driving feels like a safe transportation option as it entails a way to maintain social distancing and reduce contact and crowds. Researchers have been showing great

concern over more automobile dependence post-pandemic. Further dependence on automobility would reverse the goals to reduce global greenhouse gases the world has been trying to implement (Zhang et al., (2021). COVID-19 has led to the comeback of the private car for many (Krams, 2020) as a safe haven away from people.

Even though private automobiles convey a sense of freedom and movement, not to mention status, they have a large impact on the planet with many key areas to consider. Cars require a lot of energy before they even make it to the road allowing for automotive production leaving a giant footprint because of the materials used for manufacturing. Petroleum products also raise environmental red flags as extracting them from the earth is an energy intensive process that greatly damages ecosystems. This, combined with shipping fuels, also consume a lot of energy and can create an occasional environmental disaster. Furthermore, automobiles are one of the world's biggest air quality compromisers producing about one fifth of all air pollution globally (Holmberg et al., 2019). Toxins emitted by vehicles are especially troubling because toxins are emitted at street level where humans breathe the polluted air directly into their bodies. Lastly, the infrastructure required to support automobility emits large amounts of GHG emission as road construction causes high amounts of air pollution and resource consumption. Consequently, GHG emissions are increasing, and the brief improvement in air quality and drips in emissions in spring of 2020 have halted (Rosenbaum, 2020). Similar to the poor environmental impacts that an increase of automobility will cause, automobility also has many detrimental effects on many different matters such as human health.

From a perspective of mobility justice, a question arises here as in pre-COVID-19 times: Who can claim the privilege of automobile? Automobility may not be affordable for many as vehicle costs, insurances and other related costs remain unaffordable. Social exclusion manifests

itself through material design decisions and interventions (Jensen, 2016) and the design of spaces influence mobility situations as they connect people and materials. The reason why those may rely heavily on automobile transportation is due to lack of comfortability and supportable infrastructure with active and public transportation uses. The automobile not only affects the urban form, but also its perception surrounding it (Charitonidou, 2020). A greater than 60% shift from public transport to car (especially in South Korea and China) was reported since the beginning of the pandemic (Zhang et al., 2021). Concerns remain over long-term changes and shifts from public and active transport to the automobile, but this could be reversed with the proper measures that allow the infrastructure or public and active transportation to be more sustainable, safe, and feasible for everyone living within cities.

The benefits of cycling and walking have been widely recognized in relation to health, in comparison to car driving (Dunning et al., 2020), but COVID-19 has thrown their advantages into sharp emphasis. Despite the fact that commuting by car ranks as people's least favourite regular activity (Dirksen, 2011), somehow it continuously becomes ever more popular as car traffic and congestion increases. Is it the convenience? The privacy? Are our transportation systems overly focused on automobiles? These questions need to be considered in order to steer people away from the automobile and onto either public or active transit. Communities globally would be healthier if our infrastructure encouraged walking, cycling, and other forms of transportation rather than subsidizing driving and ignoring alternatives. After decades of city planning focusing around the automobile, removing the automobile completely is extremely unlikely but having the right infrastructure and implementing the right measures that encourage public transit use and active transportation is a large step in the right direction. Public policy will have to address the increase of GHG emissions due to driving, traffic congestion and possible urban sprawl.

Although there is no one-size-fits-all approach, staring with temporary interventions that repurpose road space for walking, cycling and transit, and scaling up to more complex policies like parking pricing, congestion pricing, green zones over time is a realistic and do-able path for many cities. Rebuilding with a human-scale mind will give cities an opportunity to move away from the default of car-centric planning and commit to actions that mitigate the existential threat of climate change we are currently experiencing. Car-centric policies harm societies and the planet. Decades of prioritizing cars has distorted people's opinions and understanding of the harm of cars, traffic and congestion. Consequently, this has made it difficult for people to see solutions to climate change that do not involve cars. With the pandemic abating and climate change surging, now is the moment to re-center design and roads around people and not cars.

4.2. City of Toronto Context

The City of Toronto has been implementing measures to allow people to not rely on automobiles as much as in previous years, but the increase of automobiles post-COVID-19 is uncertain and is something that should be monitored and regulated by all municipalities alike. According to data generated by Waze Users, the number of kilometres driven daily suddenly dropped more than 70 per cent in April of 2020 across Canada. As the country reopens, numbers are looking higher than before the pandemic as many continue to choose the personal vehicle over public transit. As large cities including Toronto depend on public transit, there is simply not enough room on the roads for everybody to drive. Cars do and can have a place in cities to a certain point; they need however to be limited to a small extent. In terms of public transit, the cost to build subways is very costly as a well as a long planning and design process where it must meet the current and future needs of the population. This explains the long periods of time municipalities

and governments collectively take to make decisions and implement new public transit plans. We currently do not have the space expand roads to meet the coming of higher populations equalling to higher car ownership in the GTA every year. How does the Toronto want people to get around and or travel? Encouragement towards public transit systems or active transportation is the solution to help people to travel healthier and more sustainably. As rush hour was undoubtedly miserable before the pandemic, the roads could become significantly more congested if commuters return to work while continuing to avoid public or active transportation (Bubbers, 2021). If society switches to larger and more vehicles, that means more congestion, slower commutes and more GHG emissions. In Canada, 26 per cent of all commuting trips are less than five kilometres- an easily bikeable distance (Keesmaat, 2019). The problem in Canada more specifically in Toronto where the city has the highest population in the country, the proper active transportation infrastructure doesn't exist.

During the pandemic, many cities opened up streets as public space and the pandemic has made cities realize the value of reachable open spaces that allow movement within dense urban areas. These open spaces have allowed movement within dense urban areas throughout the City of Toronto. Many believe that communities should not give back the street space they reclaimed during the pandemic (Sadik-Khan et al., 2021). Physical isolation with absence of adequate open spaces is one of the major causes of discomfort and poor living conditions. If we continue to be stuck in an auto centric transportation planning mindset that dictates that roads are for cars and everyone else who wants to use those roads must fight for leftover space, we are heading down an extremely dangerous path. In Toronto, private passenger vehicles account for almost 80 per cent of the overall greenhouse gas emissions that come from transportation (Keesmaat, 2019). There's no near time solution to the climate crisis that does not rely on getting people out of their cars and

travelling by active transportation. COVID-19 has allowed us to see how efficient opening up our roads as public spaces and has changed habits and use of places and cities. The City of Toronto has taken many measures to encourage public and active transportation infrastructure over automobility use. Major road closures of major streets to provide more space for walking and cycling enabling physical distancing has been completed by the City of Toronto. This provides space for thousands of people to be active, respect physical distancing and contribute to the overall well-being of residents. The measures that were taken by the City of Toronto will be further analyzed in Chapter 5 and 6 of this paper. The goal of active transportation infrastructure should be to have 75-80% of trips under 10km to be walked or cycled (Keesmaat, 2019), which would help greatly with Toronto's GHG emissions as vehicles are the source of over one-third of their GHG emissions. After experiencing life with less traffic, larger outdoor patios instead of parking spaces, more bike lanes making it easier and nicer to get around, and the knowledge that working from home is doable for many office works, it would be a shame to go right back where we started, stuck in personal vehicles in rush hour traffic that's only getting worse. The hope relies on transportation leaders who recognize this is going to be an opportunity for people to change their travel behaviour.

