

Climate change after COVID-19: Challenges and opportunities to transform the Irish transport sector

Thesis submitted in part fulfilment of the requirement for the award of Doctor of Philosophy

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Abstract

Climate change after covid-19: Challenges and opportunities to transform the Irish transport sector

Erica Fox

While Ireland experienced reductions in transport emissions due to the wide-ranging behaviour changes caused by the COVID-19 pandemic, (SEAI, 2021) these reductions have not been sustained, and emissions have continued to rebound (EPA, 2025). As transport accounts for approximately 20% of Ireland's total greenhouse gas emissions, achieving the national commitment of a 50% reduction of transport emissions by 2030 (EPA, 2025) requires a transformative approach. Achieving these targets requires large scale modal shifts to public and active travel, decarbonisation zones, significant decline in private car use and sustained remote working.

The COVID-19 pandemic provides valuable insights into how rapidly behaviour can change, including changes pertaining to public transport behaviour, perceptions of safety across travel modes, and appreciation of socially necessary measures at a time of crisis. Thus, a study of travel and transport at this significant time can highlight strategies that may enforce transport behavioural change towards an uptake of sustainable transport.

This research provides such a focus on travel and transport at a time of crisis, and in doing so addresses a knowledge gap by investigating how attitudes and behaviours can support a long-term reduction in transport emissions. Specifically, this research centres on bottom-up experiences of transport users coupled with top-down insights from stakeholders in the transport sector. The mixed-method approach adopted for this study utilised two rounds of online surveys (n = 314; n= 448) and 12 interviews with stakeholders in the transport sector to identify pathways for improving transport infrastructure and increasing sustainable transport behaviour. The results highlight a socio-demographic difference in the experience of safety for sustainable transport use in Ireland, particularly for women and older people. Furthermore, the results highlight the need for robust changes to the transport infrastructure in Ireland to support the perception that sustainable transport is safe, fast and inexpensive.

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Section 1:

Introduction to the Research

Chapter 1: Introducing the Research

1.1 Research context

This research assesses public attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland. In doing so, it contributes towards an understanding of how behaviour could change over time to support Ireland's climate change goals. This section will clarify why this research trajectory has been developed. In the 6th Assessment Report, Working Group III on *Mitigation of Climate Change*, the Intergovernmental Panel on Climate Change highlighted the importance of behavioural changes in the transport sector for mitigating climate change. Given the important role that the IPCC has allocated to behavioural change in reducing transport emissions (IPCC, 2022, p.34), this research finds a suitable starting point to examine the current role of behaviour and how it influences transport behaviour in Ireland. This topic addresses a crucial knowledge gap by assessing the current attitudes and behaviours towards transport in Ireland and examining the barriers and motivations towards behavioural change. Identifying these barriers can aid policy and practice in supporting individuals to shift from the private car to sustainable transport modes by providing infrastructure that adequately meets their transport needs. Ireland's national climate policy efforts outlined in the Climate Action Plan (2023) has set out ambitious targets for transport GHG emission reductions of 50% by 2030 with net-zero emissions targets set for 2050 (Government of Ireland, 2023). In identifying the barriers to transport behavioural change and understanding public attitudes towards transport, this research can provide valuable insights for policy and infrastructure development that could support individuals in shifting from the private car to sustainable transport modes. By understanding these barriers and ensuring infrastructure adequately meets the transport needs of users, this research is a timely and important piece of research to support national climate change commitments.

A deeper understanding of this context requires an overview of the existing transport system in Ireland. Ireland's public transport system is largely publicly owned and managed by the National Transport Authority (NTA) under the Transport for Ireland (TFI) brand. The network of services in Ireland include Dublin Bus, Luas (tram system in Dublin), Bus Éireann (national bus and coach service), Iarnród Éireann (Irish Rail), TFI Bikes, TFI Local Links (rural community bus service), and Go-Ahead Ireland (a private transport company operating bus services across Dublin). Plans for transport development occur under the TFI such as the Connecting Ireland Rural Mobility Plan which focuses on developing the bus services available in rural communities by providing improved services and demand responsive transport (TFI, 2025). The NTA also oversees the development of active travel across Ireland by liaising with local

authorities who roll out the infrastructure in their areas. The NTA have an Active Travel Programme to support the government's target for increasing sustainable journeys set out in the Climate Action Plan (NTA, 2025; Government of Ireland, 2023).

Thus, this research examines the factors needed to shift attitudes and behaviours from the private car to public and active transport in a post-COVID-19 Ireland and identifies how behavioural change is hamstrung by the perceived reliability of these modes as they fail to match the cost, time and safety benefits of the private car. Furthermore, the entrenched habitual use of the private car, supported by the historic ribbon-development of housing has widened the gap for behavioural change in rural areas where users can experience forced car ownership as no other viable transport solutions are available to them. Thus, policy must consider how sustainable transport could be reshaped as safer, faster and cheaper than the private car while also making the private car less attractive to users. These considerations could reshape the perceptions towards sustainable transport and support long-term behavioural change in the sector. This research contributes to these necessary policy considerations by exploring the barriers to transport behavioural change and identifying pathways to support individuals in shifting their travel behaviour.

