Reducing the transport sector's carbon emissions in a changing climate: To what extent do micro-incentives influence modal shift?

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Abstract

As global Carbon Dioxide (CO_2) emissions increase, sparking immense concern for the planet's sustainability, research is needed into the branches that contribute the most to emission outputs. The appropriate mitigation strategies can then be considered. The transport sector contributes roughly one fifth of global CO_2 emissions. The way in which this research will contribute to investigating how emissions can be reduced will be through analysing the extent to which micro-incentives can influence modal shift. This will be examined through three means: a literature review, semi-structured interviews, and data analysis of a Christchurch City Council survey. A literature review exploring the psychology of behaviour change, how the term micro-incentive can be defined, and analysing examples of transport incentives internationally. Following the literature review, interviews were conducted with businesses that have previously or currently offer employee transport incentives. What the interviews achieved was finding out what businesses had offered employees, what the uptake was like of the incentives, and how central Government agencies and Councils could support businesses wanting to provide their employees with transport incentives. To support the findings in the interviews analysis of Christchurch City Council (CCC) survey data was conducted. The data expressed the main deterrents people had that prevented them from using specific modes of transport. Key findings from the research concluded that the end of trip facilities was more important for employees. With the facilities being more important to individuals than a financial or non-financial reward, the facilities must be invested in so that they are of a high standard and quality for individuals. Overall, the research concluded that micro-incentives have an influence on modal shift; however, the extent that they are effective depends on the duration of time that the incentive is offered and the openness of the individual to commit to changing the way they travel.

Keywords: Micro-incentives, Sustainable travel, Public Transport, Cycling, Community engagement

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Abbreviations

Associazione Nazionale Ciclo Motociclo Accessori – ANCMA

Carbon Dioxide – CO_2

Central Business District - CBD

Christchurch City Council – CCC

Electric Vehicles – EVs

Fringe Benefit Tax - FBT

Public Transport - PT

Social Cognitive Theory – SCT

Theory of Planned Behaviour – TPB

Travel Demand Management – TDM

Waka Kotahi New Zealand Transport Agency – NZTA

1 Introduction

1.1 Background

In New Zealand alone, an average of 1,700 million hours annually is spent travelling, with 82% of these journeys completed in a car or van (Ministry of Transport, 2018). As a result, transport is one of the leading contributors to greenhouse gas emissions in New Zealand, making up 17% of gross emissions (Wood & Gandy, 2022). On a global scale, transport accounts for 21% of greenhouse gas emissions, accounting for one-fifth of global Carbon Dioxide (CO_2) emissions (Ritchie, 2020). As can be inferred from these statistics, transport plays a huge role in climate change and global temperature fluctuation. The goal of the New Zealand Government is that by 2035 transport related carbon emissions will be significantly reduced, creating a transport system that will be more equitable, accessible, and resilient to change.

With increasing concern for the effectiveness of emission reduction policies, it is predicted that by 2100 we will have experienced a global warming of 2.1°C to 3.9°C (IPCC, 2022a). What this is indicative of is the need to reduce greenhouse gas emissions. An increase in global warming will result in scarcity in areas such as food and water becoming more prominent, and more aggressive and unseen diseases will be experienced for the first time. Areas of biodiversity and differing ecosystems will also be damaged (IPCC, 2022b). The complex issues that the globe will face through global warming highlight the need for individual countries to play their part in mitigating emissions that lead to global warming. Climate change is not an issue that people will begin to experience in the future. It is something that people globally are already living through, and they have had to adapt their ways of livelihood to coexist with these changes. Water security, food production, health and wellbeing, cities, settlements, and infrastructure are just a few human systems being challenged by climate change (IPCC, 2022c).

The relationship between climate change and transport is a complex one. While transport produces emissions increasing greenhouse gas levels and thus causing global warming, the change in climatic conditions caused by emissions can significantly impact transport systems and infrastructure. What is predicted is that an increase in CO_2 levels atmospherically will accelerate concrete deterioration, and an increase of CO_2 in saltwater will weaken submerged

infrastructure elements more easily (ITF, 2016). What this means for the transport sector is that increased use of fossil fuel-run vehicles contributes to the decline of the infrastructure available for vehicles to use. To ensure that this cycle of concern does not continue, a reduction of greenhouse gas emissions is needed to ensure that the transport networks, infrastructure, and the planet remains resilient and functional. Globally there is more growth than decline trends experienced in the transport sector which can lead to the conclusion that cutting emissions from the sector entirely will be incredibly challenging (Gössling et al., 2016). What contributes to the difficulty of decarbonising transport networks is the way in which cities are built and designed. As populations increase and cities expand, the design and functionality of transport systems evolve to cater for the increased use of private vehicles. With the design of the cities catering towards vehicles, not people, changing people's travel patterns is difficult. However, it is not just the use of vehicles that contributes to total CO_2 emissions. Outputs can be broken down to 76% of CO_2 emissions coming from fuel usage, 9% from manufacturing, and 15% from emissions and losses in the fuel supply system (Potter, 2003, as cited in Chapman, 2007). Thus, acting as an indication that transport-related climate emissions are more widespread than people may initially think.

1.2 Purpose and significance of the research

This research aims to evaluate the extent to which micro-incentives can influence modal shift at a time when an early response to climate change is needed. Waka Kotahi New Zealand Transport Agency (NZTA) has an interest in this topic as they are looking for a way to reduce transport sector emissions. Through investigating the logistics and feasibility of incentivising low-emission and active transport modes, this research aims to provide a baseline for Government policies that will help inform decisions that promote alternative modes of transport. Through collaboration with Christchurch City Council (CCC), the research direction became more focused on exploring the journey to and from work and the effectiveness of incentivising sustainable travel.

With the transport sector being one of the fastest growing and producing emissions set to double by 2050 (Creutzig et al., 2015), transport is a crucial area to target to help lower greenhouse gas emissions. Analysing the extent that micro-incentives influence modal shift will result in understanding the different ways in which people are motivated to use modes

of transport other than private vehicles. As climate change is a pressing issue and the instability of CO_2 levels in the atmosphere increase, every attempt must be made to contribute towards reducing emission levels (Chapman, 2007). As the climate is a fragile component that makes Earth inhabitable, protecting it at all costs needs to be taken seriously by individuals, organisations, and Government agencies. This research is produced due to the need to reduce the emissions the transport sector is responsible for. Given New Zealand's goal to significantly reduce carbon emissions by 2035, it is of utmost importance that change begins immediately so it can become more integrated into how people commute. Through integrating sustainable transport into the way people travel, future generations will grow up experiencing this over private vehicle use, thus creating a generation that primarily travels in sustainable ways.

1.3 Research aims and focus questions

1.3.1 Aims

The primary aim of this research is to analyse how impactful micro-incentives are for influencing modal shift. With transport modes significantly contributing to greenhouse gas emissions, many businesses are trying to encourage staff to walk, cycle, e-bike, or bus to work to reduce their carbon emissions (Ministry of Business, Innovation and Employment, 2019). With New Zealand's goal being to reduce transport related carbon emissions by 2035, this topic is an important one to explore. Not only will modal shift help to decrease carbon emissions, but it will help to reduce the congestion levels on the road as people shift away from being the sole occupants of private vehicles, creating a community that embraces more active and sustainable modes of transport. The research gap that this research will contribute to is the lack of research surrounding micro-incentives, and the role that incentives have on influencing modal shift. This gap is important to fill as incentivising people to use more sustainable modes of transport will be one of the largest ways in which modal shift can be seen through. So, knowing the incentives that have the most impact on an individual's travel choices is important for implementing official incentive schemes.

1.3.2 Focus questions

The overarching research question is "To what extent do micro-incentives influence modal shift?" which is supported by the sub questions:

- What incentives are used globally?
- What micro-incentives are appropriate for use in New Zealand? and
- Who are different types of incentives most likely to impact?

Understanding how well individuals respond to micro-incentives is a crucial step in discussing how modes of transport other than private vehicles can be promoted to be more attractive primary transport options. This research can then be used to help guide Council and Government decisions around promoting sustainable travel modes.

1.4 Community partner

This research has been completed in collaboration with CCC's Travel Demand Management (TDM) team, led by Sarah Anderson. The TDM team offers a city travel planning programme that originated in 2016 following the Christchurch earthquakes and the influx of people and businesses moving back into the Central Business District (CBD). Businesses can register for travel planning advice online, and the service provided by CCC is free. The service entails travel planners coming into the business to provide personalised journey planning sessions and advice about transport modes people can take to travel to and from work. The planners provide resources such as cycle route maps, bus maps/timetables and physical incentives such as pre-loaded metro cards, reflector strips, and bells for bikes (Christchurch City Council, 2016).

CCC's TDM team is interested in how people travel to and from work, with a focus on encouraging people to travel in more sustainable ways rather than being the sole occupant of a private vehicle. The shared interest in this research comes from the need to understand the impact that incentives can have on modal shift. By focusing on the journeys people take to and from work, the research will focus on people who make up most of the commuter network. In Christchurch alone, 24,150 people travel to Central Christchurch for work, and 62% use private cars, trucks, or vans to complete their journey (Cooper, 2020). In the CCC Long Term Plan, an outcome is to create "*A well connected and accessible city promoting active and public transport*" (Christchurch City Council, 2021, pg. 18) which is something the TDM team is trying to achieve. By incentivising different transport modes, the TDM team hopes to see an increase in people using public transport (PT) and active travel modes.

2 Literature Review

The literature review provides an outline for the primary and secondary research that will be conducted. The topics analysed in the literature review were selected due to their ability to help answer the overall aims and objectives for the research project. As the overarching research question is "*To what extent do micro-incentives influence modal shift?"* it was important that the literature review topics provide a point for the primary and secondary data to build on to answer the research question. The literature review covers three topics and discusses the research gap that has been identified through analysis of the topics.

2.1 Defining micro-incentives

Human motivation to complete a task can occur through various incentives, which can be further broken down into two types: intrinsic and extrinsic (MasterClass, 2021). The first type of incentive in which humans are motivated by is intrinsic incentives. This form of incentive is defined as doing the activity for internal satisfaction. Intrinsic incentives do not include external products, pressures, or rewards which can act as motivators for some people. Commonly intrinsic incentives are more visible in youths and less so as they grow up due to changing life scenario influences (Oudeyer & Kaplan, 2007). On the other hand, Extrinsic incentives provide a material reward for people through primarily economic means (Fischer et al., 2019).

Extrinsic incentives are heavily critiqued by economists and sociologists due to their ability to completely change the way people complete tasks due to their motivations changing and distaste being exhibited for putting effort into the activity without seeing a reward (Goffman, 1974; Kreps, 1997; Kidder, 2000). The changes in people's motivation can create a paradigm clash between the psychological and economic perspectives. Bénabou & Tirole (2003) discuss this clash through an economic lens in which the negative impacts of extrinsic incentives are analysed. The 'hidden costs' of rewards is the target area of Bénabou & Tirole's research in which the concerns raised by psychologists are then closely examined. The psychologist's perception that extrinsic incentives have limited impacts on people's motivation to complete actions once the reward has been paid out is shared by Bénabou & Tirole who shape the rest of the article around this concern. The article proceeds to elaborate that intrinsic and extrinsic incentives do not have to be so separated but can complement one another to ensure that

the beneficiary receives both internal satisfaction and a material reward. The combination of both intrinsic and extrinsic incentives can encourage the activity to be taken up repetitively as there is a higher chance of the individual's long lasting satisfaction.

The literature critiquing incentives is predominantly business-centric and provides advice on what incentives can look like in a team environment. Milne (2007) analyses the desire for corporate firms to introduce incentives. The incentives on offer by the businesses are created in order to bring desired cultural change and work ethic on a team scale rather than an individualistic level. A key critique of team-based incentives is that instead of creating a co-operative relationship between teams in a business, support for a more competitive, and conflictual team environment is created (Lawler & Cohen, 1992, p. 6). Company based incentives can be considered too extreme to be listed as micro-incentives due to multiple factors but predominantly due to the amount that a business is able to invest into creating an incentive scheme. An example of an incentive scheme that will boost the company's income as a whole states that "*A company decided to introduce targeted incentives to accelerate value delivery by challenging a team to execute initiatives worth $40million. If this goal is achieved in 40 days, it would receive $40,000 in financial incentives.*" (Bachman et al., 2022, p.4). The amount of money that a company is willing to put into incentivising teamwork is reflective of their financial status not necessarily their ethical motivations which resultantly creates a one tracked approach to incentivising behaviour. What is not mentioned is that teamwork can be incentivised through non-financial means as well.

Drawing conclusions from the analysis of financial incentives as outlined above, a micro-incentive will be defined as cash, rewards, and vouchers that an employee can redeem to get something that benefits them. Whilst there is no clear number that separates a micro-incentive from a macro-incentive, it could be assumed that a micro-incentive would have a monetary value not exceeding $20-50 as this price range is reasonably sustainable for businesses that are large and more prominent, and the smaller more boutique business. The price range being any larger would likely result in businesses seeing it as more of a loss to the company than a gain to employees. Despite the definition provided primarily accommodating to financial gains as micro-incentives, a micro-incentive can include things like morning teas and music to encourage people to change the way they travel.

2.2 Behaviour change

The psychology behind what motivates someone to act the way they do is one that is complex and can have an overlap into different areas of the sciences. From an economic viewpoint, the assumption is made that people are driven by maximising the expected value of a particular behaviour. The economic viewpoint is used to form the basis of the models of behaviour in psychology, but in the psychology lens a different understanding of the word 'value' is used. Whilst the economic lens looks at this in monetary terms, the psychological viewpoint uses the concept of 'utility' to designate the expectation of the perceived value towards reaching a particular behavioural outcome (Edwards, 1954). There are many theories that social scientists have used to analyse and critique the probability of behaviour change, most commonly the Theory of Planned Behaviour and the Social Cognitive Theory.

2.2.1 Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is a cognitive theory formulated by Icek Ajzen in 1985 that proposes how an individual's decision to engage in specific behaviour can be predicted by their intention to engage in that behaviour (Brookes, 2021). In the TPB there are three ways in which human intentions can be determined which are outlined below. The central factor in this theory is the individual's intention to cater to a particular behaviour. The intentions that can capture an individual's motivations can be used to predict the effort that one will exert to perform the behaviour (Ajzen, 1991). From this central component, the theory can split into the three determinants of intentions – behavioural beliefs and attitudes, normative beliefs and subjective norms, and control beliefs and perceived behavioural control.