4.3. Global City Comparison - City of London

We still have decades of auto-dependent land use trends to offset, but small shifts in the way our received infrastructure is designed can go a long way to making our neighbourhoods more walkable - and in turn healthier, more affordable and more vibrant. The city of London, England has made progress towards sustainable transportation measures in previous years. In comparison to the City of Toronto, the population of London continues to grow at staggering rates and is

predicted to continue to grow. London and Toronto have very similar growing patterns and as it happens: Toronto is almost exactly the same size with a sense of economic growth in both these market-driven places which are bubbling with opportunity and bursting with innovation (Micallef, 2010).

If all people in London, England drove, traffic would not move and be worse than it already is. To deal with the growth and the air pollution problem already occurring, the City of London is proposing new plans that would eventually make half of the streets car-free or a "pedestrian priority," meaning that people on foot would most often have the right of way. The City also wants to build protected bike lanes on most major streets to encourage cycling over other forms of transportation. In 2003, the City established a congestion charge which is a fee that drivers have to pay when entering the city during peak driving hours. Essentially, how this works, is if one wishes to drive or park a vehicle on public roads within central London between the hours of 7:00 a.m. and 6:30 p.m. on workdays, they will need to pay an entrance fee (Leape, 2006). This has allowed traffic congestion to decline substantially, and the program is proven to be largely popular within the U.K. "The congestion charge represents a high-profile public and political recognition of congestion as a distorting externality and of road pricing as an appropriate policy response" (Leape, 2006). These measures have targeted traffic congestion and appear to have modest benefits on air pollution levels and associated life expectancy within the residents in the city of London (Tonne et al., 2008). In 2010, the city started opening its first 'Cycle Superhighway' on busy routes which allowed for better suitable cycling infrastructure. Cycle Superhighways are cycle paths running from outer London into and across central London, aiming to increase commuter cycling, breaking down barriers to commuting by bicycle though a unique package of measures (Li et al., 2018). The implementation of the Cycle Superhighways has encouraged more cyclists to use the

service which has consequently prompted large increases in cycling as a main mode of transportation. We can see below in Figure 2, the amount of cycling infrastructure available to London residents throughout the city which encourages all who are able to travel by bike for either work, leisure or even just exercise. The superhighways were designed to cover areas where there is a great demand for cycling and has the proper infrastructure in place to support many daily riders.

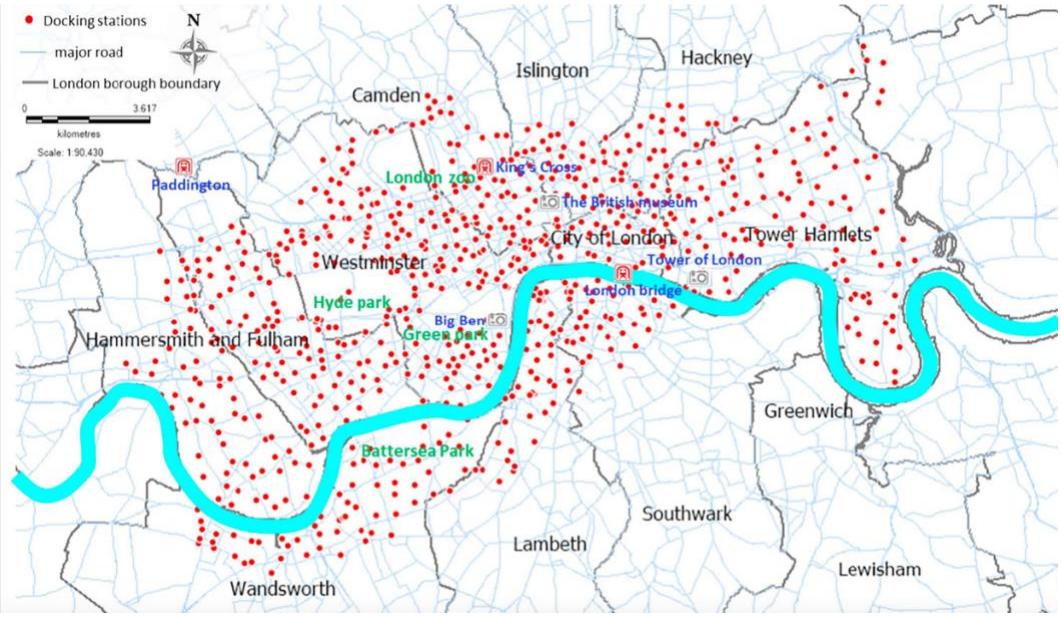

Figure 2: London Cycle Docking Stations Throughout the City (Li et al., 2018)

Transport for London has reported that the number of cyclists has significantly increased during the Cycle Superhighways scheme period and the program has a proven successful (Li et al., 2018). These measures implemented by the government have collectively allowed for the volume of cars dropping by about a quarter since 1999 which is quite significant considering the high populations residing in the city of London (Li et al., 2018). As London has very limited street space and a lot of demand for it, they need to continue to find ways to implement measures that

will allow these spaces to be used most efficiently and economically (Topham, 2020). As the need to reduce carbon emissions from cites has been ever more clear, London sets itself on a path to remove cars and become more sustainable. Other cities need to take action and analyze London's successes to find viable sustainable solutions that will get people out of their cars and into travelling by active transportation.

Chapter 5: Implications and the Future of Public Transit

5.1. Overview

Mobility is an essential feature of urban life, as it defines the ability to participate in modern society. The COVID-19 pandemic poses a great challenge for contemporary transportation planning worldwide especially in cities where high populations reside. Urban public transit systems bind cities together and are currently in a crisis due to the global pandemic.

Public transit is predominantly susceptible to disturbance and shocks from pandemics due to the collective nature of its mobility. There are over 180 metro systems around the world that have become the key mode of transportation in urban cities worldwide facing multiple threats due to the global pandemic of COVID-19. The public transit industry has seen an unprecedented decline in demand and revenue as people have been uncomfortable using public transit systems. 48 per cent of Americans stated that riding public transit posed a high health risk due to COVID-19 and that they prefer to drive or walk (Conway et al., 2020). Due to the mobility restrictions, a sharp reduction in transport demand has been seen in global public transit combined with the precautionary actions to avoid public transportation due to the panic of contracting the disease (Conway et al., 2020). Public health and safety concerned associated with the pandemic have dramatically reduced overall travel and precipitated large and historic declines (American Public Transit Association, 2020). Compared to April 2019, ridership across all transit agencies and modes nationally in the United States is down by 73 per cent, with some experiencing declines of nearly 90 per cent (American Public Transit Association, 2020). Stay at home orders have also depressed sales and therefore, use tax revenue designated for transit funding as fares and other ridership-related funds are transit agencies' largest source of revenues accounting for large percentages of annual budgets.

The economic and social effects of the COVID-19 outbreak in public transportation extend beyond service performance and health risks to financial viability, social equity, and sustainable mobility. Declines in transit demand are unequal across social groups as many information, managerial, technology, and knowledge workers can work from home while people with jobs that demand physical presence still need to travel to work (Tan et al., 2020). The risk remains if the public transportation sector is perceived poorly transitioning to post-pandemic conditions, as viewing public transportation as unhealthy will consequently gain ground and will remain the perception moving forward (Tirachini et al., 2020).