1.2 The research problem

While Ireland has international climate change obligations of a 4.8% annual reduction in carbon emissions by 2025, the Environmental Protection Agency (EPA) have indicated that these emissions will not be reached (EPA, 2025). The transport sector is also not on target to achieve it's 50% reduction by 2030, as emissions from the sector have rebounded since the COVID-19 pandemic (EPA, 2025). Given that Ireland's transport emissions decreased by 17% in 2020 following COVID-19 (SEAI, 2021), there is evidence that a transformative change to transport behaviour is possible. However, as these emissions continue to rebound, the pathway to sustaining emissions reductions lie in long-term behavioural change that is currently not being evidenced in Ireland. To further understand the current state of transport behaviour in Ireland we can look towards statistics on private car use in the country. Nearly 70% of all journeys are made by car (NTA, 2023), with 63% of journeys to work being made by car (CSO, 2023), and nine out of ten adults aged over 50 years travelling primarily by car (as a passenger or driver) in Ireland (Donoghue et al., 2017). To understand private car use in the context of wider European car use, the EU average of journeys made by passenger car is 70.6%, which highlights the reliance on private car use across the EU (European Commission, 2025).

If the government's target for sustainable journeys to account for 50% of all journeys made in Ireland by 2030 is to be achieved (Government of Ireland, 2023), an overhaul of the current relationship with, and ease of use of, the private car must occur. The high reliance on the private car for journeys indicates an underlying systemic issue that indicates a social norming of private car use over sustainable transport modes. This research explores this relationship to the private car further to understand how the private car is perceived, alongside uncovering the perceptions towards sustainable transport modes. In doing so, this research examines what can be done to support a behavioural change shift from the private car towards sustainable transport and how this can be done to maintain a sustained, long-term change.

The pandemic has provided a useful window of opportunity for researching how sectoral transformation could be achieved to meet national climate change commitments. Sudden and wide-ranging transport behaviour changes were introduced in Ireland following the COVID-19 pandemic which included a limiting the number of passengers allowed on public transport modes and travel restrictions where individuals could not travel outside certain distances. These temporary emergency measures, such as restrictions in travel distance allowed and reduction of passenger numbers on public transport modes, had positive and negative impacts on citizens in their attempts to limit the spread of disease. A consequence of this has been that transport emissions did decrease in Ireland (SEAI, 2021). Given that the transport sector is responsible for 21.5% of all greenhouse gas emissions in Ireland, a transformative approach to transport is required to ensure that significant and sustained reductions in transport emissions are achieved. Ireland's transport emissions doubled from 10% of national greenhouse gas emissions in 1990 to 21.5% in 2023, unlike all other sectors, which have experienced stabilisation or decline in greenhouse gas emissions since 1990 (EPA, 2025; SEAI, 2021).

However, the transport sector does have transformative potential as emissions did decrease during the COVID-19 pandemic (SEAI, 2021). Long-term sectoral transformations of the transport sector are widely recognised as essential if national climate change commitments are to be achieved. These include large scale modal shifts to public and active travel, decarbonisation zones, reduction in airline travel, significant decline in private car ownership and sustained remote working. While the disincentive measures used to change travel behaviour during COVID-19 were effective in reducing transport emissions (SEAI, 2021), they were not effective in transforming temporary changes into long-term behavioural change, as transport emissions have rebounded since travel restrictions were lifted. Therefore, this research will

examine how incentives measures, such as cheaper public transport, could support individuals to choose sustainable transport modes in a post-COVID-19 context. This project addresses a knowledge gap by investigating attitudes and behaviours towards transport, while also examining the barriers to behaviour change and how these are experienced at urban and rural levels in Ireland, which will create data on pathways to support behavioural change and a shift away from the private car. Specifically, the research design of the project centres on bottom-up and top-down experience of this transport crisis and to what extent this can be translated into long-term change in the transport sector to reach Ireland's climate goals.

This research seeks to address the following research aim, which is to ***assess the attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland to further understand how behaviour could change over time to support Ireland's climate change goals.*** To address this aim, the objectives of this research are to:

1. Identify the current attitudes and behaviours towards different transport modes.
2. Explore barriers to transport behavioural change.
3. Assess if proposed incentives could support sustainable transport behavioural change.

1.3 Contribution to knowledge

While there has been a significant number of studies conducted on transport behaviour, a knowledge gap still persists regarding what is required to translate temporary behavioural change witnessed during the COVID-19 pandemic into sustained, long-term transport behavioural change in a car dominated country such as Ireland. This research addresses this gap by providing a mixed-method approach, utilising behavioural psychology theory through the Theory of Planned Behaviour, alongside policy and infrastructure insights from stakeholders in the transport sector, to examine behaviour in a post-COVID-19 context. The COVID-19 pandemic highlighted how transport behaviour can be changed through hard disincentives, and emissions decreased as a result. However, these emissions have rebounded as travel restrictions were eased and further research is required to understand what the current attitudes and behaviours are towards transport and travel in a post-COVID-19 Ireland, and what is required to support a shift towards sustainable transport. The original contributions of this research lie in the utilisation of two large scale surveys and 12 interviews with stakeholders in the transport sector to provide a comprehensive assessment of current transport attitudes and behaviours in Ireland. This research connects a top-down assessment of transport through these qualitative interviews with stakeholders in the transport sector and connects them with a bottom-up overview of individuals transport behaviour

through two rounds of quantitative surveys, alongside interviews with organisations advocating for transport users, to bridge an understanding gap between what stakeholders in the sector can provide and what transport users need to support behavioural change. Finally, this research develops findings that can create a pathway towards evidence-based recommendations for developing future transport infrastructure to best support transport behavioural change and support the governments targets of reducing transport emissions and increasing sustainable transport journeys.