2.2.1.1 Behavioural beliefs and attitudes

Behavioural beliefs and attitudes are an individual's outlook to the consequences of performing the behaviour. The outlook towards a behaviour can predict the probability that an individual will adopt the habit. an individual's political, cultural, religious, social, or economic beliefs of can influence their behaviour and attitudes towards a particular action (Manstead & Parker, 1995).

2.2.1.2 Normative beliefs and subjective norms

Normative beliefs can be distinguished as injunctive and descriptive. The descriptive norm is derived from observing how other people act when faced with the task of completing a particular action. Thus creating a social reality which can act as a guide for how to complete a task. This reliance on others' approaches to tasks has the ability to shape our own approaches to tasks so we can copy the most successful approach. On the other hand, injunctive norms characterise the perception of what society approves. Shaped by the moral rules of the group, injunctive norms influence actions and one's ability to complete tasks through potential social rewards or punishments for aligning with the societal normative actions (Cialdini & Trost, 1998). Both branches of normative beliefs are heavily dependent on social pressure from an individual's companions.

2.2.1.3 Control beliefs and perceived behavioural control

Control beliefs are the factors that can either facilitate or impede performance of certain tasks. These factors influence an individual's perceived behavioural control of a situation. For an example, if the factors present are ones that the individual is uncomfortable with, then their level of performance will be hindered. On the other hand, if the factors present are ones that the individual is comfortable with, then their level of performance is likely to increase (Ajzen & Schmidt, 2020).

Ajzen (2011) acknowledges that since the formation of the TPB in 1985, critiques of the theory have been prevalent among social psychologists. The most common critique of the TPB is the irrationality that the theory does not consider the cognitive and affective process that bias and influence human behaviour. By taking on an approach that is output and goal related, the TPB fails to acknowledge that behavioural, normative, and control beliefs are often influenced by these other operating factors. Geraerts et al. (2008) support this concept of irrationality surrounding the TPB arguing that the human brain is one which can be influenced and manipulated incredibly easily due to experiences that we have had previously. These previous experiences alter one's behaviour and if an individual is faced with re-experiencing these conditions before making a decision, the actions an individual takes will be reflective of their previous experiences.

Leading from the irrationality surrounding the TPB, the theory neglects entirely the biasing conditions of affect and emotion (Conner & Armitage, 1998; Richard et al., 1998; Wolff et al., 2011). This critique is based on the perception that the individual is an emotionless rational actor who is unaffected by emotional command and thought. Ajzen (2011) rejects this claim stating that emotion and affect contribute to the TPB in multiple ways. The first argument that Ajzen makes is that emotions and affect serve as background influencers to shape behavioural, normative, and control beliefs. Building on this, Ajzen conveys how differing emotional states can help an individual to select the beliefs that are accessible when performing a task, often related to previous experiences.

Critiques of the TPB and Ajzen all have a common theme to them which is that the TPB needs to be extended in order to include conditions and factors in which psychologists are now more familiar with. Having the TPB available to incorporate new conditions increases the validity of the theory and its application to society.

2.2.2 Social Cognitive Theory

The Social Cognitive Theory (SCT) is a theory designed by Albert Bandura in 1986 and further expanded on in his 1991 publication "*Social Cognitive Theory of Self-Regulation*" (Bandura, 1991). Bandura discusses how human behaviour is motivated and regulated by self-influence and the sub-functions of self-monitoring behaviour, determinants and effects; judgement of behaviour in relation to personal standards and environmental circumstances; and self-reaction. Unlike the TPB which focuses on engagement behaviour in primarily social settings, Bandura's SCT focuses on the self-regulatory systems with little regard to the external outcomes of societal norms. The SCT is based on the concept that learning how to act in certain settings is influenced by cognitive, behavioural, and environmental factors. The learning that takes place differs from other theories as the individual can learn through observation of others' responses to tasks and the success of their approach (iSALT Team, 2014).

SCT is a theory that which has been widely utilized across many sectors such as health related, occupational and organisational settings, educational contexts, sports, and parenting (Luszczynska & Schwarzer, 2020). SCT has produced efficient salient results regarding

outcomes related to health indicators, academic attainment, and criminal behaviour. Luszczynska & Schwarzer provide an analysis of health contexts where SCT has been used to help individuals manipulate their behaviour based on their health needs, concluding that the SCT has sufficient support for predicting and changing behaviours and attitudes. Despite evidence being provided for the SCT determining its value, it is not without the critique that it does not consider the emotional and nonconscious processes that one goes through when making decisions. Beauchamp et al., (2019) supports this critique through the explanation that an individual's self-efficiency beliefs can have one of the largest impacts on how an individual responds to a situation.

2.2.3 COVID-19 transport behaviour change

Whilst literature has been published discussing transport behaviour change, the topic is reasonably new and has become prominent since climate emergencies have been declared by Governments between 2019 and the current day (Mik Aidt, 2022). Despite climate emergency being the initial driver of transport behaviour change, the most significant modal shift is appearing to be a direct response to the COVID-19 pandemic and people's fear to travel. The common theme across studies about transport behaviour in the covid era have shown there to be substantial decreases in the number of people using public transport (McKibbin, 2020; WSP Railway Advisory, 2020; McDonald, 2020; Richert et al., 2020). A report published by Waka Kotahi New Zealand Transport Agency (NZTA) looks at global transport responses to COVID-19 and reiterates the point that people feel unsafe utilising public transport due to the belief that this increases chances of contracting the virus. So alongside the decrease that is seen in public transport use, we are simultaneously seeing an increase in private vehicle use as this is perceived as the safest choice (O'Donnell et al., 2020). This reluctance from people to use public transport in the COVID era can stem from behavioural theories such at the TPB and SCT which illustrates the individuals social and emotional behavioural cues influencing their actions. What understanding the impact of COVID-19 on travel behaviour does is allows the research to be more mindful of the fears that people may have developed about being exposed to more people during their travels. COVID-19 behaviour change has had a huge impact on transport networks globally and in New Zealand has resulted in significant driver decreases and so it provides the key to understanding why people change the way that they travel.

2.3 International transport incentives

In order to plan the best ways to incentivise travel, it is beneficial to look to the countries that are known for their exceptional transport modes. This research looks at how transport is incentivised in Norway, the Netherlands, and Italy as they world leaders in specific areas of transport promotion.

2.3.1 Norway

Norway is a world leader in the sales of electric vehicles (EVs), with 83.7% of new cars sold in January 2022 being EVs ranging from fully electric to hybrid vehicles (Hill, 2022). Despite the high number of people in Norway driving EVs, the Government is trying to increase the accessibility of EVs through incentives which make the initial investment more attractive. The incentive scheme in Norway to encourage EV usage date back to 1990 when concern for the climate was starting to mount (Aasness & Odeck, 2015). Incentivisation has gone through four distinctive phases which are shaped to meet the demand for EVs. The first phase of incentivisation included vehicle tax exemptions, toll exemptions, and the provision of free parking spaces to commercialise the concept of EVs. Following these incentives, from 1999 to 2009 EVs were permitted to use bus lanes and received discounts on car ferries due to local EV suppliers becoming bankrupt. The period stretching from 2009 to 2013 was a time of growth with EV supply coming from both local and international producers, thus leading to more affordable EVs due to the price competition. With higher competition for EVs, the Norwegian Government produced public EV charging stations to increase the accessibility of using EVs. The current period of time sees Norway's EV market in one of rapid expansion. The work of Figenbaum et al., (2015) raises the valuable point that incentives alone cannot solely influence the uptake of EV use. In this case they specify that attractive cars need to be available across the market that cater to a range of people's needs. Although the incentives offered have been effective in making Norway a world leader in EV ownership, they are not without flaws in the incentives offered. With over 500,000 EVs in the Norwegian car fleet (Norsk elbilforening, 2018) toll exemption and free car parking have adverse effects on the available infrastructure. Typically toll payments and car parking fees pay for the maintenance of roading infrastructure, with decreasing numbers of people having to pay these fees, infrastructure quality will decrease as the money available for maintenance decreases. The other incentive with the most criticism is the allowance of EVs in transit lanes. This incentive

has caused increased congestion in rush hour and has the lead on effect of public transport users having to pay additional transport costs to make up for the increased time that the journey takes to complete (Aasness & Odeck, 2015).

As well as incentivising EVs, Norway is also looking at the possibility of incentivising cycling. A study by Ciccone et al., (2021) discusses how the idea of incentivising walking and cycling is one that is not incredibly obvious as financial incentives can backfire and decrease the motivation of an individual to complete the task. The study offered a financial incentive of 2 Norwegian Kroner per km cycled. Although the incentive worked at encouraging people to cycle, the study confirmed that once the study period was completed and the incentive had stopped being provided, ridership decreased significantly as people no longer had motivation to cycle.

2.3.2 The Netherlands

The Netherlands is seen by the western world as a leader in cycling infrastructure and uptake (Centre for Public Impact, 2016). Whilst the Netherlands is a world leader in cycling, the State Secretary for Infrastructure and Water Management, Stientje van Vaeldhoven, argues that there is always room for improvement given that half of journeys taken by car are less than 7.5km which is a bikeable distance (Ministry of Infrastructure and Water Management & Rijkswatersaat, 2020, pp. 7–9). Taking inspiration from Germany pre 2005, Dutch policy introduced a tax break for cyclists. The tax break offers cyclists €0.22 per kilometre cycled which is tax free and is put directly into the cyclists pay check (Fleming, 2019). The incentive's impact has resulted in a dynamic shift in which Germany now follows Dutch model of incentive. As well as Germany following the Dutch mode, France, Luxembourg, Italy, and Belgium have followed the cycling incentive of tax breaks (Boschetti, 2017; Bauldry, 2019; Giaume, 2022; Reid, 2019). Evidence here points to the success of the cycling incentives offered by the Netherlands, measured by other countries being able to model their incentive schemes based off of what the Netherlands offer.

2.3.3 Italy

2022 has been the year of targeting more sustainable transport in Italy. In May, the Government introduced the concept of a €60 public transport bonus for those earing under

€35,000 annually. This one-off payment has been designed to improve the uptake of the public transport network as it will provide people with the ability to purchase a metro voucher (The Local Italy, 2022). As far as literature goes surrounding incentives for transport in Italy, most appears to be in the more conceptual stages or very early implementation with little to no analysis of how effective schemes have shown to be at the time of writing.

Over the span of the COVID-19 era, the Italian Government has been formulating a transport bonus of €500 for the purchase of bicycles and electric vehicles (Idealista.it, 2020). Announced in 2020 by the Minister of Infrastructure and Transport, the bonus targets residents in metropolitan cities and urban areas as part of the climate decree and to reduce the risk of COVID-19 spread on public transport. The bonus scheme has proven to be an initial success with the number of units sold increasing from 340,000 in 2019 to 540,000 in 2020. Despite this initial increase and effectiveness of the scheme, Associazione Nazionale Ciclo Motociclo Accessori (ANCMA) has declared that to keep people cycling long term once the pandemic is over, the cycling infrastructure needs to be developed as what is currently available is insufficient and does not meet the needs of cyclists (van Schaik, 2020).

Through understanding the achievements and issues with transport incentives internationally, New Zealand is able to consider the best fitting approach for how incentives may be implemented into New Zealand societies. As seen different incentives work best for different groups of people and understanding this whilst implementing incentives is incredibly important. Learning from the trails and errors that international incentives have experienced will allow New Zealand to avoid the same mistakes.

2.4 Research gap

From this literature review, several key knowledge gaps can be identified and provide the basis of the current research. The first area in which there are gaps in is defining what micro-incentives are. The literature available discusses incentives in a workplace setting and from a team approach setting, and whilst this information gained provides an understanding of incentives, the individual level of motivation fails to be acknowledged and so a definition needs to be provided that accurately describes what a micro-incentive is in the context of the research scope. The definition used in this research can be found at the end of section 2.1.

The second identified knowledge gap is the literature available that analyses the extent to which incentives are effective. The current research around this topic is limited and so this research aims to understand the effectiveness of incentives in New Zealand. Through a series of semi-structured interviews with business and organisations and the analysis of CCC survey data, the effectiveness of incentives will be analysed based off of the experiences and feedback from businesses and individuals.

3 Methods

3.1 Methodological framework

The primary methods used in this research can be defined as purposeful qualitative methods of analysis, meaning that certain case studies are chosen for analysis as they are information rich in the areas of interest to the researcher (Berg, 2002b, p. 10). Using qualitative methods centres the findings on individuals' experiences, lives, behaviours, emotions, and feelings (Corbin & Strauss, 2008) which will help to better answer the research questions. In the case of this research, it is important to be able to understand people's perceptions, feelings and understandings of micro-incentives that influence modal shift. Rahman (2020) expresses that qualitative methods allow the researcher to gain deeper insight into perceptions, feelings, and understandings around topics and themes. Using qualitative methods of analysis as opposed to quantitative methods, the researcher aims to collect a wider range of individuals' epistemological viewpoints surrounding incentives that can induce modal shift.

The initial method of data collection is a literature review. The purpose of the literature review is beneficial in gaining a deeper understanding of the chosen topic area and the factors that interact with one another in the overarching topic (Winchester, 2016). Through providing a synopsis of the existing literature, the researcher is able to shape their argument and research questions, having gained insight into what areas are critical and where attention is most needed. The literature review identified micro-incentives as not being frequently explored in transport literature and that there is not a clear definition of what micro-incentives mean outside of a financial definition. Having identified these gaps, interview questions were formulated to fill the knowledge gaps that were identified as missing in the literature review.