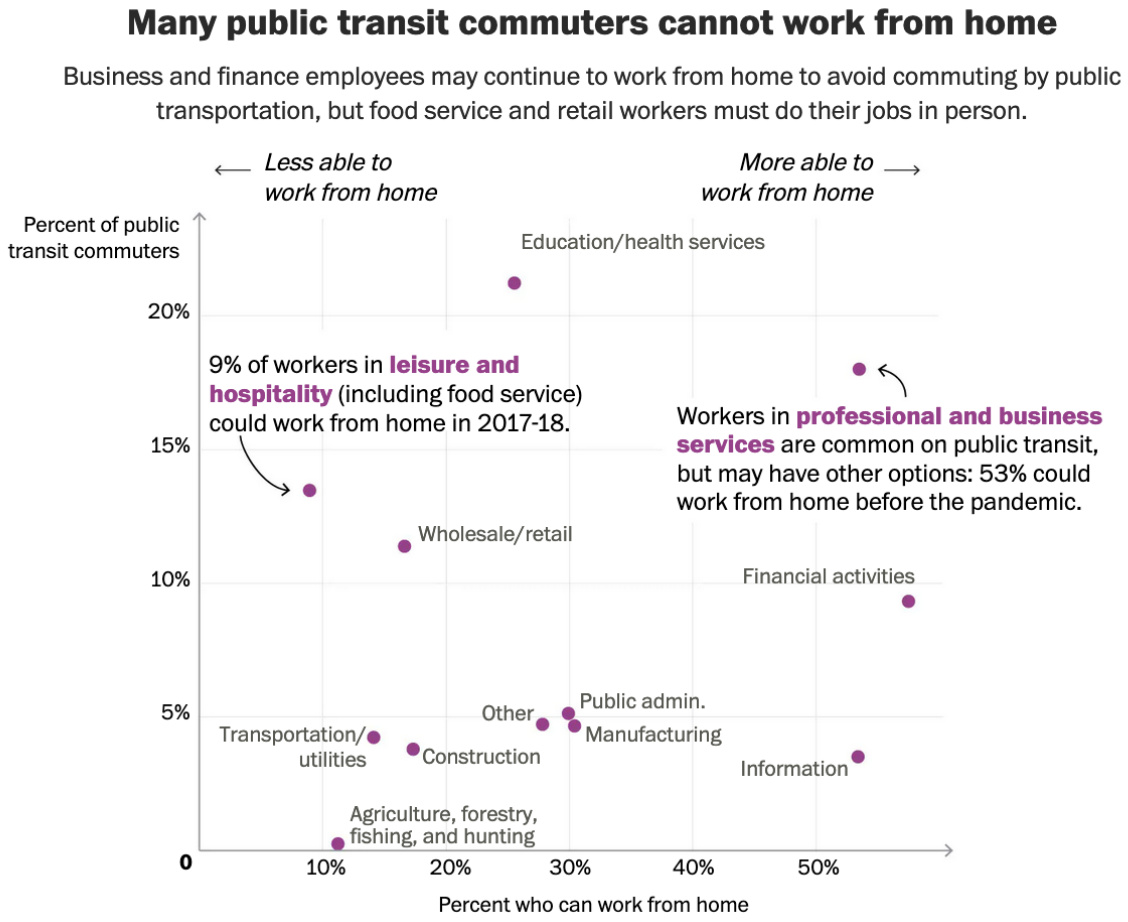

Figure 3: Washington Post, 2020. (Shelly Tan et al, 2020)

Urban travel has declined all over the world, but not uniformly for all modes; public transportation has taken the hardest blow, as shown by survey-based data (Molley et al., 2020; Astroza et al., 2020). It is critical that transit systems keep running even as ridership and revenue have plummeted due to COVID-19. Allowing public transit users to be comfortable and to feel safe will allow many to use public transit rather than relying on other forms of transportation/mobility. Public transportation is extremely important to cities as it reduces road congestion and travel time, air pollution, and energy and oil consumption, all of which benefits both riders and non-riders alike.

Society needs public transportation services to prosper and to address key societal challenges as it is critical to avoid contributing to stereotyping the use of public transportation as unhealthy, discouraging people to use the service (Tirachini et al., 2020). Both high-and low-income workers use public transportation to travel to work, however, the key difference is that the highly paid workers are also more likely to be able to work from home. Neighbourhood geographics, income levels of residents and working remotely are all issues that policy makers will have to consider while examining public transit in their long-term plans (Tan et al., 2020). The ways in which the public transportation sector expands and creates solutions to their problems caused by the pandemic will determine how people perceive public transit and define future usage.

Liu et al., 2020 provide a systematic analysis of the dynamics and dimensions of the unprecedented decline in public transit usage working with data from a transit app to conduct systematic analysis on the impacts of COVID-19 on 113 public transit systems across the U.S (Liu et al., 2020). The results have shown substantial departures from typical weekday hourly demand profiles and provided insights into public transit as an essential service during the pandemic. Thus, urban planners and policy makers must design more effective transit systems that meet the needs

of vulnerable passengers, creating transportation systems that are most inclusive and resilient to shocks.

Subway systems are the most environmentally friendly transport system for medium to long distances and the most ideal in terms of time, money saving and accessibility for those who live in high populated cities. Thus, to have inexpensive, more comfortable and safer travelling in cities, subway systems should be expanded to various points of cities, continuously be upgraded in order to keep up with the high ridership they face as well as the urbanized growth in cities around the world. These upgrades have to be made continuously while analyzing the implications that came with the COVID-19 pandemic on public transit. As the public transportation sector becomes restored and upgraded to deal with the concerns associated with COVID-19, other forms of transit need to be explored and expanded within cities across the world.

The problem is not the people switching to active transit measures, it is the people who are now relying on automobiles as a way of getting around which not only puts more cars on the roads, it also increases GHG and reverses the measures cities have been trying to implement for years. As public transit looks to rebound from COVID-19 with extended support from governments, people will have to move around differently when the pandemic is over. People working from home will be more likely to take trips during the day instead of at rush hour and services will have to increase outside traditional peak periods. Public transportation networks will reduce services, become even less attractive and useable, and the operators will not be able to meet the expectation of a post-COVID service regarding cleanliness and spacing. While some people may abandon or reduce urban living as well as choosing to use personal cars for travel, both will generate congestion, pollution, and sustainability impacts. The need for cities to prosper and grow will remain intact, requiring measures implemented in the transport sectors to provide future

sustainable transportation. Transit agencies need to make informed decisions about how to best recover while establishing realistic financial expectations for transit systems to succeed moving forward.

5.2. City of Toronto Context

The Toronto Transit Commission (TTC) provides countless benefits to those living and working in the City of Toronto. The measures taken by the TTC will determine if people will feel safe to use the services. The TTC provides a basic mobility service to many people and to all others without access to a car or bicycle while also helping to reduce road congestion, travel times, air pollution, and energy and oil consumption, all of which benefit both riders and non-riders alike.

The COVID-19 crisis has shown that effective public transport is vital to keeping cities running efficiently by providing a way of transporting for many essential works (Tirachini, 2020). Since the beginning of the pandemic, the TTC has seen a steep decline in ridership. Officials have estimated that the transit agency is seeing a revenue loss of about $65 million per week (Freeman, 2020). In March of 2020, when the province declared a state of an emergency, the TTC ridership dipped to less than 20 percent of its typical ridership which has caused tremendous stress financially on the transit agency.

As the economy reopens, people will have to choose between different modes of transportation to get to and from various destinations including work, school, and various other locations. This will inevitably make public transportation systems become busier again. Safety measures by the TTC will need to be continuously analyzed, updated, and restructured as the future of this pandemic remains uncertain. As ridership increases, the TTC and transit experts acknowledge that physical distancing of two metres will soon become an unrealistic standard on

public transit, but there are hopes that other measures will continue to be implemented to help protect riders and workers. Public sensitivity will focus on the need for space, cleanliness, and hygiene. This has already been promoted as a basic need in public health messages. While there will be some assurance of being more than two meters away from other travelers at some stages of a journey, “crowding” will be a stressful and barely tolerated experience for many.