1.4 Thesis guide and structure

This research has been presented in five sections with 11 chapters, which are outlined in Table 1 below. Section 2 outlines the analysis of the available literature in one overarching chapter. It examines the available literature in the research areas of attitude and behavioural psychology, transport behaviour and the factors influencing this behaviour, and COVID-19 in Chapter 2. The methodological framework for data collection and analysis is outlined in Section 3, with Chapter 3 giving an overview of the methodology and research philosophy. The data collection and analysis methodologies for the first round of surveying are explored in Chapter 4, while Chapter 5 outlines the methodology used for qualitative data collection and analysis. Chapter 6 examines the methodology employed for data collection and analysis in survey 2. Section 4 reports the results following the data collection for the qualitative and quantitative methods across three chapters (Chapters 7-9). Section 5 presents the discussion of this research's findings, and the policy and future research recommendations in Chapter 10. The research is then concluded in Chapter 11.

Section	**Chapter**
Section 1	Chapter 1: Introduction to the research
Section 2	Chapter 2: A review of the literature
Section 3	Chapter 3: An overview of the methodology section
	Chapter 4: Survey 1 data collection and analysis methodology
	Chapter 5: Qualitative data collection and analysis methodology
	Chapter 6: Survey 2 data collection and analysis methodology
Section 4	Chapter 7: Results from survey 1
	Chapter 8: Results from the qualitative interviews
	Chapter 9: Results from survey 2

Section 5	Chapter 10: Discussion of the results, policy and future research recommendations
	Chapter 11: Concluding remarks

Table 1: Thesis structure

Section 2 consists of one chapter. It presents the literature review in Chapter 2 which explores the available literature to justify the research aim and objectives. An exploration of the foundations of behavioural and attitude psychology is explored through the work of Pavlov, Watson and Skinner. Their development of behaviourism is examined further and critiqued due to how it is disconnected from the many wider influences that can shape behaviours. The chapter moves on to examine the theoretical framework of attitude and behaviours, focusing here on the work of Ajzen (1991) in developing the Theory of Planned Behaviour (TPB) which provides insight into the relationship between social norms, attitudes and perceived behavioural control on intention and behaviour formation. This chapter then examines how habits, cognitive dissonance and social norms can influence how travel behaviour is shaped. The barriers that exist in changing travel behaviour are then examined, where literature on the impacts of safety, cost, time and information on travel behaviour are discussed. The impact of COVID-19 on travel behaviour is examined also. Finally, insight into the development of housing is discussed to shape an understanding of the varying transport access across Ireland.

Section 3 introduces the methodology for this research and consists of four chapters. Chapter 3 introduces the methods section and outlines the ethical considerations examined for this research and discusses how a pragmatic approach to the research was taken. Chapter 4 examines the quantitative methods of research that were considered and outlines how online surveys were selected as the suitable methodology for the first section of data collection. This chapter outlines how the survey was designed, how the survey questions were written and what software was used. The final section of this chapter examines the quantitative data analysis methodologies that was considered for analysing this research and how a partial least squares structural equation model (PLS-SEM) approach was deemed the most appropriate for the theoretical framework which uses the TPB. Chapter 5 discusses the qualitative approaches to data collection and outlines why semi-structured interviews were chosen for this portion of the research. The chapter examines how the 12 interview participants were recruited and how piloting benefited the structure of the interviews. Chapter 5 outlines how thematic analysis was chosen as the qualitative analysis methodology using NVivo to code the data and how this fits within a pragmatic approach to data analysis. Chapter 6 outlines how a second round of surveying was conducted and how this survey was designed and administered in a similar way to the first round of surveying. This chapter

outlines why SPSS was deemed the most suitable analysis methodology for this round of surveying and discusses the tests that were used.

Section 4 presents the results from the data collection in three chapters. Chapter 7 reports the results from the first round of surveying using a PLS-SEM approach. Chapter 8 presents the qualitative results from the 12 stakeholder interviews with eight organisations following thematic analysis in NVivo. Finally, Chapter 9 presents the results for the second round of surveying following a series of non-parametric statistical testing conducted in SPSS.

Section 5 is the final section of the thesis that across three chapters presents the discussion, policy recommendations and conclusions of this research. Chapter 10 discusses the results of this research and examines how transport reliability, measured through cost, time and safety, serve as barriers to transport behavioural change. This chapter also examines how habitual car use can pose a barrier to behavioural change. Incentives and disincentives are discussed as measures for supporting future transport behavioural change. Chapter 11 outlines the policy recommendations and areas for future research. Finally, this research is concluded in Chapter 12 where a summary of the main findings is presented, and the limitations of the research are discussed.

The following chapters will now present this research by outlining how transport attitudes and behaviours are formed and what is required to shift these behaviours to support Ireland's climate change goals.

Section 2:

A Review of the Literature

Chapter 2: Review of Existing Literature

2.1 Introduction

This research seeks to understand the motivations and barriers to sustainable transport behaviour and examine the role of incentivisation in supporting transport behavioural change. In achieving this overarching aim, this literature review will explore how social, infrastructural and psychological factors can influence transport behaviour. With regards to the latter, it further highlights how the interplay between intentions, social norms, attitudes and perceived behavioural control can influence pro-environmental behaviour. This examination serves to acknowledge the complex nature of changing travel behaviour and understand what is required to support individuals to choose sustainable modes of transport. This chapter will define attitudes and behaviours broadly, examine them in the context of transport, and serve to identify the relationship between attitudes and their influence on transport behavioural change. COVID-19 is also explored in this chapter, due to its rapid influence on transport behavioural change. This exploration includes how enforced behavioural change was received across the world and will provide a foundation for examining how future incentivised or enforced behavioural change, led by government action through policy, could be enacted to support climate change goals. This literature review will establish what is currently known about the motivations and barriers to sustainable transport use in Ireland and identify evidence gaps to situate the present study.