Semi-structured interviews were the main means of gathering primary data as they allow the interviewer to ask certain questions, but there is also the freedom to digress and expand on answers given by the interviewee (Berg, 2002a). The justification of choosing to conduct a series of semi-structured interviews over surveys is that interviews give the participant the opportunity to seek clarification on questions that they are unsure of. With the questions being worded in basic level English, this will help to mitigate any confusion that could be caused between the interviewer and the interviewee regarding the questions asked and the

objectives of the research. There is one area of the interview questions in which participants could be confused about and this is the phrase “micro-incentive” as it is not a common phrase. By ensuring the interview space is one in which the participant feels comfortable asking questions (Løken et al., 2022), a relationship is built between the interviewer and the interviewee which allows people to be more open with their thoughts on the questions asked and gives them the opportunity to comfortably ask questions back. Ultimately using interviews will provide an in depth understanding of individuals’ perceptions on incentivising modal shift and will help to answer the research objectives.

Secondary analysis of existing Christchurch City Council survey data was used to confirm and reinforce ideas gathered in the semi-structured interviews. The data provides the opportunity for the researcher to understand trends over time and how events can shape opinions and behaviours (Pienta et al., 2011). The primary goal of the secondary data in this research process is to support the findings from the interviews.

In order to use interviews as a method of gathering data, ethics approval was needed from the University of Canterbury’s Human Resource Ethics Committee (HREC). HREC was approved on the 12th of September 2022 with the reference HREC 2022/70/LR.

3.2 Literature review

The first topic analyses how micro-incentives can be defined. The purpose of analysis in this area is so that micro-incentives can be defined in the research. This section provides an economic insight into financial incentives and how these are often used in large scale team environments. From the understanding of larger scale financial incentives, a more focused direction can be taken through looking at the factors that can be considered micro-incentives. Following this topic, behaviour change was examined. The purpose of analysing this topic was to gain an understanding of the factors and considerations that influence individuals’ transport related decision-making processes. The section analyses both the Theory of Planned Behaviour and the Social Cognitive Theory as they appear to be the most prominent theories that can explain behaviour change. Whilst this section predominantly analyses the psychology of behaviour change, it delves into understanding the impact that COVID-19 has had on the way that people travel. The final topic analysed in the literature review is effective international transport incentives.

The major takeaways from the literature review are outlined in section 2. Primarily through the identification of gaps in the literature, the questions asked in the interviews were formulated with the purpose to fill gaps in literature. One of the key takeaways was that incentives in literature are looked at on a corporate level not an individual level and so the literature review has shaped the interviews to look at incentives on an individualistic level.

3.3 Semi-structured interviews

Semi-structured interviews were conducted over the three weeks between the 27th of September through to the 14th of October 2022 with 12 individuals from a variety of business types. The participants for interviews were found through two means. The first way in which contact information for participants was received was through a contact sheet provided by the community partner Christchurch City Council who has previously worked with these businesses. The other way in which participants were found was through googling companies that offered transport incentives and are located in New Zealand. Once the list of potential candidates was compiled, emails were sent to the 49 potential interview candidates asking them if they would be interested in contributing to the research. Interviews were estimated to take between 20-45 minutes to complete which allows for all the topic questions to be asked as well as for any additional questions to be explored. Before the interviews participants were given information sheets to review and the opportunity to ask any questions that they may have about the research process. From here the participants were able to give informed consent to partaking in the research.

The semi-structured interviews consisted of 10 questions originally and then later modified to include an additional question. This additional question asked participants what the main barriers are to people travelling more sustainably in their opinion. The question was added after the first interview as understanding the barriers people face in terms of transport option is a crucial part in understanding behaviour change and motivations. Once this question was added, the pre-set questions were as follows:

- Why did the business want to look into sustainable transport for employees?
- When were incentives first offered?
- What facilities are available for employees?

- What incentives are offered?
- What was the uptake like of the incentives?
- Was the offering of incentives something the business had to do?
- What was the feedback like surrounding the incentives?
- Are incentives still offered? Has usage changed over time?
- How could businesses be more externally supported while offering incentives?
- Has the business moved since incentives were first offered?
- What are the main barriers to people travelling more sustainably in your opinion?

The questions provided the interviewer with the ability to gain an extensive amount of information from participants but also provided the opportunity for topics that the participants brought up to be expanded on. The questions outlined above provided a guide in what would be asked to participants. There were circumstances in which participants did not know the answers to the questions or the questions drafted did not apply to the business, so some modification of the questions asked was needed in some interviews to cater for these circumstances which was one of the benefits of conducting semi-structured interviews.

3.4 Analysis of Christchurch City Council data

The Christchurch City Council Travel Demand Management Team has conducted a yearly survey in which businesses are asked about individual's transport habits. Due to the COVID-19 pandemic, the conducting of a 2022 Annual Workplace Travel Survey was not possible and the chance was taken to modify the survey. For this research the data set gathered from the 2021 Annual Workplace Survey has been used.

The survey acts as secondary data that explains people's travel behaviours and can provide a basis for the interview questions that are asked, and then can provide support for both literature review findings and interview findings. The data gathered from the survey will be examined by each transport mode to figure out the most popular methods of travel and then the concerns with each mode of transport will be analysed.

4 Results

To provide answers to the research aims and objectives, various methods were used to gain a selection of detailed results. The results from each method are outlined below. The interview results are examined by the questions asked and the Christchurch City Council data is examined by mode of transport and deterrents.

4.1 Semi-structured interviews

4.1.1 Why did the business want to look into sustainable transport for employees?

In a changing world, the promotion of sustainable travel is something important for many people in all professions. With this in mind, it was important ask interview participants what motivated the business to look into sustainable transport for employees. The reasoning offered by the participants was varied but was able to be condensed into three themes – Health and wellbeing benefits, being climate conscious, and cyclist culture. Aside from the common themes outlined below, the need for looking into sustainable transport for employees came from businesses trying to lead by example in the industry that they work in.

Health and wellbeing benefits

Health and wellbeing benefits as a result of travelling in more sustainable ways such as cycling and walking to work was a theme identified by 6 of the businesses interviewed. As one interviewee stated *"If you're fit, healthy, active, use a bike to get to work, or a bus, it shown to be better for your mental health. Those things are all important to employee productivity."* Whilst this participant has identified the benefits to employee productivity, health and wellbeing benefits can reach well beyond this. Through active and sustainable travel modes, employees are able to reduce their likelihood of getting particular cardiovascular and respiratory diseases, which can overall improve health levels. On the wellbeing side, sustainable modes of travel can allow an individual to become more exposed to green and blue spaces which has many positive benefits to an individual's wellbeing such as reducing the risks of depression and anxiety (Reece et al., 2021). Through the use of more active modes, employers have noticed the increased health and wellbeing benefits that their employees are experiencing and so more interest is being circulated into business advocation for modal shift.

Being climate conscious

In an era in which climate change is one of the most pressing issues, 9 of the 12 interview participants identified climate change as a reason for wanting to encourage employees to travel in more sustainable ways. There was a range of ways in which being climate conscious was identified in the interviews and this ranged from organisation sustainability strategies to reducing carbon footprints and fossil fuel outputs. The overarching point from this theme was that having the business actively supporting employees to travel more sustainably complemented the businesses' values and sustainability goals. The concept of being climate conscious was primarily something that participants identified first when asked about why they wanted to look into sustainable transport for employees. Through being climate conscious, businesses embraced the leading by example idea, showcasing to clients what they are capable of and what a climate conscious business can look like. Thus, becoming a more attractive option to clients who want to embrace their businesses being more climate conscious.

Cyclist culture

The final identified theme for this question was the pre-existing cyclist culture within the businesses. One interview participant stated that *"I'm a keen cyclist myself and I feel like fundamentally if more people cycle that would be a really good thing for a whole lot of reasons."* In this situation the cyclist culture is driven by the company lead but other interview participants identified that cycling was the easiest mode of travel to get to their work and so it built up a community of cyclists. A few of the businesses identified that a majority of employees cycled to work and the interest in sustainable travel came from encouraging those who don't cycle to give it a go. This encouragement of the mode was described as *"positive peer pressure"* by one participant who found that the more people who cycled in the office, the more people would be likely to give this mode a go. By creating a supportive cyclist culture in the workplace, beginner cyclists felt more encouraged to experiment with different modes of travel and the ability to ask for guidance when needed is able to be provided in a judgement free manner.

4.1.2 When were incentives first offered?

The majority of the businesses interviewed are located within Christchurch and the point of change in many of the businesses' attitudes towards climate conscious travel was identified following the Christchurch earthquakes and the shift of businesses back into the CBD. The opportunity was provided for businesses to examine how people could be encouraged to travel in alternative ways. A quote from one interview participant states that *"Now's a good time to do some travel planning, find out how people are travelling"* Indicating that the shift back into the CBD provided businesses with the opportunity to relocate to buildings that have facilities built into them and are close to public transport hubs and bike lanes to make journeys into the city easier for employees.

4.1.3 What facilities are there for employees?

As expressed in Table 1, businesses have invested in providing multiple facilities that give employees the means to use alternative modes of transport to travel to and from work. The facilities outlined in Table 1 contribute to modal shift in a variety of ways. The provision of carparks for people's private vehicles will encourage people to drive to work as they have the knowledge that there will be a park awaiting them for their vehicle. Business that provide employees with secure bike storage space see an increase in people cycling to work as there is somewhere safe for people to store their bikes without having to worry about theft or vandalism to their transport. The end of trip facilities such as showers, lockers, towel services, wall hooks, and personal desks facilitate modal shift through providing people with areas to store their equipment and to freshen up after their journey so that they do not have work in their clothes used to get to work. By providing storage, businesses are allowing employees to leave clothes and shower equipment so that there is one less thing for people to have to worry about bringing into the office with them each morning. Through providing EV charging stations for bikes, scooters, and cars, employees do not need to bring their own charging equipment to work. Having these stations provided can encourage an individual to utilise the facilities provided by the business to make their trip easier.

Table 1: Facilities provided for employees

Facility	Count
Internal bike storage space	9
Showers	7
Lockers	6
Towel Service	2
External Bike stands	2
Personal desks	2
Wall hooks	2
Electric Vehicle charging stations	1
Carparks (For private vehicles)	1

As shown the provision of internal bike storage, showers, and lockers were the most popular means of facilities which had been provided by businesses. Not expressed in the table is the security measure in place for the bike storage facilities. Businesses with internal bike storage space reported that to access the bike storage you need either a code or to swipe your access card multiple times. The external bike stands are more easily faced with the problem of theft with one interview participant stating that *"They've never [been stolen] from the bike garage park but have been from the front of the building – we've had bike stands there for the past 5 years which have had passive surveillance from inside, but it hasn't stopped half a dozen bikes from being stolen."*

Only one business expressed that they provided car parks for individual's private vehicles. When other business were asked if the facilities they provided included car parks, the majority stated that the carparks were for branded fleet cars, management cars, or in some circumstances guests and tradespeople. Others noted that despite not providing carparks for staff there were multiple public carparking buildings in close proximity to the office location.

4.1.4 What Incentives were offered?

The businesses interviewed provided a wide range of incentives for employees to travel in sustainable ways. Many of the incentives were unique to the business but there were a few shared incentives that multiple businesses claimed to use, and these are outlined below. A complete list of incentives can be found in Appendix One.

An unexpected result from this question was what businesses considered incentives to look like. A common answer from businesses was the participation in the Aotearoa bike challenge in February and Biketober. Both of which act as an incentive to encourage more people to partake in cycling as a mode of transport. Around these events businesses have further incentivised people to participate. One interview participant stated *"[Name redacted] will always help put forward go by bike breakfasts, or bring speakers in, or provide sponsorship for the likes of the Aotearoa bike challenge those kinds of things really help incentivise people to ride their bikes, a bit of internal competition in the likes as well."* Regarding incentivising the bike challenges, another participant stated *"Normally around the bike challenge we sign up to that and there's incentives like prizes for the person who bikes the most, and we have a lunch off site where it's encouraged that people will bike there. Go from our office then go around Hagley Park. We get food delivered to the other side of the park, so people have to bike to get there."*

Other non-conventional incentives offered by business included the location of the building with a few businesses identifying that when looking for a new building moving back into the CBD, the proximity of the building location to the bus interchange and cycleways was an incredibly important factor to consider. Following building location, businesses identified that the facilities they offer can be seen as incentives for employees. For example, one interview participant stated that *"We were using the cycling [parking] at the car park opposite [the office] but that shows to be a massive problem for bike theft even though it's monitored by the Council"* by then going on to provide secure facilities, people are more likely to utilise them.

Another incentive identified by Christchurch based businesses was the Christchurch City Council travel planners. The planners ran sessions for businesses in which they helped people to plan their journeys via bus or bike. Employees were then entitled to different incentives such as:

- Pre-loaded metro cards ($20 if living in Zone 1, and $40 if living in Selwyn and the Waimakariri districts)
- Metro card top ups if a card is already owned
- Bike bells

- Bike reflector strips for wheels
- Bike reflector bands for ankles

The planners also provided employees with a range of maps detailing cycling routes and bus routes. The value of these resources is highlighted by businesses who have used this information provided by Council to form welcome packs for their staff members who joined after the Council sessions occurred.

The form of incentive that very few businesses offered was a direct financial incentive. Explicit reasons for businesses not providing this sort of incentive were not provided but the size of the business could be a contributing factor. One of the businesses interviewed offers employees $5 a day to cycle to and from work with the incentive going to $10 a day if the employee cycles more than half the days that they're in the office. The incentive is then paid to the employees at the end of each year. With a team of 5 and 3 people making the most of the incentive, it is a financially feasible incentive for the business to offer.

4.1.5 What was the uptake like of incentives? What was the feedback like surrounding the incentives/facilities?

The results for these two interview questions have been merged together as the responses to both questions were very similar. The majority of businesses that provide internal bike storage reported that employees actively have been asking for the amount of bike storage offered to be increased as the cages are often full and do not provide room for the larger models of bikes such as e-bikes. Following the demand for more space to store bikes, many of the businesses interviewed are currently figuring out how more storage for bikes can be put in place, and how e-bike and e-scooter chargers can be placed in bike cages without causing a tripping hazard.