In April of 2021, TTC has stated that customers who use the Rocket Man or Transit mobile apps will be able to see real-time passenger counts on TTC transit systems to accommodate concerns about overcrowding. This will allow customers to better plan their trips around the city. "You’ll be able to see the volume of passengers on vehicles approaching your stop to help you choose which vehicle you’re most comfortable boarding”, the TTC said in a news release (Freeman, 2020). Digital improvements to the TTC will upgrade public transit systems and allow improvements to user ridership. Gaining better tracking of users of the systems helps coordinating and efficiently running routes to prevent overcrowding. This could be done through the proper technology that will track capacity in real-time and then provide backup when needed. Better data management and tracking will make it a safer and more efficient (time and cost-wise) system as a whole. Innovate solutions utilizing technology may help to bridge the educational gap for residents during these unprecedented circumstances (Howard, 2020). Rapid innovation and implementation of technology has allowed to navigate the challenges from this deadly threat and safely make measures to keep Toronto residents safe.

The City of Toronto and other orders of government need to make full use of digital technologies to confront the COVID-19 pandemic and address a wide range of pandemic related issues. Apart from cleanliness measures and mobile applications that will advise crowding, there are many other issues that need to be analyzed. Focus has to be shifted to have an increase coverage

across networks, efficient routes for all commuters throughout all public transit platforms during peak times, and reducing transit stoppages and obstacles for public transit users. It is crucial and extremely important to invest in the base transit systems to properly function and consequently accommodate the increase of users and the influx of customers due to expanding networks and stations.

Expansion projects such as SmartTrack, the Relief Line South, Line 2 East Extension to Scarborough and new LRT lines on Eglinton and Finch West will add thousands of more customers to Toronto's transit network (TTC Capital Investment Plan, 2019). This will result in a dramatic increase of pressure on the base transit systems that is currently grappling with aging fleet, outdated signals on key subway lines, inadequate maintenance and storage capacity and infrastructure in need of constant repair (TTC Capital Investment Plan, 2019). Without continuous upgrades and investments, service reliability and crowding will worsen resulting in less users wanting to use the service. With fewer options to bring money into the city, increased funding by the federal and provincial government for municipalities including the city of Toronto is imperative. Nonetheless, the trust in essential services like public transit to remain operational and safe is just as important. As Toronto needs to continue its path of reducing carbon emissions and creating a more resilient city, public transit is a vital part of that solution. COVID-19 might provide the opportunity to end decades of underfunding that have resulted in decaying and inequitable systems. Instead of service reductions, the TTC should be increasing services, centered on a plan towards a greener and a more environmentally-friendly Toronto, with service upgrades and expansions, while having the proper health and safety measures for everyone to be able to use the system, sustainably and economically.

5.3. Global City Comparison - New York City

Similar to TTC and many other public transit services worldwide, the New York City Subway (Metropolitan Transportation Authority (MTA)) has faced unprecedented hardships brought about by the pandemic of COVID-19. In a city where over 40 percent of the population relied on public transit pre pandemic, the pandemic has caused many riders to either turn their back to public transit or rely on other modes of transportation. As stay-at-home orders were instituted in March and April of 2020, the transit system was hit hard.

It has been evident that New York City residents have adapted to the circumstances and individuals have reduced trips and frequencies while avoiding public transit and have shifted to non-motorized travel modes (Wang et al., 2021). New York City's transit agency, which is grappling with the biggest losses of any system in the country, forecasts a $6.1 billion deficit by the end of 2021 (Goldbaum and Wright, 2020). Through history, when transit agencies have faced financial shortfalls, they have typically turned to city and state governments. But with many municipal and state governments grappling with their own financial problems, this has made the situation that more complicated forcing transit agencies to turn to the federal government for financial aid (Goldbaum and Wright, 2020). In Washington, transit officials say that if the system receives sufficient federal assistance, they will revive services as much as possible to help coax riders back as vaccines are distributed and the cadence of normal life begins to return (Goldbaum and Wright, 2020). Transit officials have indicated they plan to recalibrate services to match what they expect to be a long-lasting levels of ridership (Wang et al., 2021).

Figure 3 below shows changes in driving, transit and walking in New York City from February to October in 2020. Increases in driving and active transportation has been shown as

many people were uncomfortable using public transit. Many individuals have reduced trip frequencies and durations, avoiding public transit and shifting to non-motorized modes of travel, especially walking and biking (Wang et al., 2021). Even though there is limited information tying major COVID-19 outbreaks to buses and trains, many have fear of social distancing as well as high-touch surfaces such as handrails and buttons previously touched by many of people . (Joselaw, 2020).

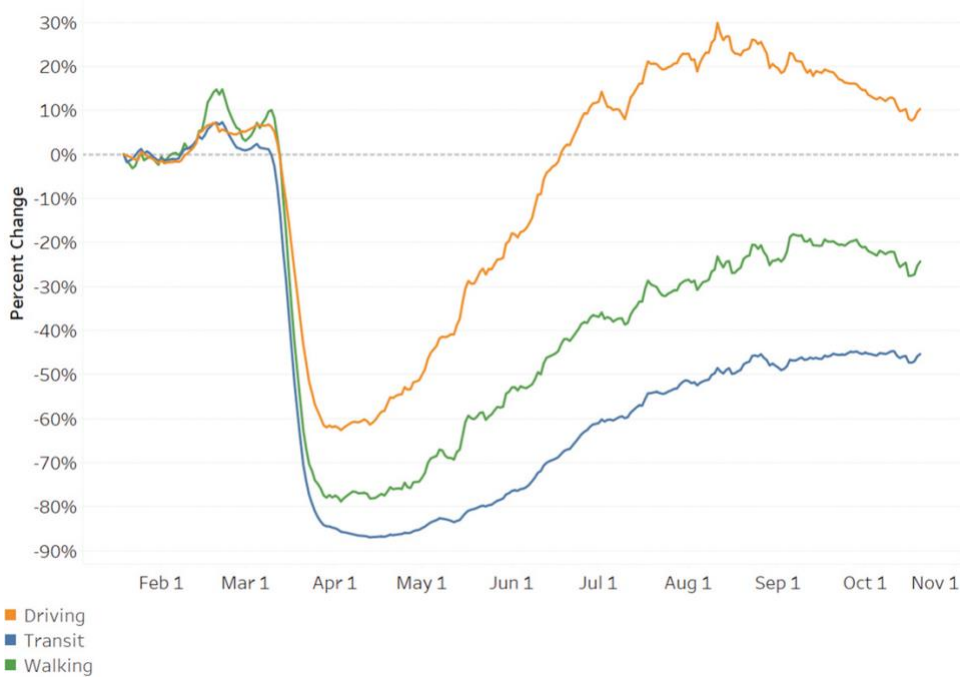

Figure 4: New York City Mobility Trends (2020). Transit Policy (Wang et al., 2021)

A study completed by Hamidi et al., 2021 discovered that there was no evidence supporting the relation between subway ridership and the COVID-19 infection rate as New York City has been particularly hit hard by COVID-19. As of May 25, 2020, about a quarter of total COVID-19 deaths in the U.S occurred in NYC (Hamidi et al., 2021). Even with proven research that public transportation ridership is not exactly related to the infection, the stigma of not riding public transit

considering it crowded, dense and busy, is what kept people off of it. COVID-19 has allowed for North America's largest public transit agency to enter its worst financial emergency ever allowing for an infusion of billions of dollars in federal aid to keep the agency afloat.