2.1.1 Finding the literature

In conducting this literature review, Hempel (2020) outlines a step-by-step approach for research in social sciences and psychology. A wide range of literature such as peer-reviewed journal articles, grey literature, books and book chapters were accessed for this literature review. Academic articles were identified for review in this research which included accessing articles from databases such as Scopus, Web of Science, PsycINFO, Wiley Online Library, SAGE journals online and ScienceDirect. These databases contain research in the field of psychology, behavioural psychology, climate change, transport and gender studies which were all relevant in the literature search for this research. Utilising Boolean terms and search parameters helped to identify important literature that was relevant to the research topic and decreased the number of papers that were not relevant to the research topic. Specific terms for finding papers included “COVID-19”, “transport behaviours”, “behavioural psychology” and “climate change”. Following the literature review, Consensus, an AI tool that serves as a search engine for academic articles, was used to ask more detailed, specific questions to locate literature beyond the Boolean terms initially applied. This final step allowed for the identification of additional relevant sources, which were then reviewed and considered

for inclusion in the literature review. This literature search helped to identify the literature reviewed in the following sections and solidify the research aim and objectives.

2.2 Defining Attitudes and Behaviours: An Historical Context

Attitudes and behaviours are widely studied in fields ranging from vaccine uptake to transport mode choice. Behaviours can change at key moments in an individual's life, where life events such as having a family, retiring or moving house can influence behaviour (Clark et al., 2014; Newell et al., 2020). It is therefore essential for this current study to understand how these behaviours can change in the context of supporting sustainable transport uptake. While this research is interested in examining attitudes and behaviours towards transport, it is important to briefly contextualise the development of behavioural and attitudinal psychology to further understand how sustainable behaviour develops and operates in the context of transport.

The study of behaviours is rooted in the field of psychology, with seminal works by Pavlov (1906), Watson (1913) and Skinner (1984). Pavlov's (1906) study of dogs salivatory responses to food alongside a stimulus and with the stimulus alone is a foundational study in classical conditioning. This conditioning developed an understanding that behaviours were a mental state that could be conditioned rather than an unlearned reflex (Clarke, 2004; Pavlov, 1906). Watson (1913) expands the work of Pavlov on conditioning by positing that the study of the observable physical behaviour should be examined rather than just the process of cognitive behaviours (1913, p.158). This approach offered a different direction from the psychological behavioural studies that had been dominated by psychologists such as Carl Jung and Sigmund Freud up to this point (Watson, 1913; Heimlich and Ardoin, 2008, p.1).

Further research into behavioural processes were conducted by Skinner whose work began to develop what is now known as operant conditioning (Clarke, 2004). In Skinner's work on operant conditioning, he utilised positive reinforcement and consequences to control behaviours, where rats or pigeons were provided with food when they selected the right lever, or shocked when they selected the wrong lever (Skinner, 1984). While Skinner's work has been criticised due to its limitations of measuring how behaviours can operate (Chomsky, 1980), the framework for understanding how behaviour can be controlled through consequences can provide insights into the use of disincentives to discourage certain behaviour, such as private car use.

While the works of Pavlov, Watkins and Skinner are crucial in understanding how the act of behaviours can operate, it's important to note that behaviours are informed by more than just stimuli. Attitudes have an important role in informing behaviours and must be examined in the context of behaviour. Allport (1935) attributes his study of attitude work in the field of psychoanalysis where the unconscious nature of attitude is studied, and sociology, where attitudes were considered representations of culture. He defines attitudes as "a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (p.810). This definition is an important foundational understanding for this research of how transport related attitudes are formed and developed, as it outlines that attitudes are formed by experience and can influence an individual's actions, a perspective which behaviourists such as Watson and Skinner disregard.

In Schwarz and Bohner (2001) the authors examine how attitudes are formed or constructed. They find that "attitudes are a hypothetical construct" and that researchers can only infer how attitudes are formed when individuals self-report their attitudes (p.438). Attitudes can be inferred from asking participants questions. Through this process participants may conduct a "systematic evaluation of features of the attitude object, draw on their own behaviour towards the object, or use their apparent affective reaction or other phenomenal experiences as a basis of judgement" (p.439). Schwarz and Bohner (2001) highlights that an attitude is produced from both personal experiences of said object and previous behavioural experiences or encounters of the object. This insight offers a fundamental understanding for this thesis on the relationship between attitudes and behaviours and how current attitudes and behaviours might be collected and observed to further understand how individuals view and use transport. Schwarz and Bohner (2001) find that a consistency can exist between attitudes and behaviours "when the attitude judgements and behavioural decisions" have the same information source (p.451). Given this understanding, examining how both attitudes and behaviours are formed and how they can inform each other is an important step in assessing attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland. With an understanding of the historical foundation into attitude-behaviour research now established, the next section will identify how attitudes and behaviours impact climate change.