The other key result recorded from these questions is the impact that more active and sustainable modes of transport have had on people's mental and physical health recordings. One business gave the example of how one of the employees had back issues and the active routine of cycling to work every day helped to ease these issues. The employee then used the financial incentive offered to purchase an e-bike to make his journey easier. The same

company who offers this financial incentive reflects on the success of the scheme by stating that *"when we had people earning 60-80k I think $10 a day sounds pretty good to those people but if you're earning 100k+ maybe it's less of an incentive. But from what I gather, it's also about family. Like when you have children and have to take them places. The car is the easier option".*

The incentives offered received a majority of positive feedback however there were a few critiques made about the incentives. The first critique questions the usefulness of services offered by Christchurch City Council travel planners with an interview participant stating that *"I respect what they're doing, and it might be helpful to other people, but it wasn't helpful to me because everything they showed me, I could've found online."* The resources in reference here are maps that are handed out showing bus routes and cycle ways. Another critique addresses the functionality and design of the lockers available for use. This concerns the lockers not being large enough to hang up a shirt and that in this particular business not everyone has a locker to use. The final critique raised is more in the form of a question with the participant questioning *"How do you start quantifying use and effectiveness with the WFH environment?"* The participant expressed how complex it is justifying the expense of incentives when working from home is increasingly more popular.

4.1.6 Was the offering of incentives/facilities something the business was obliged to do?

Offering incentives was not something any of the businesses were obliged to do. However, there were a few additional reasons why the businesses incorporated incentives. The reasons for providing incentives and facilities stemmed from ticking the right boxes for the brand, staff surveys acted as indicators that this was something that people wanted to see in the corporate space, and finally the incentives had stemmed from a leading by example case for certain businesses. As some of the businesses interviewed were from the public sector, they made the point to reinforce the idea that the provision of incentives is not something that they had the budget for.

4.1.7 Are incentives still offered? Has the usage of them changed over time?

The response for this question was a variation of incentives offered being either a one-off thing or incentives are consistently offered. In the cases where the incentives offered were a

one off, they were typically offered to promote an event such as car free day on the 22nd of September or because the business had asked for travel planning advice from Christchurch City Council's travel planning team. On the other hand, the businesses who have offered incentives continuously have noticed changes in the amount of people who utilise them. However, this is a mixed result from the organisations. In some cases, the number of individuals using the incentives was at a record low which businesses put down to a change in demographics of the company, or people's lifestyles have changed e.g., They have kids, they have a larger distance to travel, their financial situation has changed. In other cases, business reported that the number of people utilising the incentives is at an all-time record for the business.

4.1.8 How could businesses be more externally supported while offering incentives?

A wide range of answers were given when interview participants were asked this question and the majority of them centred around cycling and cyclist protection. In this theme of response suggestions included people being paid to ride bikes like the schemes in Europe, a Government match scheme where employee contributions are met, defensive cycling courses could be offered for free or a reduced price, old bikes could be fixed up to help people with a starting point, bike lanes needing to be separated from the road, and bike parking needs to be more secure and located next to key transport hubs such as bus interchanges and train stations.

The other category of response included financial programmes. Suggestions here included reimbursement of setup and bike equipment, gamifying peoples commute with financial rewards, subsidising e-bikes, and the fringe benefit tax (FBT) being removed from public transport ticketing. This form of response tended to follow the typical understanding of what an incentive is in a financial sense.

Results also called for official Government information addressing behaviour change needing to be updated. An interview participant commented *that "people go 'oh this is 10 years old and no one's doing it anymore' and yeah they're not doing it how they did 10 years ago you don't necessarily need to write a travel plan you just need to do these initiatives and a lot of them might be like technology based initiatives so rather than trying to go through individual*

organisations it might be that there's an app or something that can get to people commuting a lot easier." in regard to Waka Kotahi travel behaviour change documents and the lack of relevancy that the public sees in them as they are over 10 years old. So, updating the documents to provide more updated ways in which people can travel sustainably is likely to increase the number of people who engage with the information and resultantly change the way they travel.

4.1.9 Has the business moved since incentives were first offered?

Primarily the businesses introduced incentives as they were moving into the Christchurch CBD after the 2011 earthquakes. From here, only 2 of the businesses had relocated again as the business had expanded or leases had run out. A business interviewed that is not located in Christchurch noted that the company had not moved since introducing incentives, but they had opened new sites which offered different routes that people would be able to get to them.

4.1.10 What are the biggest barriers to people using more sustainable modes of transport?

The biggest barrier to people using sustainable modes of transport was the weather with Five businesses identifying this as a barrier that people face. The distance that people have to travel was also identified with the comment that someone cycling into the CBD from the Selwyn District was not feasible as it is too far to travel. Other barriers noted were people not feeling safe on the roads, the cost of travelling, not having the right gear, and people having others be dependent on them for journeys. Another point raised by an interview participant was that *"On the Public transport front, it doesn't have the reliability and speed it needs to be attractive to people, particularly on the shorter trips. It's no quicker than getting in a car sometimes"* identifying that speed and reliability can be huge deterrents of use to individuals on their journeys to and from work.

4.2 Christchurch City Council survey

In June 2021, CCC's TDM Team sent out a survey to the businesses that they had worked with to get an understanding of how people travel to and from work and whether the COVID-19 pandemic has impacted the way they travel. It is important to note that the researcher did not have full access to the CCC data, meaning that when participants selected 'other' as an

option for why they did not use certain modes, the answers that they expanded on were not available during the research due to the privacy restrictions around the data available.

4.2.1 Transport modes pre COVID-19 vs now

Out of the 1693 respondents, 24% of people stated that the way they travel to work has changed. Most modes saw an increase in people using them as can be seen in Figure 1. The mode that saw the largest increase in modal shift was walking, running, scooting, and skating with an increase of 37.3% of respondents.

4.2.2 Cars (Alone)

Using the car to travel to work as the sole occupant was the most popular mode of travel with 70.5% (N=1194) of survey participants using the car over the 6-month period before the survey period. Not only was the car the most popular mode of transport to travel to and from work, 32.3% (N=386) of participants used the car 5 or more times a week to travel to and from work. Figure 2 expresses the high percentage of people who use the car as a sole occupant for their travels 2 to 4 times a week and 5 or more times a week. The distinction appears to be that people either use the car for the majority of their travel per week or they do not actively engage with this mode frequently as 9.9% (N=118) and 16.3% (N=195) respectively will drive at least once a month or less than once a month.

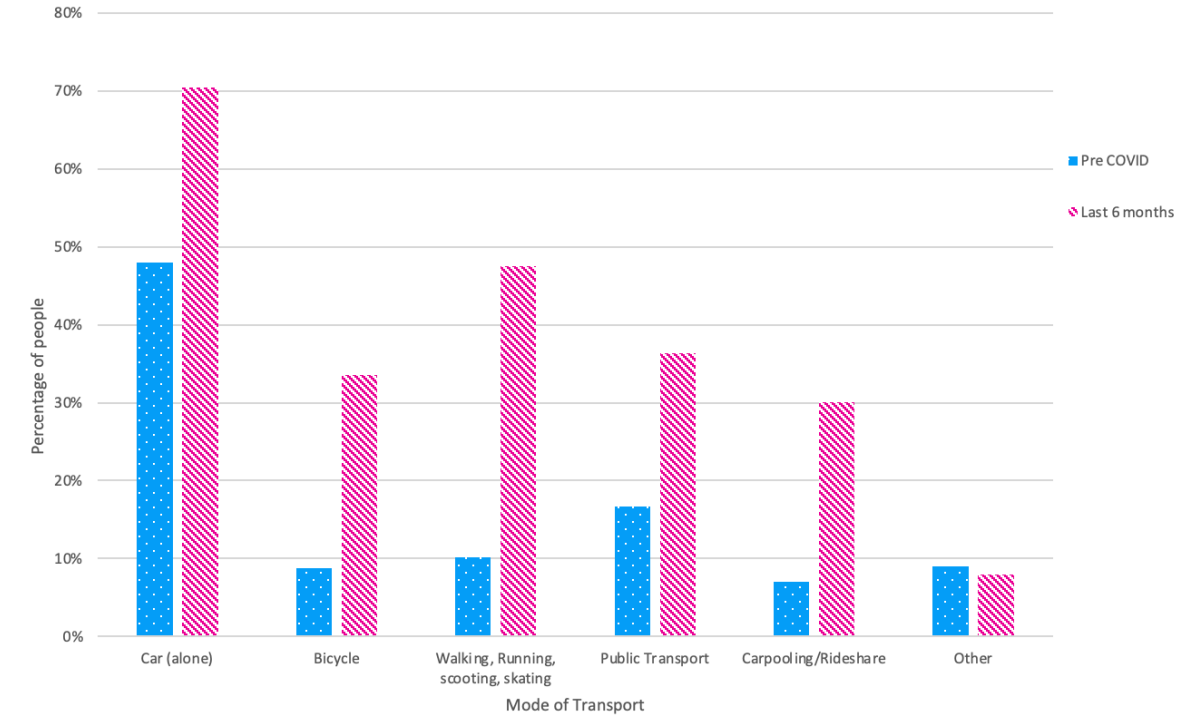

Figure 1: Comparison of modes of transport used pre-March 2020 vs 2021

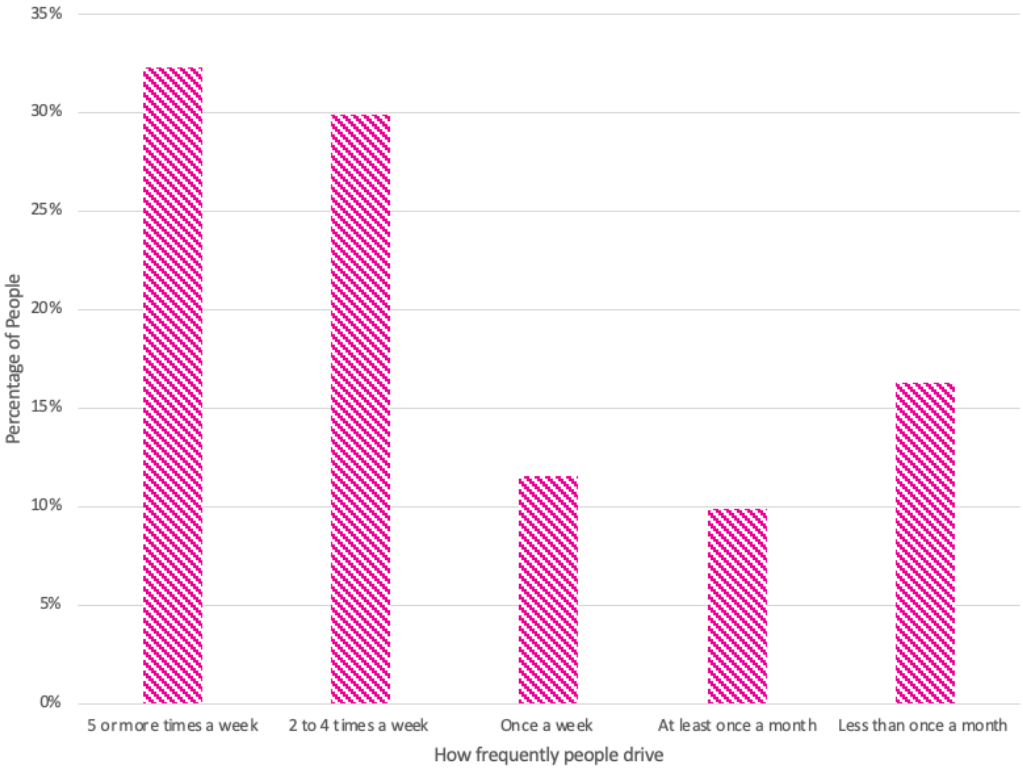

Figure 2: Frequency that people have travelled by car to work over a 6-month period

4.2.3 Bikes and e-bikes

Cycling to work had a total of 33.6% (N=569) people responding that they used a bicycle to complete their journeys. Participants were further asked if they travelled by e-bike and 74 people stated that they used as e-bike for all their cycling days and 19 responded that they only sometimes travelled by e-bike. As it stands from this data, the majority of cyclists still travel by manual bike. As can be seen in Figure 3, cycling is most popular for travelling to work 5 or more times a week or 2 to 4 times a week. 41.7% (N=237) of cyclists travel by bike 5 or more times a week and 40.4% (N=230) travel by bike 2 to 4 times a week. The number of people who use a bike to travel to work once a week, at least once a month, and less than once a month significantly decreases.

The 63.6% of participants who answered that they do not cycle to work were asked what the main deterrents to them travelling to work by bicycle. Participants were able to select as many options from the 9 categories provided that were relevant to them as to why they do not bike to work. As can be seen in Figure 4, the most popular answer was that cycling is not convenient or I travel too far which included 31.1% (N=521) of answers. The least popular given reason that deterred people from cycling was that people's final destination did not have showers or changing rooms available which equated to 1.1% (N=19) of responses.