Many big city systems rely on fare revenue more heavily than their counterparts in smaller cities and rural areas (Goldbaum and Wright, 2020). Similar to the TTC and the City of Toronto's situation, the MTA in NYC's long-term survival depends on the return of riders and their fares to make up for the agency's largest funding source. As cities' mass vaccination measures reach more people and urban life slowly rebounds, public transit ridership may never return to pre-pandemic numbers, therefore, the agencies will have to reshape and increase service to reflect new commuting patterns that will be popular in a post pandemic world. State funding will be required especially in the interim, to allow the agency to stay financially stable and provide efficient service.

Although public health experts generally agree that riding transit and buses is not a major risk factor to exposure, transit experts believe that some commuters with the means to do so, will likely steer away from public transit and opt for other ways of getting around like using cars or bikes with many continuing to work from home. A surge of car traffic in Manhattan would cause gridlock and loss of productivity and higher air pollution that comes with increased congestion. If ridership does not bounce back, the MTA will sink back into a financial crisis. Regardless of its relative safety, transit can play a crucial role in combating climate change and air pollution. Transportation represents 23 precent of Canadas GHG emissions (Government of Canada Environmental and Natural Resources, 2018), and 30 percent of the United States' GHG emissions; however, this high number can easily be reduced. The most effective ways to limit these emissions is to invest in public transportation for a chanced to increase ridership again, which will play a crucial role in the push for sustainable development. The increased investment and use of

public transit are critical steps in the battle against climate change and are necessary for the promotion of sustainable cities.

In the midst of the pandemic recovery, customer service experience is the number one factor to allow for more users to use the public transit system. Comparable to TTC and any other public transit agency, one of the ways to bring ridership back is making people feel safe in the system. Allowing measures such as mandatory mask wearing for workers and customers, daily disinfection of vehicles and stations, sanitization dispensers, educating riders on appropriate spacing and distancing, addressing air flow and ventilation in vehicles, providing the proper PPE, providing computerized Apps to view how many people are on each train, and using seat barriers between seats will have to be implemented even after cases become lower, allowing people to feel and be safe using the system.

Another important measure, as users have not used public transit in a while, is to make clear what services and transit options are available and promoting the various transit services agencies have to offer. Making customer experience a priority is key to increasing ridership and helping public transit agencies such as TTC and MTA to push for pre COVID-19 numbers. Public transit is so important to urban areas that even with measures or funding implemented, still everything and anything needs to be done to allow public transit to run efficiently and back to normal for a high-functioning urban area. Transit agencies around the world have to continue to adapt and provide services while upholding public health guidelines to allow users to feel comfortable. Confidence needs to be restored before users will get back on public transit, which will allow numerous benefits to occur.

Chapter 6: Implications and the Future of Active Transportation

6.1. Overview

Proper connectivity is key to allowing sustainable and efficient flow of people to and from their jobs. Proper infrastructure networks are required to allow this to happen. Promoting active transportation post COVID-19 confers to numerous social, environmental, and economic benefits. Cycling as a means of transportation, provides many health benefits by incorporating physical activity into the daily life (Garrard et al., 2012). Cycling is good for the individual; it is also very good for the environment and will be a highly examined form of transportation in the post-pandemic life when cities are in the process of making decisions regarding creating new transportation resolutions.

If the spotlight remains on bikes and walkability, cities will need the proper infrastructure that comes with it. The provisions of dedicated infrastructure are considered a crucial policy to increasing cycling. Cities around the world have been taking measures to adapt to new city lifestyles by opening up roads to pedestrians and streets for walkability. However, more needs to be done moving forward. Garrard et al. states that most populations have high rates of bike ownership, and people generally know how to cycle. For smaller trips, with the proper infrastructure, why wouldn't somebody want to use active transportation as a means of transport? Active transportation also allows for social distancing which would make the user more comfortable walking or cycling as a way of transport. More efficient future infrastructure would need to be implemented to allow cyclists to commute safely and allow people to feel comfortable using cycling as a means of transportation. COVID-19 has been pushing urban planners to think aloud about redesigning more resilient cities going forward. We cannot fully control the population or urbanization of cities, but we can control the provision of better infrastructure and for safer

communities and neighbourhoods post-COVID-19. Planning for cycling infrastructure makes the urban fabric less car dominated and more human scaled. This improves the safety for everyone using it for years to come, especially when looking at implications of past planning practices. As social distancing will become normalized and a part of planning, this will forever modify the transportation sector.

As mentioned previously in this paper, these influences for a drastic change will include employment changes and people working remotely, resulting in overall less travel. While high levels of public transport ridership are the pillar of an efficient transport system, alternative modes such as cycling, are capable of working in conjunction (Villwock-Witte et al., 2015). In a pandemic event where the fear of overcrowding is exacerbated by the risk of contagion, the bicycle can serve as a lifeline to satisfying the mobility needs of urban residents (Teixeira et al., 2020). While public transport should be further improved, the current crisis should be regarded as a chance to significantly increase the share of walking and cycling (Zhang et al., (2021). There is evidence that suggests and supports the shift away from transit and the automobile allowing for greater volumes of cycling and walking, and that the shift is likely to be sustained (Cooper, 2020).

Cities have redefined car lanes to create more spaces for bikes and pedestrians as people began to avoid public transportation and opt out of their automobiles for some physical activity. As active transportation is a low-cost means of transport linked to low risk of transmission of infectious diseases, governments globally have had to incentivize cycling provisionally throughout cities (Kraus et al., 2021). Many cities around the world are doubling down on cycling measures and cycling infrastructure in post-COVID recovery plans as the health, economic and environmental benefits remain highly associated with it. To accommodate a larger proportion of trips on active modes in both large and mid-size urban areas, renewed investment in the

improvement of active transportation infrastructure will be critical. It is important to ensure active transportation improvements are fully integrated into transit services, stations and stops to share similar corridors to reduce accessibility impacts allowing for both systems to intertwine with one another.

Factors that affect the feasibility of making trips by a bicycle are the natural environment, built environment, policy surrounding cycling, society's perceptions of riding a bike for transportation and lastly the individuals opinions on cycling. Municipalities can act in support of these spheres by creating a context that is conducive to cycling. The natural environment can be addressed by municipalities addressing the challenges of hills and weather through a combination of infrastructure and programming to make cycling a more attractive option throughout the year for people of all fitness levels. The built environment needs to be safe with good quality, protected and lit cycling infrastructure that is designed to be safe for everyone who walks, cycles, or takes transit in all age groups with different abilities. Having the proper policy in place by creating the proper cycling infrastructure plans, projects and programs that encourage and support cycling as a mode of transportation will inspire people to use cycling as a mode of transportation. These policies must envision communities that are designed specifically to support transit and active forms of transportation. This could be done by encouraging compact communities that have streets pleasant to either walk or cycle. The attitudes and perceptions of society can be addressed by tapping into trends while creating an equity lens, identifying and highlighting the potential cycling has to offer and using partnerships across municipalities to build cycling culture where it does not exist. Individuals can make a difference by sustaining life-long cycling, sparking interest in cycling adoption by promoting the benefits active transit has to offer. By addressing these factors in a feasible matter, municipalities could see increase in the number of active transit users.

6.2. City of Toronto Context

While the weather and topography of most Canadian cities pose barriers to year-round cycling, active transportation is likely to continue to grow in Canada, given the shortages in the retail availability of bicycles during the pandemic and increased cycling traffic. Heightened anxiety over public transit and a surge in exercise has meant that more are choosing to use the most basic forms of mobility, leading to a so-called “bike boom” (Bernhard, 2020).