2.3 Attitudes and Behavioural Change: A Climate Change Context

As outlined in Section 1.1, the IPCC 6th Assessment Report, Working Group III, on *Mitigation of Climate Change*, finds that behavioural change in the transport sector is an important method for mitigating climate change by reducing emissions in the future (IPCC, 2022, p.34). Newell et al. (2022) found that a

shift in behavioural changes to reduce emissions can be brought on from a top-down policy effort that is met with bottom-up actions from individuals and households (p.3). This perspective indicates that individuals' actions must also be met by government policy efforts to support their behavioural change. Furthermore, Verplanken and Whitmarsh (2021) state that "tackling climate change will require profound behaviour change" (p.42). Given this perspective, large-scale behavioural change requires government action through targeted transport policy and the development of infrastructure that can support individuals in making these behavioural changes, highlighting the complexity of enacting and supporting behavioural change.

Examining behavioural change requires understanding if attitudes influence behaviours, if behaviours influence attitudes or if both influence each other. Kroesen and Chorus (2017) found that there is a lack of research to effectively answer this question (p.191). As this question can define how policy is written in ways that can either influence the behaviours of individuals through hard measures or influence the attitudes of individuals through targeted campaigns, it is important to understand which of these variables influences the other more (Kroesen and Chorus, 2017, p191). As seen in Section 2.2 previously, the influence of attitudes on behaviours has been a contested area in behavioural psychology, showcasing the complex relationship between the two variables.

Section 2.2 highlights the importance of examining the foundations of attitudes and behaviours in psychology, which has further branched out into the field of sociology, to understand how attitudes and behaviours operate in the context of this research (Schwarz and Bohner, 2001; Allport, 1935). Reviewing the historical context of how attitudes and behaviours are formed and how they are studied can enable a more focused application to climate change studies. More specifically in the context of this research and it's aims, assessing attitudes and behaviours towards different transport modes post-COVID-19 will aid in the understanding of how behavioural change over time could support Ireland's climate change goals. The following section will further explore attitudes and behaviours in the context of theoretical frameworks to examine what shapes behaviours and attitudes and the relationship between both.

2.4 Defining Attitudes and Behaviours: Theoretical Frameworks

Heimlich and Ardoin's (2008) literature review of behavioural change studies in the field of psychology aims to improve the conversation of behavioural change in environmental education. In defining behaviours, they state that "Behaviors are not static, and people are continually adapting behaviors for myriad reasons" (Heimlich and Ardoin, 2008, p.230). This perspective on behaviours provides space for

behaviours to be influenced and changed over time, which is beneficial when considering how behaviours could change towards different transport modes. Pronello and Gaborieau (2018) define attitudes as "hidden psychological states of an individual about something not directly observable but partly measured through some indicators – opinions, judgements, feelings" (p.6), indicating that psycho-social factors have a role in informing attitude formation. Pronello and Gaborieau (2018) identify eight psycho-social variables that can determine behaviours: knowledge and beliefs, values, worldviews, norms, personality traits, emotions and personal stories, attitudes and intentions, and habits and past-behaviours which is noted as having an important function to understand behaviours, while not being considered "a psycho-social determinant" (p.2). Similarly, Newell et al. (2022) find that behaviours can be influenced and "shaped by a range of family, community, regional, and broader societal influences, as well as physical infrastructures" (p.2). These influences are important when examining why an individual may or may not change their behaviour and expand the understanding that behavioural development is solely related to stimuli responses outlined in Section 2.2. These insights provide a foundation for further exploration into the phyco-social variables that can influence both attitude development and individual behaviour, as they can be influenced by environmental, social, infrastructural and emotional factors.

Ajzen's (1991) study *The Theory of Planned Behaviour* examines how individuals form behaviours, how these behaviours are influenced and what behavioural intention means for actualising a behavioural change. There are three independent determinants of behaviour discussed in the study. The first is the positive or negative *attitude* towards the behaviour. The second is the societal factor known as the *subjective norm*. This determinant refers to the pressure an individual might feel from society, or family and friends, to perform a certain behaviour. The third determinant, *perceived behavioural control*, refers to the perceived ease in which an individual can perform a behaviour (p.188). Each determinant can influence behaviour individually or collectively. Ajzen notes that attitudes and subjective norms are formed from past experiences (p.203) and that the experience of a behaviour in the past is the "most important source of information about behavioural control" (p.204). This finding is similar to Schwarz and Bohner (2001), discussed above, where they find that past experiences have the potential to influence future behaviours. Figure 1 below is taken from Bohner and Schwarz (2001) where they outline *The Theory of Planned Behaviour* (p.429). This graph identifies the interplay that exists between attitudes and behaviours and what can ultimately lead to a behaviour change. As the graph shows, a variety of external variables such as age, gender, attitudes towards people and personality traits can potentially influence a behaviour, which stands in opposition to Watson's (1913) work on behaviours. These variables can mean

an individual holds a certain belief or preconceived understanding that a behaviour will have a specific type of outcome, which ultimately leads to having an attitude toward the behaviour. This attitude can lead to behavioural *intention* which ultimately leads to a *behaviour*. This is just one example of the influence of external variables on behaviour intention. The below graph identifies different paths that these variables can take to ultimately lead to a behaviour. This process of behaviour formation is important to the structure of this study as it will utilise Ajzen's (1991) theory to understand how these variables influence the formation of travel behaviour.