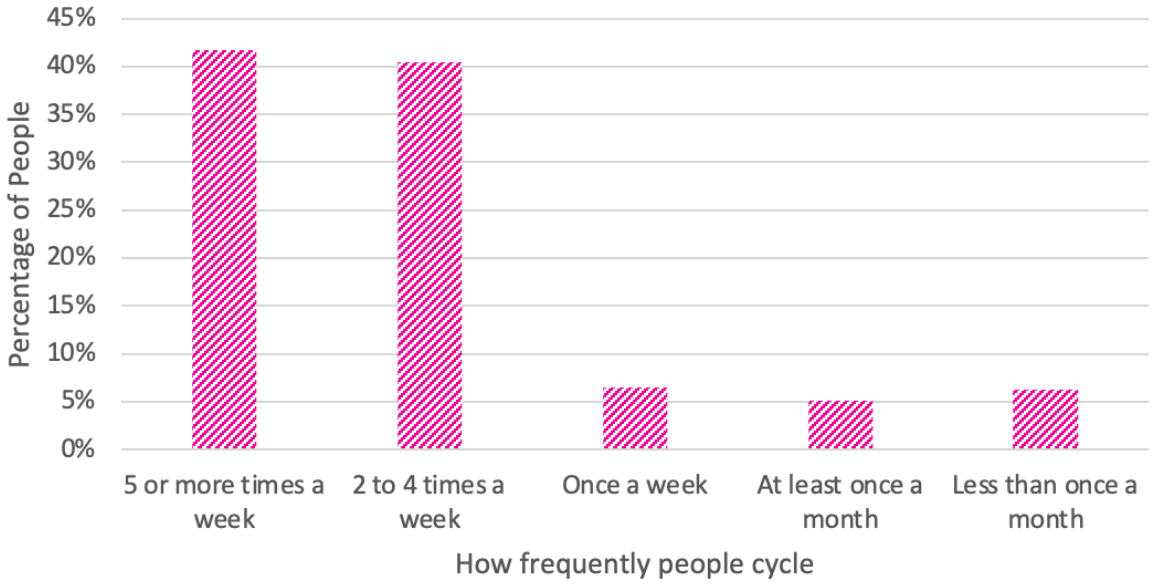

Figure 3: Frequency that people have cycles to work over a 6-month period in 2021

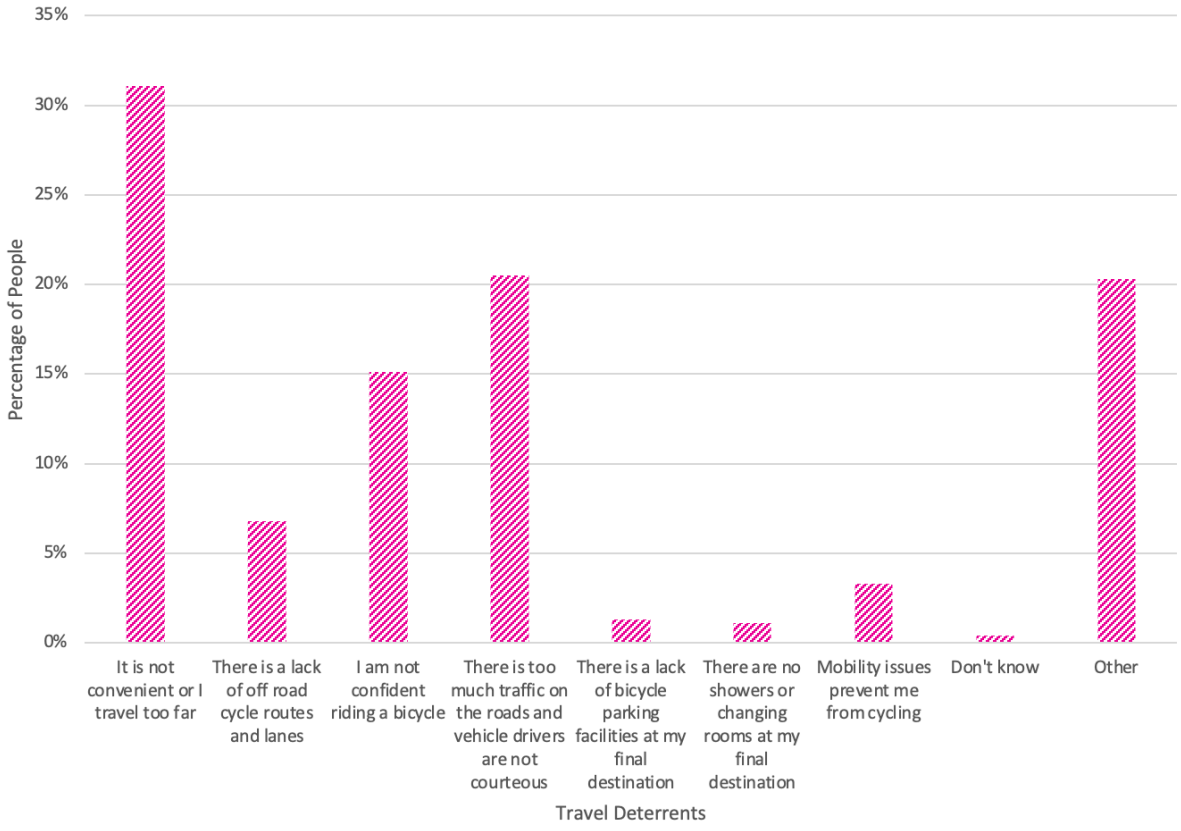

Figure 4: Factors that deterred people from cycling to travel to and from work

4.2.4 Walking, running, and scooting

Walking, running, and scooting to work was the second most popular mode of travel to work with 47.4% (N=804) of participants using one of these modes. As seen in Figure 5, People who walked, ran, or scooted to work often travelled this way 5 or more times a week making up 29.9% (N=165) of responses. The least popular option for this mode was using it once a week with 10.1% (N=52) of respondents using the modes this way.

When people who do not utilise this mode of transport were asked the deterrents preventing them from walking, running, or scooting to work, the most common answer was that the distance I travel is too great with 38.9% (N=786) of responses indicating this to be the primary factor deterring them as can be seen in Figure 6. The lowest response with explicit reason is that there are no showers or changing facilities at my final destination with 0.4% (N=8) of respondents noting this as a deterrent to them. Participants were able to select as many options from the 9 categories provided that were relevant to them and why they do not walk, run, or scoot to work.

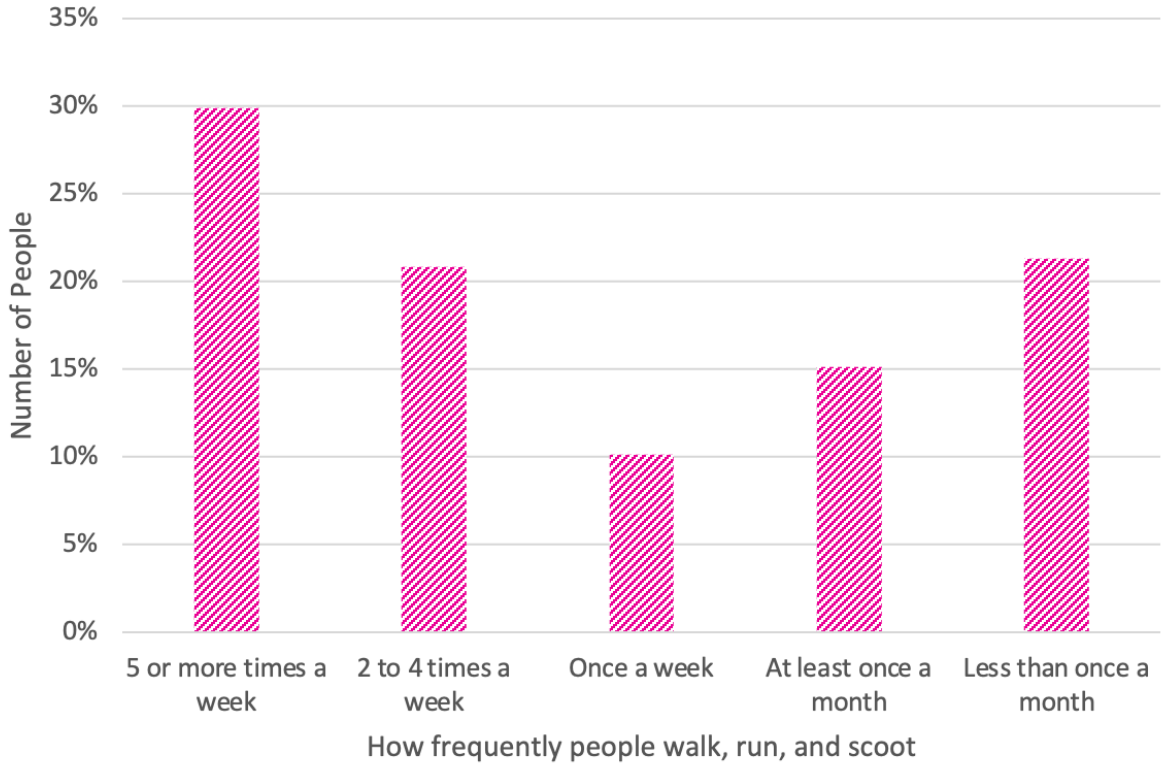

Figure 5: Frequency that people have walked, run, or scooted to work over a 6-month period in 2021

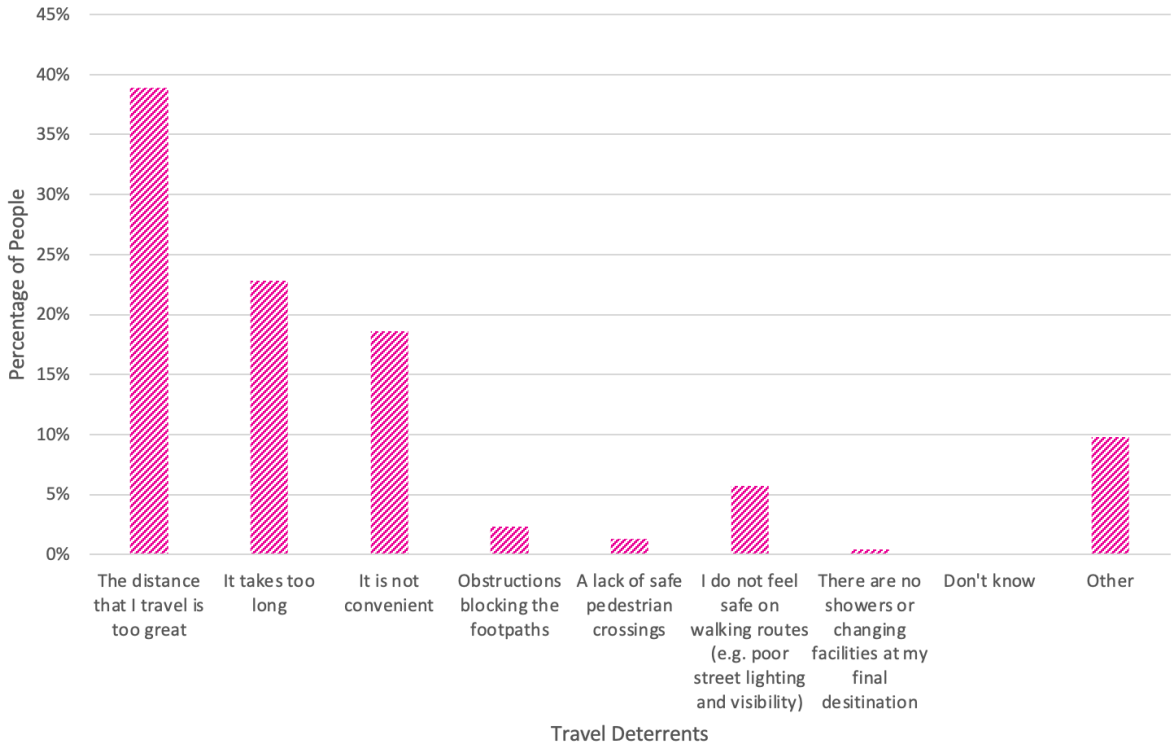

Figure 6: Factors that deterred people from walking, running, or scooting to and from work

4.2.5 Public Transport

36.4% (N=617) of survey responders indicated that they used public transport to travel to work in the 6 months leading up to the survey period. As can be seen in Figure 7, the frequency in which people travelled by public transport is slightly more varied than other modes. The response with the highest frequency that people used public transport to commute to work was less than once a month with 30.5% (N=188) of respondents identifying this to be the how often they utilised public transport. The least popular amount that people used public transport was once a week with 8.6% (N=53) respondents identifying this to be how often they used public transport.

The 59.9% of respondents who do not use public transport were asked what factors deterred them from using public transport. Participants were able to select as many options from the 9 categories provided that were relevant to them as to why they do not use public transport to travel to work. As can be seen in Figure 8, there is quite a variation in the reasons why people do not use public transport. The most popular response being other with 21.2% (N=382) of respondents identifying that the available options were not the reason why they don't use public transport to travel to work. This response is closely followed by people identifying that routes and connections offered by the public transport provider are not direct enough. 19.6% (N=353) of respondents put this as a reason to why they do not use public transport. This could be down to the transport stop at either end of their journey not being in a convenient location to them or that the routes available where they live do not take them to where they need to go. The least popular response was Don't know with 1.2% (N=25) respondents identifying this as a deterrent to them. The next lowest deterrent was people admitting that it is hard to access information about public transport. This response made up 3.3% (N=55) of responses that deterred people from using public transport. With consistent negotiations around the cost of public transport, it was interesting to see that 11.9% (N= 215) of respondents identified public transport as being too expensive.

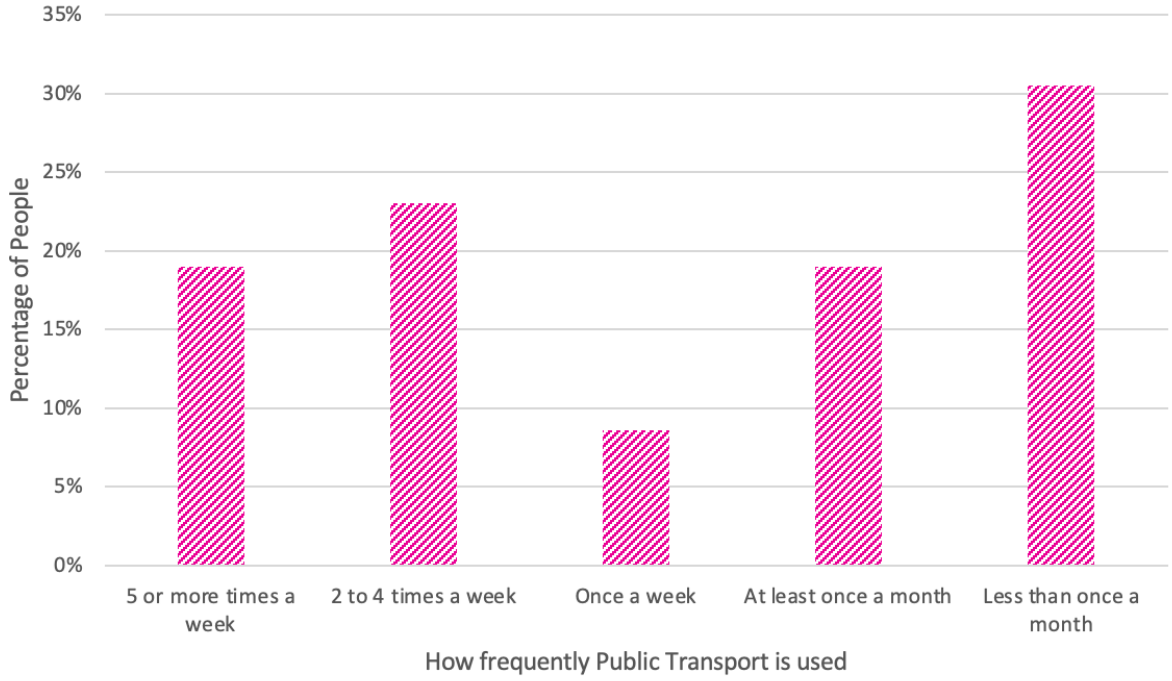

Figure 7: Frequency that people have travelled by Public Transport to work over a 6-month period in 2021