The increase in bike sales demonstrates that more are willing to use active transportation as a mode of transport. As bike sales and bike shortages remain high globally during the pandemic, there is clearly a desire to using cycling as a mode of transit. Bicycle shops across Canada are so busy with pandemic-triggered boom in sales and subsequent backlog that most bike shops do not even have product to sell. There is a major slowdown in the bicycle manufacturing because of COVID-19 safety protocols in workplaces combined with lack of materials and shipping containers. Bicycles provide an outdoor activity at a time when COVID-19 travel bans and lockdowns have made staying indoors either suffocating or dangerous. Health officials have recommended outdoor activities such as cycling and also warned of the danger of the virus transmission in gyms and on public transit. That has provided a surge in the demand for bikes across the world including Canada.

The newfound interest in cycling was essentially spurred on fears of travelling on public transit amid COVID-19, as well as the creation of ActiveTo freeing up roadways encouraging many to get out and stay active and travel by bicycle (Lucs, 2021). Cycling rates can increase through new people cycling, more and longer trips being cycled, and more people maintaining their cycling practise. From the beginning of the pandemic, cities around the world tried to implement cycling measures to allow for more active transportation in the midst of the global

pandemic. The City of Toronto created ActiveTO as a temporary cycling network aiming to allow people on bikes to move around Toronto safely, to better connect the city and to mirror transit routes. Toronto residents have eagerly turned to programs such as ActiveTO and Bike Share Toronto as many want to get outdoors and avoid public transit. Bike Share Toronto is a city initiative that offers 24/7 convenient access to thousands of bikes across various stations throughout the city for commuting, biking or even for recreation.

ActiveTO, which is a program launched by the City of Toronto, entails weekend street closures that enable residents to exercise outdoors on major roads throughout the city while maintaining physical distancing. ActiveTO allowing for increased cycling infrastructure has led to record numbers in 2020 and a similar increase in 2021 (Fox, 2020). The pandemic has allowed for City of Toronto officials to recognize the importance of active transportation especially in the midst of a pandemic.

Toronto had expanded biking initiatives throughout the city to better foster the cycling infrastructure that was previously there. Since the beginning of the pandemic, the City of Toronto worked alongside Bike Share to expand the system into 20 out of the city's 25 wards covering over 200 square kilometres of the city (Draaisma, 2020). The expansion of services also included Bike Share pilot areas in both North York and Scarborough which was well used and enjoyed by Toronto residents according to surveys (Draaisma, 2020). In June 2020, Toronto added 1,850 new bicycles and 160 new stations to its existing bike-sharing networks as it continues to look for new ways to help residents get around during the COVID-19 pandemic (Fox, 2020). The total cost of this overall expansion was $11.25 million with nine million of that coming from the province as a previously announced commitment. Continuous investment and expansion will provide residents different yet safe ways to get around the city as officials continue to respond to the pandemic and

make plans for the post-pandemic period where residents want to go outside, be active and have a variety of transportation alternatives. We can see below, even before the COVID-19 pandemic began, the ridership levels of Bike Share Toronto have significantly been increasing every year. During and post COVID-19, these numbers have and will continue to sky rocket and the proper viable infrastructure will have to be in place to accommodate the growth.

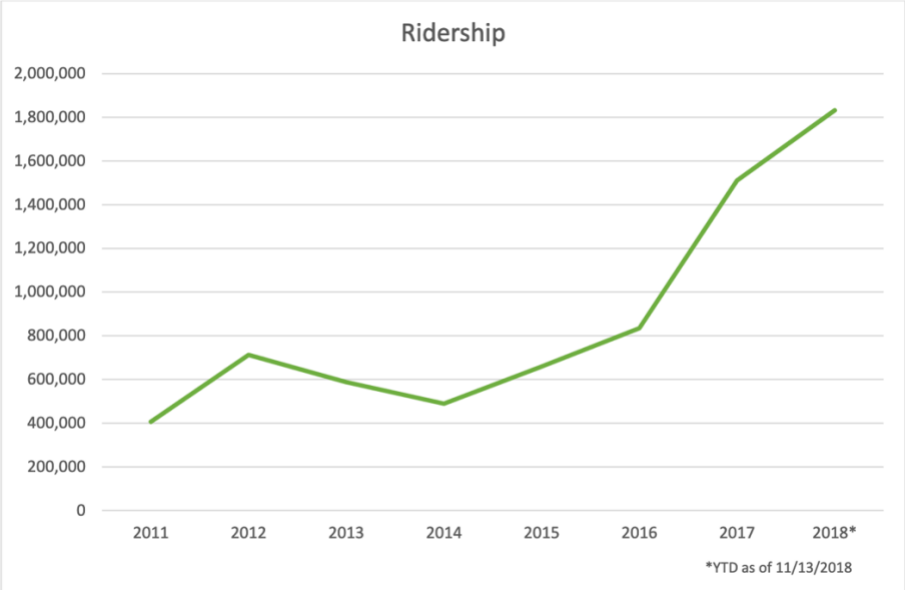

Figure 5: Bike Share Toronto Ridership Through the Years

The City of Toronto has made adequate proposals and authorized many pedestrian-friendly plans that will allow for the viable proper infrastructure to open roads for cyclists and walking pedestrians to have more room and experience less competition for space against cars. This is something that needs to be continuously updated and more measures need to be updated and authorized to allow for safe pedestrian capacity by giving priority to those travelling by bike or by walking. Due to the current COVID-19 pandemic circumstances, this is even more important for those who do not have access to a vehicle or any other form of transportation in the core of the

city. As the City of Toronto continues to respond to the pandemic, residents throughout the city want to go outside especially as millions were stuck in their condos during lockdown measures without having an opportunity to be outdoors and get fresh air. Residents want to be outside, be active and have those transportation alternatives to get around the city to either exercise or travel.

6.3. Global City Comparison - City of Paris, France

In April of 2020, the World Health Organization (WHO) in a policy guidance recommended that cycling and walking are useful for both social distancing and meeting the requirements for daily activity (Reid, 2020). Cycling has long been one of the fastest, most flexible, and reliable methods of transportation. Even before the pandemic, millions relied on bicycles to get to their jobs. When stay at home orders temporally curtailed daily life across the globe, the role of bicycles transformed as one in ten American adults reported having ridden a bike for the first time in a year or longer since the onset of COVID-19, according to research by People for Bikes (Bernhard, 2020).

Active transportation plays such an important role in the road to recovery for all transit users and agencies. Many cities around the world including Toronto have been giving over road space to cyclists and pedestrians during the pandemic with the sort of generous space usually assigned to motorists, accommodating people who want to stay active post-pandemic. The City of Paris has also implemented these changes very rapidly which has led to much success. Paris re-adapted how they use their roads allowing for large numbers of people to be able to get around safely while maintaining adequate distance from one another. Before the pandemic crisis, Paris Mayor, Anne Hidalgo, had promised that every street in the city would become cycle-friendly by 2024 recognizing the benefits that come with active transportation infrastructure (Reid, 2020). Even prior the pandemic, the city of Paris had goals to become one of the most cycling friendly

cities in the world. Her plan was to reinvent the formula of urban proximity by implementing some of the principles of Transit Orientated Development (Knowles et al., 2020) making the city of Paris the "city of fifteen minutes" (Reid, 2020). If implemented in Paris, this urban concept popularized by Mayor Anna Hidalgo would allow all residents to meet most of their needs within a short walk or cycle form their homes and offer quality of life within short distances (Reid, 2020).