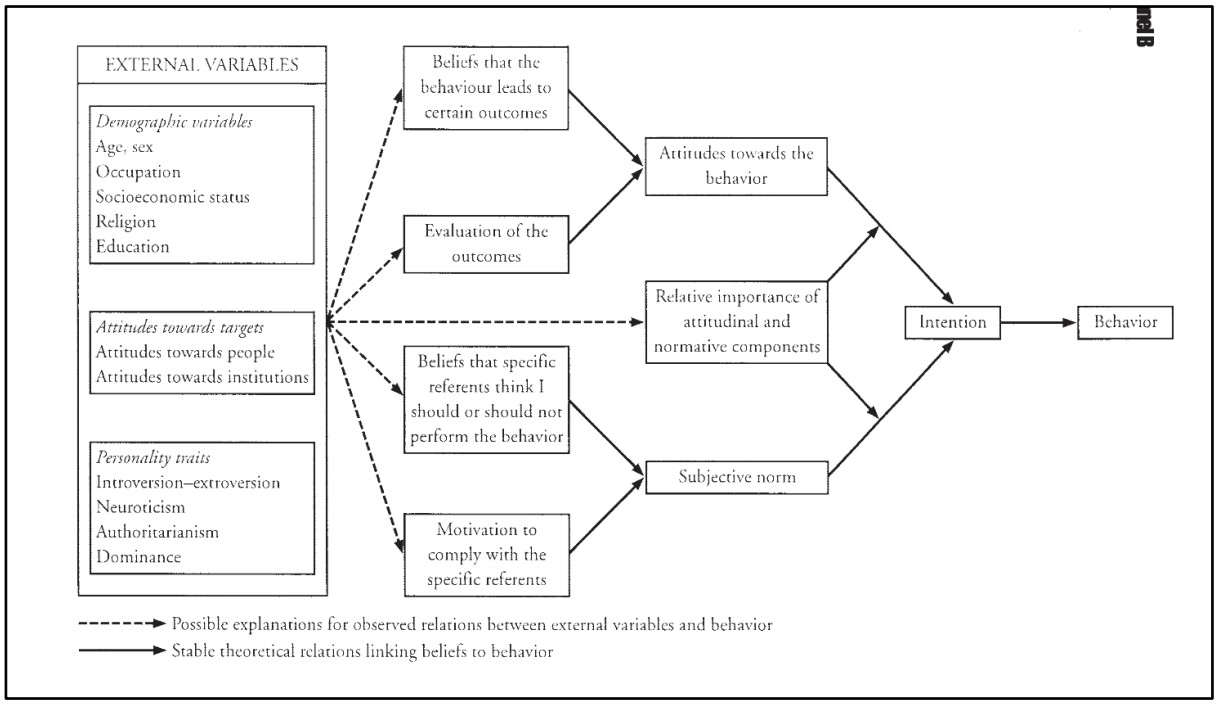


Figure 1: Ajzen's (1991) The Theory of planned Behaviour graphed by Bohner and Schwarz (2001).

Consistent with Ajzen's (1991) findings on the subjective norm, Heimlich and Ardoin (2008) identify that "people act in ways that are usually consistent with how they express their values, beliefs, understandings, culture, socialization, enculturation, upbringing and training" (p.230). Walker et al. (2022) found that an individual's social norms, whose views have been shaped over their whole life, can enable private car users to justify their environmentally harmful behaviour (p.16). Political identity has also been found to influence the prediction of individuals climate attitudes (Clayton, 2024; Fisher et al., 2022; Clayton, 2019), while government action and policy can influence individual's climate action (Dechezleprêtre et al., 2022).

In line with Ajzen's (1991) finding that positive or negative attitudes can influence behaviours, Heimlich and Ardoin (2008) identify attitudes as an influencing factor for environmental behavioural change, noting:

> Despite the continuing debates about precisely how attitude links with environmental behavior, most studies suggest that attitudes do have some impact; therefore, it is important to explore and understand the mechanisms by which attitudes may be changed, particularly when pursuing behavior change. (Heimlich and Ardoin, 2008, p.221)

Malhado et al.'s (2014) study examines the attitude-behaviour gap which examine how the attitude expressed by an individual does not align with a behavioural change. Malhado et al. (2014) found that where transport infrastructure was improved due to a mega-event happening in the city, participants positively responded to these changes by identifying a positive attitude towards improvements in the transport infrastructure. However, they still did not change their travel behaviour (p. 115). The attitude-behaviour gap, which is related to cognitive dissonance, is typically applied to a chosen research area and as such will be examined in the context of the transport sector in further detail below. In contrast, Bohner and Schwarz (2001) found that while attitudes and behaviours have a high correlation value, it is not enough to assert that attitudes cause behaviours (p.428).

Perceived behavioural control serves as an important indicator of individuals' transport behavioural intention and behaviour. In their work on behavioural intention to use public transport, Ambak et al. (2016) identify how perceived behavioural control, alongside subjective norm and attitude, are important determinants of behavioural intention to use public buses. In their examination of active travel, Cristea and Gheorghiu (2016) found that when cyclists perceived they had higher control over their behaviour, their intention and adoption of risky behaviour, such as running red lights, could be decreased. In examining the uptake of sustainable mobility, Nogueira et al. (2023) also found that perceived behavioural control, alongside subjective norms and attitudes, were important indicators in influencing the adoption of sustainable mobility choices. Similarly, Semenescu and Gavreliuc (2019) found that perceived behavioural control was one of the strongest indicators of reducing the intention to use the private car. Furthermore, Semenescu and Gavreliuc (2021) also highlight that perceived behavioural control is an important predictor for car use, alongside other factors such as car use habits, infrastructure and policy measures, which indicates that car use behaviour requires a multi-perspective examination to understand

how it operates. These findings highlight the important role of perceived behavioural control in predicting intention and behaviour. The literature also highlights how perceived behavioural control should be examined alongside other factors to clarify what can predict transport behaviour.