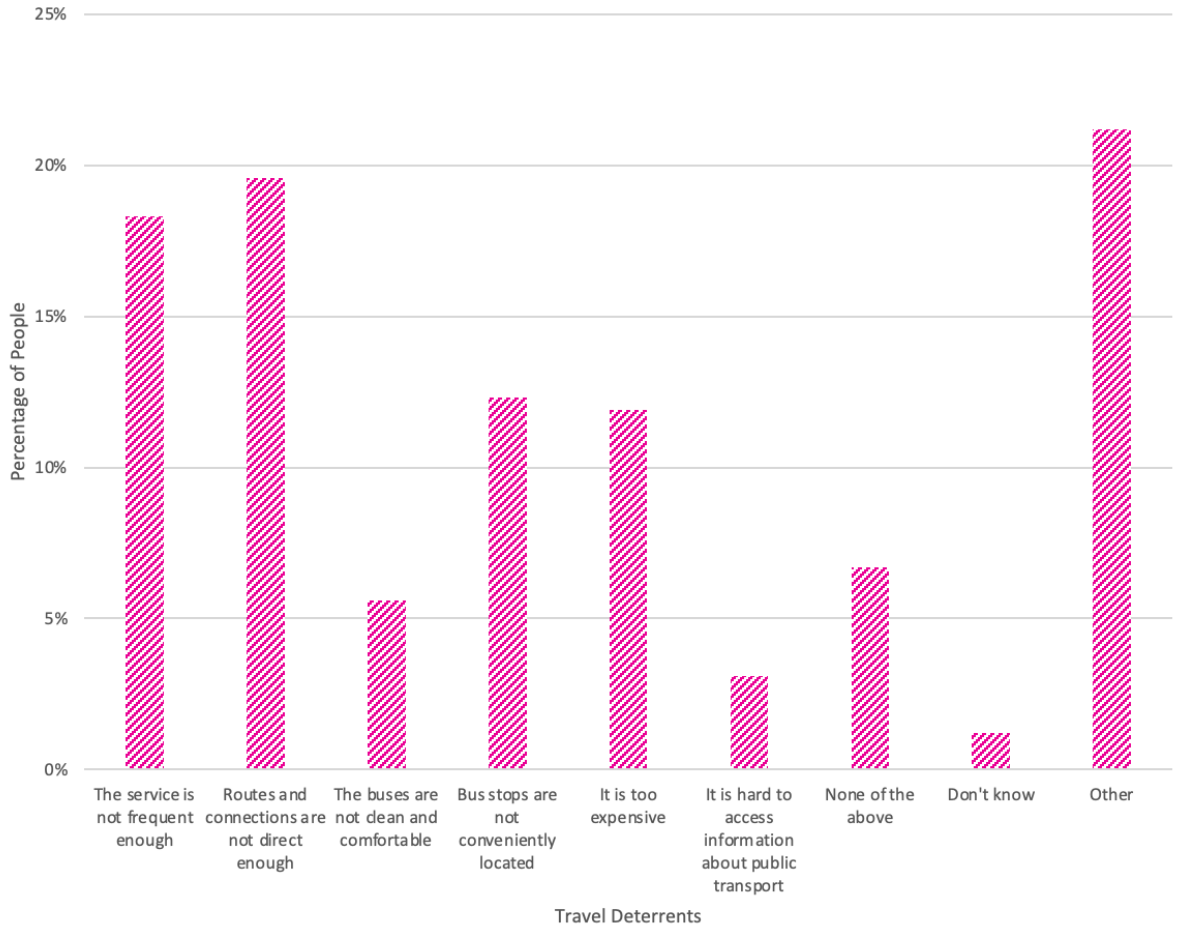

Figure 8: Factors that deterred people from using Public Transport to travel to and from work

4.2.6 Carpool and Rideshares

30.1% (N=510) of respondents used carpooling or rideshares to get to and from work. As can be seen in Figure 9, carpooling and ridesharing is not a regular way that people travel with less than once a month (28.8% (N=147)) identifying that this is how often they carpool or rideshare to get to work. This is closely followed by the amount of people who carpool and rideshare 2 to 4 times a week which is 26.9% (N=137). The least common response was people carpooling and ridesharing once a week. This made up 12% (N=61) of responses.

The 1119 people who answered that they did not carpool or rideshare were asked what deterred them from this mode of transport and the responses can be seen in Figure 10. The most common deterrent was that people find carpooling and rideshares not convenient to them with 23.4% (N=447) listing this as a deterrent. The deterrent with the least number of responses was that people have had bad experience in the past. 0.6% (N=12) of responses included this answer. The second response with least number of results was people stating that they don't feel that it is safe. 1.5% (N=29) respondents recorded this as being a deterrent.

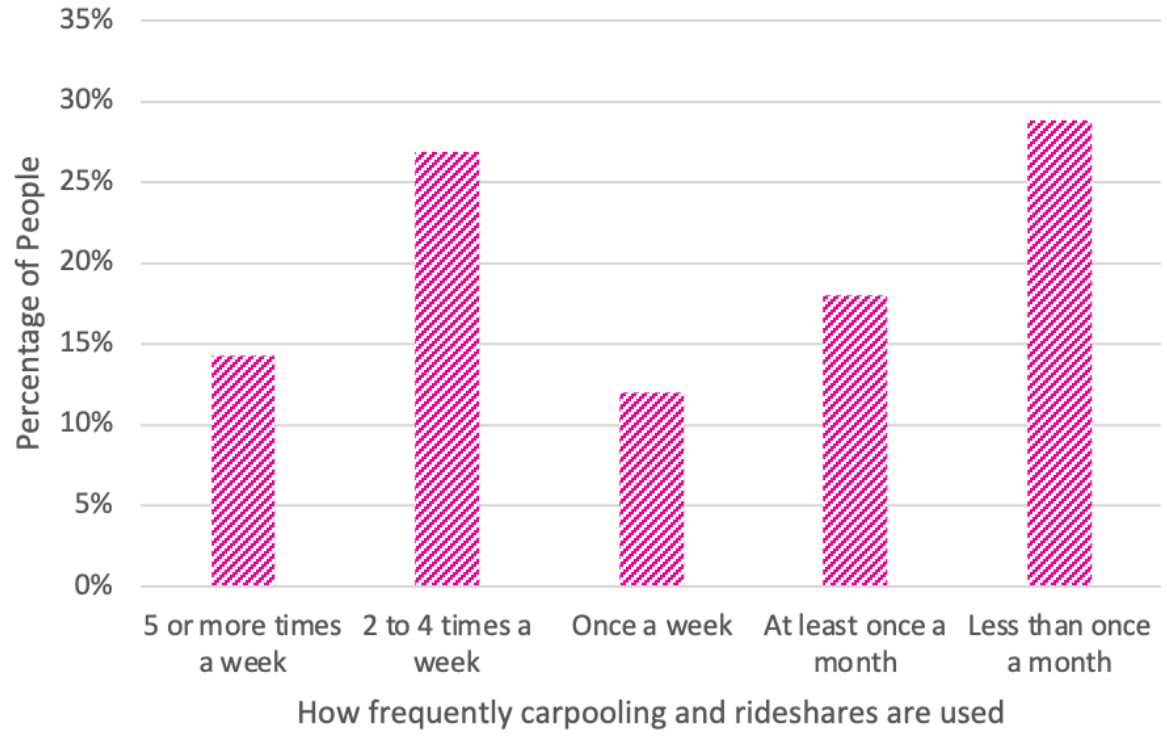

Figure 9: Frequency that people have travelled by carpooling or rideshares to work over a 6-month period in 2021

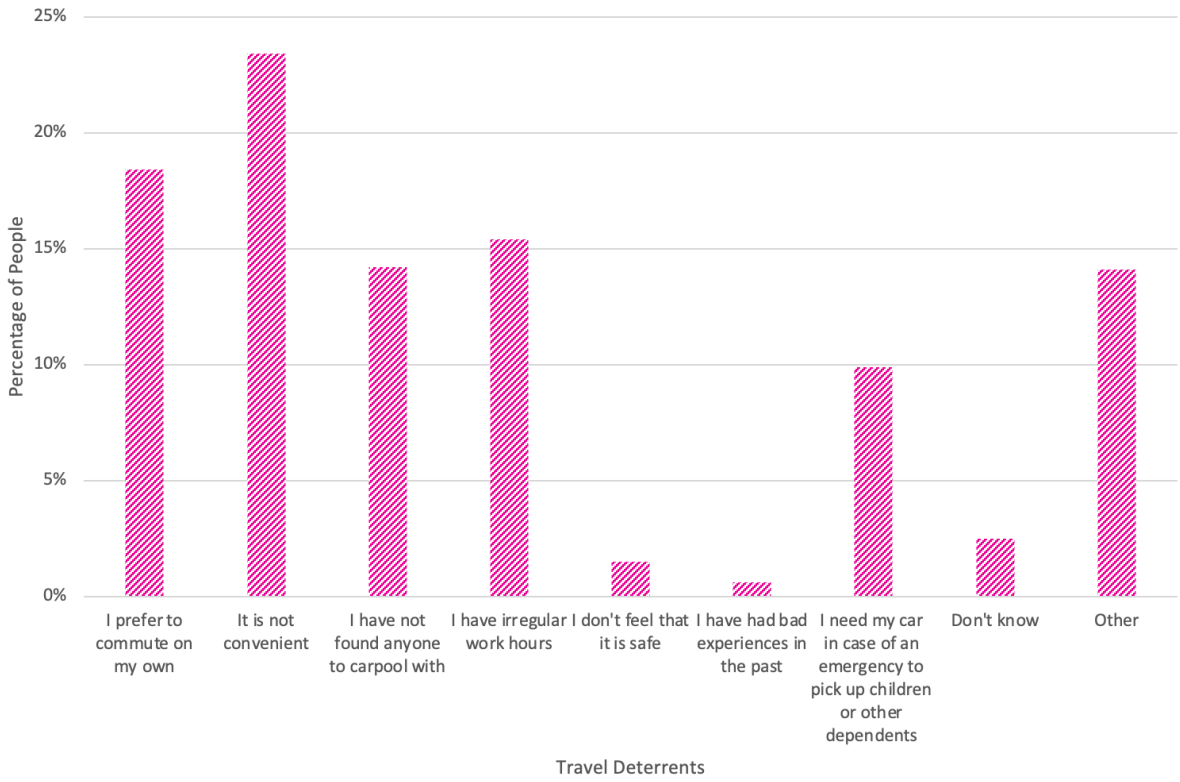

Figure 10: Factors that deterred people from carpooling or ridesharing to travel to and from work

5 Discussion

5.1 What incentives are used globally?

As evident from section 2.3, there are a variety of incentives offered globally that promote the use of sustainable transport to individuals. It is important to note that the international case studies examined in the literature review are all Government and state-based incentive schemes which is not on the same scale of potential options that for example, small businesses do not have. The purpose of analysing international incentives has been to gain an understanding of how larger scale incentive schemes operate. Each incentive offered comes with benefits but often are not without critiques from individuals who are not open to the concept of modal shift. The form of incentive provided varies but the most common genre of incentives used appears to be financial incentives. The sort of offering that can be included in the financial incentives genre can be subsidies, discounts, tax exemptions, and project financing programs (Camargo-Díaz et al., 2022). The financial incentives that are offered globally act as a push to encourage people to travel in more sustainable ways and in ways that can improve their health and wellbeing. What was found by studies that explored the impact of financial incentives on transport was not surprising. Through the provision of free bikes, money to ride, subsidised/free PT, people are more likely to use these modes over their car as it is the cheaper option and in cases people are being paid to use other modes. On the flip side with financial disincentives becoming more prominent through the introduction of road tolls and congestion charges, people were shown to change their modes however as there was still financial gain in some schemes, an increase in driving was experienced (Martin et al., 2012; Paulley et al., 2006).

The provision of subsidised and even free PT is a concept that is becoming more widespread across the globe in the push for more sustainable travel. When a country provides free PT, this tends to be on a city by city/state by state basis with each Council/Government department overseeing the PT available. The entire PT network is often not free with only particular modes having this incentive tied to them, or the free/subsidised PT operates on a zone-based system with certain zones being free to travel in. An example of how free PT can be offered is seen in Switzerland in the cities of Geneva, Lausanne, Basel, and Bern. Tourists visiting these cities who have paid the tourist tax are given a free transport pass which allows them to make use of the PT available without any additional costs (Geneva.info, 2022; This is

Basel, n.d.; Bern, 2022; Schweiz Tourismus, 2022). On the other hand, some countries provide free travel for those who are disabled and for those within certain age brackets. In Wales, people over the age of 60 are able to apply for a concessionary card which gives them free access to buses and rail travel; those with disabilities are also eligible to apply for a similar concessionary card (Transport for Wales, 2022). In New Zealand the equivalent of these schemes would be likened to the Gold card which allows users over the age of 65 to travel for free during off peak hours.

Other incentives exist globally that encourage people to travel in more sustainable ways. However, the majority of the available literature and online media focuses on the financial incentives. The incentives seen overseas have shown to be impactful on people's travel behaviour because they provide people with something to gain from using the PT available. What can be deduced from this is that individuals operate on a rewards-based mentality which is what financial incentives offer.