The fear of COVID and the possible increase in private car consumption accelerated "Plan Velo" which includes removing space for cars and boosting spaces for cyclists and pedestrians throughout the city. This plan would remove 72% of Paris street parking spaces, making room for active transportation measures. Prior to the pandemic, Paris experienced a 46-day transit strike in 2019, and many users switched to cycling, doubling the number of cyclists on the roads in Paris, with a 131% year on year rise in the number of cyclist (Reid, 2020). The continuous governmental leadership has allowed the cycling infrastructure in Paris to excel over other urban areas and has allowed users to feel comfortable using it. During the lockdown period alone on top of Paris' multiple cycling initiatives, they have added over 30km of cycling infrastructure. Paris has also indicated that 650 kilometres of temporary and permanent cycleways will be created as part of a longer-term strategy to make every street in Paris cycle-friendly (Dunning et al., 2020).

In conjunction with other measures that have been implemented, cycling levels continue to increase. These interventions were a consequence of the large increase (about 60% compared to the pre-COVID-19 period) in bicycle use during the pandemic (Nikitas et al., 2021). Like so many other global cities, Paris has suffered decades of car-centered planning, but from the current state of road use and a glance at the city map, it is clear that there's great potential for cycling. Some changes seem like they may be built to last. "Paris added hundreds of kilometres of pop-up cycle lanes along the Rue du Rivoli, while in London a designated bike lane now runs along Hyde Park.

Increased access to bike paths creates more incentives for ridership, which in turn reduces traffic and emissions" (Bernhard, 2020). The City of Paris continues to impress with its latest city cycling roll outs providing hundreds of kilometres of cycleways for those residing in the city, making traveling by bike much easier than pre pandemic. The current health crisis shifts our focus to rethink our mobility system and Paris is a lead example for cities including Toronto can learn from.

Chapter 7: Leadership Matters

The COVID-19 pandemic has affected governments, cities, regions and planners, as there was has been no possible way to prepare or react to the chaos that the pandemic has caused globally. Absence of proactive programs and emergency plans are major reasons for failure to respond effectively in many countries across the world. “Decision-making in government is a process in which evidence, both from systematic research and practical experience, mixes with a complex interaction of ideas, interests, ideologies, institutions and individuals” (Aucoin, 2005). According to Peter Aucoin (2005), good governance and public management require decision-making processes that do more than secure political responsiveness (Aucoin, 2005).

Fragmented urban governance erodes response and adaption capacities. Governments will not only need to do more but will need to know what their roles are with regards to post-COVID-19 legislation. New infrastructure measures and regulation will be required, and policies and legislation will need to be developed or amended to accommodate post pandemic lifestyles. It is imperative that governments step in and begin to prioritize and invest in measures that will allow their citizens to not only be but also feel safe. Any policy or legislation implemented will not only require positive short-term implications, but also positive long-term future implications allowing the city, town, region, province, or country to be better prepared for any sort of future disaster.

Leaders have an opportunity to allow our cities to evolve and become stronger and more resilient due to the COVID-19 pandemic to demonstrate leadership in providing high quality transportation options despite the financial challenges that have been posed. For city leaders, the task is to start investing in micro-mobility and pedestrianization, while testing new models of urban design, including retrofitting buildings and public spaces with healthier renewable alternatives. The overall goal for city officials is to improve affordability, promote cleanliness, ensure stable

supply chains, produce energy, reduce congestion all the while providing various options of transportation infrastructure for the large populations that reside within urban areas.

Any crisis presents an opportunity for change, and not just in the realm of public health. As we look forward, leaders should consider how we can build back better and sustainably which will change the ways cities approach their risks and opportunities so governments alike can see every project as an opportunity to create more inclusive governments. With an improved strategy for resilience, the future of cities can be bright, but our leaders need to stay focused on the vision to help us get there. Long term visioning and integrated urban governance to enhance adaptive capacity and local governments should always provide economic and social support to vulnerable groups, especially in the midst of a pandemic. In addition to top-down initiatives, certain levels of local leadership and community engagement are critical for timely response to pandemics. Increased community participation in government decision making produces many important benefits short and long term (Irvin et al., 2004). Citizens have the right to influence what affects them and citizens should have a role in making the decisions that shape their communities.

We have seen positive leadership with the City of Paris' Mayor, Anne Hidalgo, where Paris's great success in improving cycling will remain one of the lasting legacies in France's politics due to her relentlessly pushing bike infrastructure as part of her pledge to reduce emissions and to make her city a cycling capital. As the current climate crisis and increased traffic congestion raise concerns and questions regarding land use, transit policy including improved cycling access offers a potential means of addressing these problems. We have seen Mayor Hidalgo address concrete change with her active transportation policies where many urban leaders have been unsuccessful doing the same. In a single year, from September 2018 to 2019, the number of Paris residents using bikes rose 54 percent, according to the Paris Mayor's office. This is the type of

leadership that is needed in urban environments. Leaders who make proper decisions, implement changes to which residents respond positively are the types of leaders the city of Toronto and many other large cities in the world are lacking.

Large scale cities require leaders to implement innovative ideas in leading their communities and such leaders must not be afraid to be different. A successful leadership team needs to be able to defend what they believe in, an example of which was seen in the city of Paris. At a time when governments are committing to large finances and investments to rail upgrades and expansions, the pandemic has shown how beneficial active transportation has been. It turns out that existing transport infrastructure can be repurposed rapidly and at a low cost to support safe active transport. While the opportunity is currently present for long lasting change, it will require a significant amount of planning with the right leadership is place to make the decisions. Governments need to provide accurate, useful and up-to-date information to people, particularly during times of crisis (Nunez, 2020). With the success of addressing subsequent public challenges including limited housing options, climate change, and unemployment, our cities will grow through the presence of high-quality transit systems and proper active transportation infrastructure.

Chapter 8: Conclusion

Transportation has and will forever be a fundamental aspect to modern societies and economic life. Transit is not an urban amenity, but an urban necessity for everyone to be able to access groceries, employment, hospitals, and various other important daily locations. COVID-19 has pushed urban planners and related professionals to think inversely about redesigning more resilient cities and communities. Along with being an existential threat to cities, COVID-19 may also lead to advanced and inclusive urbanism in cities around the world.

COVID-19 has shown that today's cities were not designed to cope with infectious diseases and depending on whether these patterns stay for short or long term, urban planners will have to start rethinking more safe, sustainable, and resilient spaces. It is evident that the partnership between city officials and public health will have to be greater to build sustainable and resilient cities to allow for stronger design principles against pandemic threats. The pandemic has provided an opportunity for all individuals to re-examine taken-for-granted routines in their lives including the transportation measures they relied on daily. This has and will continue to manifest choosing different mobilities, rerouting and for some, removing commuting entirely. It has been shown that there is a need for renewed focus on the objectives of equity, environmental integrity, and efficient public investment inherent in the context of economic recovery. It has been made clear that the world is not going to be back where it was and that opens opportunities in all sectors including the transportation and urban planning sectors.

Improving transportation networks and access to public transport services play a key role in stimulating the economy and reducing poverty for equitable growth (Starkey, 2007). All urban areas deserve clean, affordable, efficient, accessible, and safe mobility. To continue to improve sustainable transportation infrastructure addressing the urban linkages, improving connectivity is

key to allow the flow of goods to be viable and efficient. This must be done by positively improving business's ability to provide goods and services, as well as people's ability to access employment and services.