It is evident that understanding the influence between attitudes and behaviours is still contested in research. While there is an evident relationship between attitudes and behaviours, this relationship requires further study. This research is bridging this gap in an Irish context by examining if an attitude-behaviour gap exists in participants environmental attitudes and their travel behaviour, which will address the first and second research objectives of this study outlined in Chapter 1. By utilising a mixed-method approach to capturing the experiences of transport users and expert stakeholders in the transport sector, a variety of transport attitudes can be measured alongside any transport behavioural changes the participants identify.

As outlined in this section, Ajzen (1991) *Theory of Planned Behaviour* is a framework for examining the development of behaviours when examining attitudinal and behavioural change. Figure 1 is taken from Bohner and Schwarz (2001) which shows the pathways of external influences on behaviours and how these influences can form behaviours. As such, Ajzen (1991) theory has been determined as the most suitable framework for examining how behaviours are formed and influenced by attitudes, norms and perceived behavioural control and their influence on behavioural intention. This framework will be applied to develop the first round of surveying in chapter 4 and to analyse the survey results outlined in Chapter 7 and 8. This framework will also be used to address the central aim of this research and the first research objective, which focuses on identifying current attitudes and behaviours towards different transport modes. Additionally, utilising this framework will support the exploration of research objective two, which examines the barriers to transport behavioural change. As discussed in this section, cognitive dissonance and the attitude-behaviour gap are areas that require further examination when assessing what determines a behavioural change. The following section will discuss cognitive dissonance in further detail.

2.4.1 Cognitive dissonance

Leon Festinger's (1957) study *A Theory of Cognitive Dissonance* establishes an understanding and definition of cognitive dissonance. Dissonant cognitions occur when the opposite of one of these cognitions follows from the other cognition such that the knowledge exists to not enact a behaviour, but the individual still enacts the behaviour (Harmon-Jones and Mills, 2019, p.3). To provide an example of

cognitive dissonance in the context of climate change behaviour, we can consider flying as a travel behaviour. Individuals who understand that there is a negative environmental impact related to travelling by plane may experience dissonance when they still choose to fly (Davison et al., 2014, p.21). Changing this behaviour can occur if the individual recognises that this behaviour is "consonant with the cognition" that flying harms the environment (Harmon-Jones and Mills, 2019, p.4). This theory has become an influential theory that is still in use in social psychology today (Harmon-Jones and Mills, 2019). Cognitive dissonance can help to explain the attitude-behaviour gap that exists between individuals' pro-environmental attitudes and their environmentally conflicting behaviours as the case of flying suggests (Juvan and Dolnicar, 2014, p.79). When taken together, cognitive dissonance and the attitude-behaviour gap are powerful psycho-social influences in the context of transport. They are therefore explored in further detail in the following sections.

2.4.2 Habits

Examining habits in the context of behaviour is important as habit has been identified as a mechanism through which behaviour is controlled (Orbell and Verplanken, 2015). Howarth and Ryley (2012) note that "habit is important as it determines existing travel behaviour" (p.279). Malhado et al. (2014) discuss the attitude-behaviour gap in their research, noting that habits can be a barrier to achieving changes in behaviour (p.107). Verplanken and Whitmarsh (2021) further this argument in their research where they found that, in the case of climate-related behaviours, these behaviours are habitual (p.42). Habitual behaviours can negatively impact the environment in dissonant ways. For example, it may be habitual behaviour that leads to individuals going on an annual sun holiday abroad (De Vos and Singleton, 2020). Mazar and Wood's (2018) define habits as "memory-based propensities to respond automatically to specific cues, which are acquired by repetition of cue-specific behaviours in stable contexts" (p.4). Verplanken and Whitmarsh (2021) state that using this definition of habits would indicate that past behaviours and habits are not similar; however, a repeated behaviour can form a habit (p.42). Malhado et al. (2014) found that external factors influencing the behaviours are at times overlooked in theories that deal with habits and behaviours. Pronello and Gaborieau (2018) note that "when a behaviour becomes habitual, it is no longer seen as a deliberative choice, but it is recalled through an action-script from past experience to minimise the cognitive effort and can be measured as the response-time of a given person confronted to a given situation" (p.5). Given this understanding, it may be necessary to intercept behaviours before they become habitual or provide disincentives to the social norming of behaviours that enable them to become habitual, such as travelling by car for journeys where there are reliable transport routes available. It is beneficial to consider habits and their influence on behaviours,

while also examining what influences a behaviour and how it is formed before it becomes an action that uses minimal cognitive effort (Pronello and Gaborieau, 2018, p.5). This interplay between habits and behaviours will be explored further in this research to help identify how behaviours operate and what is required to change habitual behaviours to support the uptake of sustainable transport modes and reduce transport emissions.