5.2 Who are different types of incentives likely to impact?

New Zealand is a highly diverse and multi-cultural society that is home to 5,124,100 individuals (Stats NZ, 2022). What having a highly diverse population means is that incentives offered cannot be in a one size fits all format as different people have different needs that they require to be met when completing their journeys. What needs to be recognised when beginning to think about offering incentives schemes is that they can be discriminatory to certain groups of people. A financial incentive such as the pay to ride schemes that are popular in Europe would be an ideal incentive to offer in New Zealand, but the incentive can completely discriminate against certain groups of people. A pay to ride scheme would discriminate against some of New Zealand's disabled community who may be unable to cycle, and then against those New Zealanders who do not own a bike, cannot afford a bike, and those who do not know how to ride a bike. In the case of planning for cycling infrastructure, studies in the United Kingdom (Inckle, 2020; Clayton et al., 2017) draw the conclusions that the cycling infrastructure available often ignores the demands of the disabled community. What can be learnt from this is if New Zealand wanted to introduce financial schemes, the disabled community would need to be further engaged in all steps of planning and development to ensure that they are not excluded from the incentives. What then needs to

be considered with financial incentives is the impact that they will have on people who are in lower socio-economic positions. Whist there is little research surrounding incentives, financial status, and transport options that currently exist, we can draw from studies that look at financial incentives and socio-economic status in relation to stop smoking campaigns. What these studies have found is that people who have lower socio-economic status do not benefit as greatly from financial incentives (Pisinger et al., 2022). What can be taken from this study is that a financial incentive does not provide enough motivation for people in the lower socio-economic bracket to change their behaviour.

Whilst this research drew the conclusion that cost is not a large deterrent to the way that people travel and towards the uptake of PT, it contradicts the finding of Ferguson et al. (2021) whose research determined that cost was one of the largest factors influencing PT uptake. Financial incentives impact people differently; from one of the interviews the participant identified that in their experience the more an individual is earning, the less a financial incentive means to them, so they are more likely to disregard the incentive available. However, it needs to be considered that for those in lower socio-economic positions they may be working multiple jobs in various areas at unconventional times, so the most efficient way for them to travel is by private vehicle. The potential that financial incentives will primarily benefit those in already well-off financial situations is reasonably high as they are the people who primarily work more normalised 9-5 jobs who can make use of PT and other infrastructure more safely (OECD, 2005). So, the framework for financial incentives to work effectively in a community is one that is flawed depending on the way you look at it. It can enhance the divide between those who are well off and those who live pay check to pay check. For people who cannot afford to use the mode that is being incentivised, they are put at more of a disadvantage as they are not able to reap the benefit of the incentives offered.

What can be deduced from this, is that incentives will impact different groups of people in different ways regardless of the amount of planning, consultation, and consideration that goes into implementing incentive schemes. There is no one size fits all scheme that will accommodate to people in different situations whether that be locationally, physically, or financially. What needs to be considered whilst planning any potential transit related incentives is that a) no group of people is excluded from being eligible for the incentive, b)

the incentives offered will not deprive people in other areas of their lives, and c) how does the incentive factor in for those whose situations change? What ideally would be offered for incentivising sustainable transport is a tiered incentives approach which considers the distance an individual travels to work, socio-economic status, and whether they are part of New Zealand's disabled community. Once these factors have been considered, the appropriate incentive could then be offered to the individual.

5.3 What micro-incentives are appropriate for use in New Zealand?

In New Zealand, since March 2022 PT including busses, trains, Total Mobility, and some ferry services have been subsidised to half price to help New Zealanders get through the global energy crisis (Wood, 2022a). The subsided PT package has been extended through to March 2023 to continue to help New Zealanders move in their day-to-day activities (Waka Kotahi NZ Transport Agency, 2022a). In a poll produced by 1 News, 79% of respondents supported the idea of half price PT fares being made permanent for New Zealand (1 News, 2022). What this is evident of is the effectiveness of subsidised or even free PT. Evidently, people who are regular users of these modes have spoken and see this level of subsidy as an effective encouragement to continue using the PT networks in New Zealand. The incentive has not solely been impactful for people who already use PT, but for people who are not regular users. Whilst PT usership is still less than its pre-COVID levels, there has been a 7% increase in journeys taken by PT with the increase coming from car/taxi users, cyclists, and walkers (Waka Kotahi New Zealand Transport Agency, 2022b). Whilst there is the support from the public about the half price bus fares, the feasibility of half price bus fares in the long run is a topic for debate. With the original 3 months of the subsidy costing the country between $25 million and $40 million (Scotcher, 2022), the question remains, is this something the country can maintain and something that the Government wants to prioritise? Whilst the PT subsidy is something that appears to be beneficial at a surface level glance, consideration must be given to whether subsidising PT is the best way to encourage more people to make use of it. Based off the interviews conducted for this research and the CCC survey analysis, cost was not one of the key factors that deterred people from using PT, concerns were primarily made about the reliability and directness of the PT available.

In terms of micro-incentives that are suitable for application in New Zealand, something like the pay to ride schemes seen in Europe would at first glance be seen as appropriate as people would be offered a small financial reward per kilometre that they cycle. However, this incentive is faced with the limitations of how this can be made equitable so everyone can benefit from it. By only providing people who are physically able to with an incentive to cycle and get paid, a diverse group of mobility impaired individuals are excluded from this scheme. The issue with the provision of micro-incentives to induce modal shift in New Zealand is the country is so diverse with different groups of people having different needs for their journey's to and from work. As discussed in section 5.2 different incentives can be discriminatory and will impact and enable different groups of people and some incentives may hinder people further in their journeys.

One of the largest issues New Zealand is faced with is that the country's city planning has been designed largely around the use of private vehicles without the appropriate consideration for cyclists, walkers, and PT use. While the New Zealand Government has declared the country's goal to be carbon neutral by 2050, the prioritisation of this goal appears to be set with private vehicles. Through the 2021 announcement of a Clean Car Discount, it will be cheaper for New Zealanders to purchase EV's or plug in hybrid vehicles, with high CO_2 vehicles being charged a fee (Ministry of Transport, 2021). Understandably the promotion of EV's directs people away from CO_2 output but leaves people with the problem of what to do with the Lithium battery that runs the car when they die and additionally does not help to solve any of the problems caused by general car traffic such as congestion. The main materials used in the batteries that power EVs present the world with supply and environmental risks as the extraction rate of these elements will need to increase to keep up with the global demand (Pelissier, 2022). So, then consideration needs to be made if the promotion of EV's is the direction that New Zealand wants to take. Although EV's provide an immediate response to CO_2 emissions, further consideration needs to be given to what New Zealand will do with the batteries for EV's when they reach the end of their life expectancy. Without proper consideration for how the batteries will be disposed of or recycled, increased risk of ecosystem pollution and human toxicity will be present.

As outlined in section 5.2, there is no one size fits all approach that is appropriate to use that will not discriminate against a group of people. Consideration at both national and local Government levels needs to be made about incentivising sustainable transport to ensure that the diverse communities and individuals are considered for.

However, drawing from the interviews, a financial incentive alone is not going to encourage modal shift permanently amongst individuals. An incentive provided needs to be something consistently offered and not for a short time only. Understandably trial periods may be needed to refine the incentives provided, but the more short-lived an incentive, the less permanent an individual's behaviour change will be. With habits taking a minimum to 2 months to form (Clear, 2014), the longer an incentive is offered the more effective it is likely to help an individual alter the way they travel. As many interview participants commented, it is not the incentives alone that will encourage someone to change the way they travel. It is the end of journey facilities that are available such as showers, lockers, and secure bike stands. Without any end of trip facilities, an individual may be discouraged from using a more active way of travelling as there is nowhere to store their equipment or freshen up afterwards. The importance of end of journey facilities is something that needs to be considered and many businesses see these facilities as incentives for employees. So, by enhancing the end of journey facilities that are available, more people are likely to utilise them. This is potentially the direction that New Zealand needs to take at the moment. The facilities in place need to make people feel safe and that their property is secure. Once the facilities are enhanced, people will use them, as evident through interview participants referencing the extent to which bike sheds are full.

5.4 Physical activity and health benefits

As mentioned in the interviews and indicated by the number of survey participants using active transport for their commute, the impact that active travel can have on an individual is significant. Links between health and the level of physical activity people partake is not a new concept that has been discovered in the 21st century. One of the studies that has helped to shape the scientific link between health and the level of activity people partake in was a 1958 study by Morris and Crawford. The study explored how London bus drivers were more likely to suffer from coronary heart disease than those in more physically demanding positions. The

study here provides an example of the importance of physical activity for one's health and wellbeing and provides evidence that regardless of the level of physical activity your job entails, additional physical activity is needed to ensure that the individual meets the appropriate level of physical activity for their age, gender, and lifestyle.

A significant point mentioned by participants in the interviews was that physical activity can improve an individual's mental health and wellbeing which can increase their productivity and efficiency in the workplace. By having employees working at peak efficiency, sustainable transport is a valuable avenue for employers to pursue in terms of incentives. For individuals who experience mental health disorders such as anxiety and depression, physical activity can provide an outlet for individuals to increase their endorphin and dopamine levels (Preiato, 2022). The level of impact that physical activity can have on an individual's wellbeing is a case-by-case matter. For example, physical activity is proven to be as effective as other therapeutic methods used for people with mild to moderate clinical depression and non-clinical depression (Paluska & Schwenk, 2000; North et al., 1990; Shephard, 1995). Through a 1988 study analysing the NHANES I epidemiologic survey, the conclusion was reached that little to no physical activity were associated with increased risk of depression in females and males (Farmer et al., 1988). On the anxiety front, the impact that physical activity had on an individual's anxiety levels is highly dependent on the sort of anxiety that an individual has. Those with panic disorders were more likely to experience increased anxiety scores after physical exercise (Rief & Hermanutz, 1996). What these studies are evident of is that physical activity can have a significant impact on an individual's mental health with a majority of the time this impact being incredibly positive. What should be noted is that physical activity does not solely impact mental health and wellbeing. In the office environment sedentary living styles can double the risk of mortality from coronary heart disease, strokes, and obesity, which can then have flow on effects to increase the risk of an individual being diagnosed with diabetes and various forms of cancer (Fox, 1999). What physical activity does for mental health and general health and wellbeing is improve how the body functions and provides the body with the hormones necessary to function.

Physical activity can have an impact on an individual's cognitive functions and memory recollection which is something businesses value. What physical activity achieves here is

enhancing the functional aspects of high order regions of the brain which are impacted by brain tissue loss during an individual's lifetime. Individuals who frequently exercise are able to better process information and increased cognitive strategies in performance outcomes (Gomez-Pinilla & Hillman, 2013). A study conducted by Wang et al. (2014) analysed the cognitive benefits of aerobic fitness in young adults. The key finding from this study was that the individuals who had higher levels of aerobic exercise had faster reaction times and their modulation of oscillatory theta power, which is associated with memory, was better than those with low levels of fitness. The specific association with memory surrounds recollection and cognitive contrasts (Herweg et al., 2020).

How this links to this study is through business owners stating that healthier employees are more effective in completing and undertaking tasks. Through businesses promoting sustainable travel to employees, the business is not going to be the only beneficiary of sustainable transport. Employees will benefit through increased health on the physical and mental fronts and improved cognitive abilities.

5.5 Fringe Benefit Tax

The FBT is a tax employers must pay when they provide staff with benefits such as motor vehicles, low interest loans, free, subsidised, or discounted goods and services (Inland Revenue, 2022a). In the case of PT, if a business provided their employees with a set amount of money to cover PT costs, the company may have to pay FBT on the benefit they provide to the employees as the money has not been previously taxed. For example, if the company provides an employee with a month-long bus pass, the company will have to pay FBT on each pass given out to employees. In the Fringe Benefit Tax guide published by Inland Revenue (2022b) a specific example is given that if a company provides a service to an employee at less than what the general public would pay, it is considered a fringe benefit so the business will be taxed for covering this expense. The level of tax that a company pays can be dependent on the income that an employee makes. If an employee makes up to $160,000 annually the company will be taxed 49.25% on any additional contributions, they make. If an employee earns in excess of $160,000 annually the company is taxed 63.93% on additional contributions they make to the employee (Inland Revenue, 2021).

In New Zealand businesses who provide carparks for employees are exempt from paying FBT on them as long as the carparks are located on company property (Inland Revenue, 2022b). The key issue that has been raised with this by businesses who are striving to promote sustainable travel is that by incentivising businesses to have car parks on site, employees will utilise these in preference to other modes of travel (O'Callahan, 2019). Where the argument comes in is that if a business does not have to pay FBT on company property carparks then they should not have to pay FBT on sustainable travel incentives. If FBT was removed from PT incentives offered by businesses, providing employees with a set amount of money to use to pay for PT could be a feasible incentive that businesses could provide. What removing FBT from PT passes would do is level the economic playing field that FBT impacts and would support the use of sustainable travel modes (Genter, n.d.).

A Regulatory Impact Statement (RIS) submitted in 2022 defined the problem as *"current FBT rules may encourage employers to choose providing their employees with private car parks on their premises over providing them with public transport fringe benefits, thereby creating a bias towards less environmentally friendly modes of transport"* (Robertson & Parker, 2022, pg.5). The RIS submitted by Robertson and Parker in May 2022 had the primary focus being to enhance neutrality of the tax system and improving the environmental bias that exists with the way the tax system is set out. In the Taxation (Annual Rates for 2022-23, Platform Economy, and Remedial Matters) Bill (No 2) section CX 9 has been amended to provide that subsidised PT is not a fringe benefit (Parliamentary Counsel Office, 2022). The amendment to the Bill is business friendly as it removes the compliance cost for the business, hoping to create an incentive for business to support employees travelling in sustainable ways (Parker, 2022). To help improve the tax bias towards environmentally sustainable travel to and from work, multiple steps could be taken. The first step that could be taken is to remove the FBT that comes with businesses providing their employees with the means to travel to work more sustainably. The following step that should be taken to help minimise this bias is to introduce FBT for carparks located on company premises. Through FBT being applied to company carparks, the number of carparks a business has could immensely reduce to cater for fleet cars only not employee cars. From the interviews it was acknowledged that many companies are introducing hybrid and fully electric vehicles to their company fleets to try offset pollution

levels and then removing all additional parking on premises to discourage people from driving.

5.6 Barriers to sustainable/active transport

What was found from the interviews and survey results is that there are many barriers and deterrents that prevent people from using more sustainable modes of transport. An individual is not limited to being impacted by one deterrent only, their mode of travel can be influenced by multiple factors. In certain cases, these deterrents are able to be overcome, however, for certain deterrents this is highly dependent on the individual and their openness to changes in their routine.