One thing that will not change in urban areas is the growth of population and urbanization, but one thing that we can control is the provision of better and more sustainable transportation infrastructure as COVID-19 has created new patterns of urban living. Cities are not uniform with one another and understanding cities with finer granularity will show where the vulnerabilities are. It has been understood from the history of pandemics and epidemics that density and globalization have strong influences on the spread of infectious diseases. We have learned that it is not always density that aides the spread of the pandemic, but also the multiple layers of social, economic, and spatial inequalities can contribute to the vulnerabilities within cities. The current pandemic has exposed the vulnerability of cities and the readiness and preparedness of each city dealing with pressures of healthcare, economy, transportation, and climate. The future of urban and transportation planning will need to be in constant change and explored dynamically through a variety of lenses including environmental sustainability, social change, economical rebuild, remote working, and allowing more active transportation and public spaces. These changes in living patterns are calling planners and city officials to bring and allow new perspectives in the way of life in urban environments. Proper sustainable green infrastructure such as cycling lanes, creates a possibility for a better quality of life and lower carbon footprints.

Furthermore, the research and exploration of information done to complete this paper has led to five final conclusions regarding transportation in a post COVID-19 environment:

1. The long-term shift in favour of the private automobile usage would create major negative consequences in the effort to reduce greenhouse gases globally, especially in dense urban

environments. Decades of city planning focusing on auto-dependency needs to come to an end and cities need to be designed for people and not cars.

2. If cities want to provide decent efficient public transit, they will have to shift their focus to having increased coverage across their networks, efficient routes for commuters during peak time, reduced transit stoppages while providing comfort and cleanliness for all users. Now that we see what is important for all users, this has given us a chance to reflect and reset the way in which cities provide public transportation networks within and around major cities. Urban society needs public transportation services and the most important goal for all transit agencies is to comfort their customers and do anything and everything possible to make them feel safe using the system.
3. Internationally, there has been a widespread recognition of the role that cycling and walking should play during and after COVID-19. Different city governments have introduced new forms of or expansions of cycling and walking infrastructure. This can allow for a new golden age for active transportation where we could all see the benefits and advantages it has to offer. The pandemic has allowed cities to recognize that entire cycling and walking networks can be created rapidly and at a low cost, which is beneficial for a proper running sustainable city.
4. Once the pandemic is under control, more holistic approaches in transportation planning will be necessary. The pandemic may not last forever, but our response to it will shape the future of our cities for the coming decades. Every pandemic in the past has taught us lessons on the importance of our response and preparedness, the most important one of being the acknowledgment of the fact that this pandemic will not be the last one. Cross-disciplinary collaboration of public policies, urban planning and design using open public spaces, parks,

urban forests and integrated green infrastructure are all needed as tools to make cities healthy.

5. Cities will prevail and bounce back with the right leadership and appropriate decisions. Through various conversations with multiple stakeholders, many different opinions were not only made but expressed regarding the situation the world is in, but one thing that remained the same is that cities have been through so much throughout history and they are far too resilient not to bounce back post-pandemic. While many major cities are down, they are far from out. With an improved strategy for resilience, the future of cities really can be bright and better prepared for climate shock, future pandemics, civil unrest, public health emergencies, recissions and more. Urban planners cannot fear density of cities post pandemic, we need to find ways to embrace it, make better decisions, become more sustainable and allow our cities to be healthier. This pandemic has allowed us to analyze and view what's most important in terms of transporting people and goods around dense cities.

COVID-19 has hit cities as well as the transportation sector hard, but the global pandemic has shown us that ensuring a healthy population requires reshaping society and the way we implement decisions. Cities are where that process will need to start. An awareness of planning for crisis is something that will take a lot of attention moving forward. We know proper guidance and leadership is necessary, we know what measures need to be implemented, and now it is time to put words into action.

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Appendices

Brief Professional Biography of Interview Candidates

David Collenette

David Collenette served as a Toronto Member of Parliament for 21 years and 11 years as Minister under three Prime Ministers, Pierre Trudeau, John Turner and Jean Chretien. His portfolios included Multiculturalism, National Defence, Veterans' Affairs, Crown Corporations, Minister for the GTA and almost seven years at Transport. Mr. Collenette is a graduate of York University, Toronto holding a BA (Honours), MA and LL.D. He is Fellow of the Chartered Institute of Transport and Logistics (FCILT). After retirement from Parliament in 2004, Mr. Collenette worked as an advisor to defence and transportation companies in Canada and the United States. He served as a director of many volunteer organizations, including as Chair of CILTNA, 2011-2016. He is Chair of the NATO Association of Canada. Mr. Collenette has been active with Stanford University, California; Glendon College, York University; Ryerson University and Trinity College, University of Toronto.

Lee Parsons

Lee Parsons is the founding partner at Malone Given Parsons Ltd. ("MGP") with over 30 years of experience in land use planning, economic development strategy, market analysis, infrastructure strategy and financial feasibility. Lee is a Professional Land Economist, a member of the Canadian Institute of Planners, a Registered Professional Planner, and member of the Professional Engineers of Ontario. Lee also has a Bachelor of Engineering at Dalhousie University in 1970 and a Master's Degree in Environmental Studies, Urban and Regional Planning from York University in 1974. In addition, he has completed a number of continuing education and professional development

programs at Harvard University, the University of Toronto and the Massachusetts Institute of Technology.

Monica Campbell

Monica Campbell is the former Director of Healthy Public Policy, Toronto Public Health where she led a team of health experts in policy development on a wide variety of environmental and social determinants of health. Areas of activity included climate change, air pollution, active transportation, food security, tobacco control and health inequities. Monica has a doctorate in Toxicology from the University of Toronto and a Masters in Environmental Studies from York University. Monica is currently Adjunct Professor at the Dalla Lana School of Public Health.

Roger Keil

Roger Keil is a Professor at the Faculty of Environmental and Urban Change, York University in Toronto, Canada. He is the author of *Suburban Planet* (Polity 2018) and co-editor, with Fulong Wu, of the forthcoming *After Suburbia* (UTP 2021). Keil's research areas are global suburbanization, cities and infectious disease, regional governance and urban political ecology. He is a co-investigator in a partnership grant on regional student mobility and currently works at the intersection of global urbanization and (emerging) infectious disease with colleagues in Berlin, Milan and Toronto on the relationship of the COVID-19 pandemic and cities.

Sean Hertel

Sean Hertel is a Registered Professional Planner (RPP) who leads a Toronto-based practice focused on the intersection of transit corridor planning, transit-oriented development, and housing.

He is also active as a researcher-lecturer in the planning schools at Ryerson University, University of Waterloo and York University.

Sean Wheldrake

Sean Wheldrake is currently the Manager of Bike Share Toronto where he is in charge of the management, oversight, operation contracts and sponsorship agreements of Bike Share. He is also in charge of long term planning, policy developments and the evaluation of the Bike Share program. Sean has been a part of numerous Bike Share Toronto Expansion projects that generated an increase of bikes, stations and docks benefiting active transportation throughout the City of Toronto.

Mitch Stambler

Mitch Stambler worked for 35 years in the Operations and Planning areas of the Toronto Transit Commission – twenty-two of them as Head of Planning and Strategy. He oversaw a number of landmark projects for the TTC, including the Ridership Growth Strategy, the Toronto Light Rail Plan, Automated Fare Collection, Transit Plan for the 2015 Pan Am Games, Accessibility Plan for the TTC, and various environmental assessment, business case, and transit technology reports. He has Masters Degrees in Transportation Planning and Business Administration, and has held positions in the International Union of Public Transport (UITP), Canadian Urban Transit Association, Institute of Transportation Engineers, American Public Transportation Association, and Canadian Institute of Planners.

Marco Di Simone

Marco Di Simone is the President of Royalpark Homes with over 36 years of experience in building and development. Member of Tarion, BILD, Resson, OHBA, and Toronto Board of Trade, Marco has numerous years of experience in the development industry. Royalpark Homes has been dedicated to providing every homeowner with a pleasurable home buying experience while providing a quality product in Ontario for many decades.