5.6.1 Safety

In the survey results many people identified safety related factors as things that deterred them from utilising certain modes of transport. Safety related factors included too much traffic, incorrect/insufficient facilities, obstructions, and feeling unsafe using the particular modes. The matters of safety when using transport can be very specific to the mode that is being considered. What a common misconception about PT is, is that the risk rate is a lot higher than what it actually is. The media will often highlight the cases in which high risk is involved and tragedy is an outcome of. Through only seeing the negative perception of PT, an individual can be more heavily influenced to assume the mode is more dangerous than a private vehicle or other modes. This mindset is not only applicable to PT as the media and personal experiences can heavily influence perception. What has been found through multiple studies in a variety of locations, is that PT passengers have significantly lower casualty rates than automobile occupants (Savage, 2013; Stimpson et al., 2014; Truong & Currie, 2019; Litman & Fitzroy, 2020; as cited in Litman, 2014). Despite the physical safety ratings of PT, people still have genuine safety concerns that act as deterrents to them using different modes of transport. What this identifies is that the transport infrastructure and systems operating have failed. If people do not feel safe using different modes of transport, then this is a significant let down from transport providers and Councils who maintain paths and infrastructure. What needs to be done is an overall improvement to the system to make modes feel safe so people will use them. If a mode feels safe to an individual from all aspects, then they are more likely to use it as that initial fear is no longer there.

5.6.2 Cost

Cost is another factor that was identified as being a deterrent from switching modes of transport. In New Zealand due to differing global events, the cost of petrol hit an all-time high in May 2022. With petrol prices being charged $3.15 per litre for 91, and $3.32 per litre for 95, the cost of running a private vehicle was so extreme that mode shift would have been expected (Tibshraeny, 2022). The cost of running a vehicle is not the only price factor that people need to consider when identifying how they will travel. Other cost related barriers can relate to bus fares, ensuring that the individual has the correct clothing for their chosen mode i.e., raincoat, windbreaker, helmet; and if cycling the individual needs to ensure that they have a bike that is in working condition. Whilst the cost of the mode itself acts as a deterrent to people, it is one of the deterrents that signifies the increasing gap between the socio-economic statuses in New Zealand. With cost of transport being a huge barrier to people, it identifies the growing need for a PT network that is well connected, and priced so that the country's lowest earners can afford it without sacrificing the majority of their pay. If a way was found so that transport could be made more affordable, then there would be an increase in people who use different modes.

5.6.3 Weather

If an individual is using a mode of transport which is highly exposed to the climatic conditions, the potential for them to be deterred from using their chosen mode is enhanced. Modes such as walking, running, scooting, and cycling are all incredibly exposed to the elements and the conditions that one faces can be highly influential in whether they decide to use their more active travel option that day. For example, if it is a rainy-day people may not feel comfortable being as exposed on their mode of transport, so a matter of safety also entwines with weather as a deterrent. On the other hand, an individual may not have the correct gear to use more exposed modes of transport in certain conditions. Weather conditions is a deterrent that was brought up frequently in the interviews and is a complex deterrent to incentivise people to overcome as it is not something that we have control over. What has been found is that walking and cycling frequency is negatively impacted by precipitation, and wind speed and direction (Ettema et al., 2017). What individuals in the interviews identified was that over the winter months where the weather is not as pleasant, bike locker usage significantly decreased and in summer months lockers reached full capacity and could not cater towards the number

of bikes that were used. The idea that weather acts as a travel deterrent is one that is not solely applicable to Christchurch with other studies drawing the conclusion that the cold, wind, and rain commonly deter people from using more active modes of travel (Winters et al., 2010; Motoaki & Daziano, 2015; Ahmed et al., 2017).

5.6.4 Reliability and speed

The largest factor deterring people from using PT as identified in both the interviews and the survey was the reliability and speed of the network. Reliability and speed are crucial aspects to one's commute as people want to ensure they will be where they need to be within a certain time frame but also do not want to spend an excessive amount of time one way on their commute. A contributing factor to PT reliability is the current driver shortage that exists across the whole of New Zealand. In Auckland alone there is a shortage of 500-600 drivers (Powell, 2022). What this shortage means is that the less popular transport routes have a higher chance of being cancelled as the need for them is not as great as the more popular routes, thus creating an issue of the reliability of PT. Interview participants commented on the fact that often using PT to travel to and from work took either the same amount of time as what a private vehicle would, or if the travel time was less it was not sufficient enough to endure mode change. An efficient PT network would not solely contribute towards more reliable and speedy journeys for individuals, it would help to deliver direct safety benefits of reducing the number of private vehicles on the road which would contribute to the Government's Road to Zero strategy (New Zealand Government, 2019). The key issues with reliability and speed of PT are that when insufficient, it has adverse effects on the individuals using the mode. The individual could be late to work, be absent from work, lack of concentration, and poor sleep quality which can result in increased anxiety levels surrounding what shouldn't be a stressful part of day to day living (Culotta et al., 2019).

5.6.5 COVID-19 and seasonal colds

In the current day and age with COVID-19 and other illnesses significantly impacting the way people travel, they can be referred to as a barrier to sustainable and active modes of transport. As evident through literature in section 2.2.3, the impact sees a significant decline in the amount of people utilising sustainable transport for their commute. The way in which COVID and other illnesses influence travel is reflected by the locations that society now sees

as key as a result of the COVID-19 pandemic. What is seen through this is the importance of travel within the residential areas and retail locations, the work from home ethic is no more prominent than it was pre-covid, so people aren't travelling as much (Conrow et al., 2021). Coming from a point of caution, people are more afraid to travel by PT due to the fear of getting sick.

5.7 Businesses without space

Whilst many businesses are in the fortunate position to be able to lease or purchase offices that are well equipped with various facilities that accommodate more sustainable ways of travelling, there are smaller businesses such as those in malls that do not have the ability to provide facilities for employees. And so, the question is raised how can modal shift be accommodated in these areas? What can be done to accommodate this is the provision of public changing places that include toilets, showers, and changing rooms. What these facilities provide is a place in which employees are able to use before or after their commute to freshen up. In England £30 million was announced by Government to facilitate the construction of 500 new changing places across the country (Wood, 2022b). Whilst the initiative caters towards providing a space suitable for the disabled who need help, the idea of introducing more widespread, high quality changing facilities in areas which are populous is one that could provide facilities for businesses without space. When constructing these facilities, they should be done so in a way which accommodates everyone, ensuring that the necessary space is provided for those of all abilities.

Changing facilities are not the only areas that need to be considered when providing for businesses without space. What needs to be considered is the availability of public cycle racks. In 2019, 832 bicycles were stolen from where they were parked (NZ Herald, 2019), highlighting the need for more secure bike racks in open places. What was identified in the interviews was that no one wanted to park their bikes in Council provided racks as the increase in bike theft was too high and Council had done nothing to improve security around the bikes. What can be further implemented here is the concept of passive surveillance. Passive surveillance refers to "*the environment in which people can see and can be seen through casual observation*" (Livingstone Shire Council, 2018). Passive surveillance is a concept used popularly in urban design to make spaces feel safer for people to be in at all

times. The way in which passive surveillance can be achieved is through maximising visibility with clear sight lines, effective lighting, active edges of developments, and elimination of entrapment spots (Livingstone Shire Council, 2018). The goal of passive surveillance is to deter offenders through the feeling that the “streets have eyes” meaning that they feel as if they are being watched. What the tricky component of passive surveillance is, is the application of it. In certain circumstances, crime deterrence has gone too far and creates a harsh environment which is not welcoming (Cozens, 2018). If passive surveillance is utilised correctly, people will feel more confident locking their bikes in Council installed racks and travelling in more active modes.

There is a multitude of ways in which individuals are deterred from utilising certain modes of transport. Through understanding the factors that deter people from using different modes of transport, consideration of how these deterrents may be overcome can be considered. Through understanding the root cause of the deterrent, individuals may be helped to overcome the factors that deter them from using alternate modes of transport.

6 Limitations

The research conducted is not without limitations that will have an influence on the overall outcomes of the project. Aside from timing constraints which are experienced in most research projects, the limitations of the research are primarily based around the methods and location of the study.

As one of the objectives of the research states, I wanted to produce a piece of writing that that would be applicable to Councils and central Government agencies across Aotearoa New Zealand to use as a guiding piece of literature to make informed decisions about the application and introduction of transport related incentives. Where the limitation for this comes in is that the majority of the data used from both the interviews and the survey is from Christchurch as this was the location that I was based in. What can be questioned here is the external validity of the research and how it can be applied to other cities in New Zealand. Whilst the specifics of the research and certain examples may not be applicable to all cities, the broader themes will be transferable to other cities. This is limitation of the research and needs to be considered if the findings are being applied to other cities due to the unique circumstances that are experienced by different cities.

The way in which participants were asked if they would like to participate in an interview is a further limitation of the research. As a majority of the people asked if they would like to participate in the interviews were contacts that CCC had already established, this immediately created a bias towards businesses located in Christchurch. This has resulted in the conclusions drawn from the interviews being less applicable to other areas of New Zealand as concerns and feedback come from one location rather than from multiple areas. A limitation linked to this one is that the people who participated in the interviews are more likely to be the people who are passionate about sustainability, cycling, and PT. By only interviewing a group of people with this mindset, the results are more limiting in the way that they do not provide a representation of people who have different outlooks on transport and sustainability.

In addition to this, a limitation was found with the questions that I asked interview participants. The questions were catered more towards businesses who provide their employees with travel incentives and did not fully cater towards businesses who do not

provide travel incentives for employees. If I were to conduct similar research again to expand on the findings of this research, it would be of use to have a set of questions for businesses who provide transport incentives and a separate set of questions for businesses who do not provide transport incentives. This would ensure that a more extensive analysis would have been able to take place that explores the effectiveness of transport incentives.

7 Further research

The research conducted has drawn the conclusion that there is room for further research around the topic of micro-incentives and the extent to which they influence modal shift. The first area in which there is room for further research is what micro-incentive means. From the interviews conducted, it was determined no one fully understands what a micro-incentive is, or that there are multiple understandings of what it means. Through discussing and formulating a definition of micro-incentives that is understood by everyone, the introduction of micro-incentives by a higher authority such as Government may be more understood as to why it is useful to provide them.

Another area in which there is room for further research is through the analysis of the half price PT fares that the New Zealand Government is offering. Literature suspects that these subsidised prices have encouraged more people to use PT and common response from the public is that they support these fares. Through analysis of the effectiveness of the subsidised prices, the changes in how people have travelled will be able to be seen. By finding out if the subsidised fares have had an impact on travel, the Government will be able to justify that this is a worthwhile expense to incorporate into the Budget for the next financial year.

A further point which would be beneficial in research and was going to be incorporated in this research if time permitted was a survey sent to businesses employees asking them their thoughts on different micro-incentives. By asking employees about the incentives they want to see, a business would be able to have a more targeted approach to the incentives that they provide encourage staff to travel in more sustainable ways. Investigating what people want provided as incentives would allow for a matrix of ideas to be produced that could act as a handbook for businesses wanting to provide incentives but not knowing where to begin.

8 Conclusion

This research investigated the effectiveness of micro-incentives and their influence on modal shift. The need for the research came from both Government organisations and a gap in literature, that was identified in the literature review component. Through a series of interviews and analysis of survey data, the research has analysed how impactful incentives are on the way that people travel. The findings from the interviews and survey confirmed what had been discussed in the literature review that there are conditions in which an incentive is impactful and the degree to how impactful it is, is dependent on the individual. What was found in the research conducted is that micro-incentives can have an influence on modal shift, but this is dependent on a few factors. The first factor that influences this is the duration that the incentive is offered. If an incentive is offered for a fixed time, it was found that individuals would be inclined to change the way they travel for the duration that the incentive is offered. Once the incentive is removed, the individual is likely to revert to the way they travelled pre incentive being offered. The other contributing factor to how effective a micro-incentive can be is the individual's willingness to change their day-to-day travel patterns. As discussed through both the TBP and SCT, the social setting in which an individual is part of can have significant impacts on the way they think and therefore will act accordingly to fit in with the societal norms. When interview participants were asked, what incentives were offered to them to travel in more sustainable modes, the key answers given were the facilities that the business provided such as showers, secure bike storage, and lockers. Whilst interview participants highlighted facilities as incentives, survey participants identified the infrastructure and facilities available as the reasons why they did not use more sustainable modes of transport. What this is able to conclude is that whilst incentives can influence an individual's mode of transport that use for their journey to and from work, the more important factor that is highlighted by the individual is the quality of facilities available and the available infrastructure to reach the end point of the journey. Through ensuring that the end of trip facilities provided by businesses are of a high quality and that infrastructure that individuals interact with on their journeys is of a high standard, we are likely to see an increase in people travelling more sustainably.

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10 Appendix one: Complete list of incentives businesses interviewed provide to employees and consider to be incentives

- Facilities such as storage, covered bike sheds, towel services, showers, and changing rooms
- Participation in the New Zealand bike month challenges
- Location of the office
- Reimbursement scheme for e-scooter use
- Provision of bikes and e-bikes in transport fleet
- PSA discounts for Torpedo 7
- Government e-bike discount scheme
- Bicycle pub crawl on Saturdays
- 529 bike registration
- Certificate of recognition for sustainable activity
- Paid $5 per ride to work
- Paid $10 per ride if over half the days working the individual cycles to work
- Wellness benefit
- High visibility bag covers
- Car parking booking system which gives employees 12 tokens for a 3-month period
- Social club events such as bike challenges, prizes, and food
- On a bus route
- Health and well-being allowance
- Close proximity to bus interchange
- Weeks pass for the bus
- Put on breakfast
- Bring in speakers
- $300 toward bikes, e-scooter, and e-bikes
- Raffles for active commuters

11 Appendix two: Human Resource Ethics Committee acceptance

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN RESEARCH ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HREC 2022/70/LR

12 September 2022

Pippa Sheppard
School of Earth and Environment
UNIVERSITY OF CANTERBURY

Dear Pippa

Thank you for submitting your low risk application to the Human Research Ethics Committee for the research proposal titled "To What Extent do Micro-Incentives Influence Modal Shift?".

I am pleased to advise that this application has been reviewed and approved.

With best wishes for your project.

Yours sincerely

Dr Dean Sutherland
Chair, Human Research Ethics Committee