2.4.3 A Note on Norm Activation Theory and Pro-Environmental Behaviour

Shalom Schwartz's (1977) study *Normative Influences on Altruism* developed the norm activation model (or norm activation theory as it is also referred to) and found that behaviours are motivated by an individual's ability to demonstrate their values, which can allow them to improve their own self-worth (p.226). Schwartz found that a person's moral obligations can influence their behaviour, and this is a core aspect of enacting pro-environmental behaviour (Schwartz, 1977; Abrahamse et al, 2009). In an environmental context, Abrahamse et al. (2009) found that pro-environmental behaviour may be considered altruistic behaviour as individuals are sacrificing activities such as flying for the greater good of the environment (p.318). A recent example of norm-activation theory at play is enacting behaviours that stem the spread of COVID-19. Rui et al. (2022) found the moral obligations of individuals can determine their behaviours related to COVID-19, specifically when concerned with the health of others, however this is predicated on political affiliation (p.2509). Utilising this norm activation theory in behavioural change research can help to identify if the motivation of individual behavioural change is influenced by altruism. This understanding could therefore influence how policy is written to consider moral obligations as a motivator for behavioural change. While norm-activation theory has the potential to examine how altruistic pursuits can influence behaviour, this research is specifically interested in understanding how attitudes and behaviours relate to and influence each other. As such, Ajzen's (1991) *Theory of Planned Behaviour* will be used as it also enables an exploration of individuals subjective norms which can be influenced by social expectations.

2.4.4 Defining Attitudes and Behaviours: Conclusion

This section has offered a historical context for attitude and behaviour formation from a psychological and sociological background through Pavlov, Skinner and Watson's formative research in developing the field of behaviourism and in Allport's (1935) study on attitudes. Heimlich and Ardoin's (2008) research on behaviours, and Schwarz and Bohner (2001) and Bohner and Schwarz (2001) work on attitudes and the attitude-behaviour relationships highlight the multi-faceted influences that exists in informing behaviours. Heimlich and Ardoin (2008), Pronello and Gaborieau (2018) and Newell (2022) further

highlight that the psycho-social variables that influence behaviour can include environmental, social, infrastructural and emotional factors.

There are still gaps in determining what influences transport behavioural change and how it can be influenced to become more sustainable (Newell et al., 2022). While this examination of the literature has highlighted the contrasting opinions on what directly shapes a behaviour or an attitude, the consensus in the literature shows that Ajzen's (1991) *theory of planned behaviour* is a seminal work in explaining attitudes and behaviours. This theory will be utilised in this thesis to further understand how behaviours are formed and influenced by attitudes, subjective norms, perceived behavioural control and their relationship with intentions.

Habits have also been studied when examining the factors that influence behaviours. While some researchers argue that certain climate-related behaviours are habitual (Verplanken and Whitmarsh, 2021), others find that understanding what influences and forms a behaviour before it becomes habitual, specifically before it becomes automatic and requires less cognitive effort, is important (Pronello and Gaborieau, 2018). This distinction is important as it highlights the different stages at which interventions can be most effective in changing individuals' behaviour. Understanding both how habits are formed and how to determine attitude and behavioural change are important areas for further exploration to address this research's aim alongside supporting climate change goals. Cognitive dissonance has been defined using Festinger's (1957) seminal work and will enable an understanding of the gap between individuals' cognisant attitudes towards transport versus the behaviours that they enact in the following section. Examining cognitive dissonance can create further insights into why individuals' attitudes or intentions do not translate into actual behaviour could provide pathways to supporting individuals to change their travel behaviour. Norm activation theory has been examined in the context of attitude and behavioural change. Its origins in Schwarz's (1977) study *Normative Influences on Altruism* are a key reference for studies applying the theory in the behavioural change field and the transport behavioural change field which will be further discussed in the following section. Altruism, as highlighted in Schwarz (1977), is a key factor in determining pro-environmental behaviour and has been discussed in the context of the norm-activation theory also. Examining supports that could appeal to individuals' desire to act in a socially or environmentally responsible way could serve to change individuals' transport behaviour.

The Irish transport sector serves as an area of important research for the application of the theories and frameworks discussed in this section on attitudes and behaviours as the sector requires a 50% decrease in GHGs by 2030 and is currently not on track to achieve this (EPA, 2025). The following section will examine how transport behaviours are influenced, understood, and potentially changed. It will identify how the theories discussed in this section are commonly applied to transport behavioural research and it will identify the influences on transport attitude and behavioural change.

2.5 Transport Behaviours

Understanding how individuals travel is essential when planning effective transport infrastructure (Harrington and Hadjiconstantinou, 2022; Abdullah et al. 2020). The following section will examine Ajzen's (1991) *Theory of Planned Behaviour* (TPB) and Pronello and Gabroieau's (2018) research on the psycho-social variables that influence behaviour in the context of travel behaviour change. These theories can help to explain how transport attitudes and behaviours are formed and will be discussed in this section. An examination of what can influence travel mode choice will be discussed alongside the barriers to sustainable travel mode behavioural change. Cognitive dissonance will be examined in a transport behaviour setting in tandem with the attitude-behaviour gap and how both can lead to a lack of behavioural change.

Contextually, this study began as Ireland was still experiencing behavioural restrictions caused by the COVID-19 pandemic. As such, COVID-19 pandemic presented an opportunity to examine transport behaviours in a unique setting and understand the changes that have occurred as an effect (de Haas et al., 2020). Lucarelli et al. (2020) used TPB to understand COVID-19 behavioural change, noting an evidence gap that focuses on how individuals' willingness to change their behaviour is impacted by crises (Lucarelli et al., 2020, p.12). The TPB identifies three determinants of behaviours (attitudes, subjective norms, and perceived behavioural control), and Pronello and Gaborieau (2018) identify eight psycho-social variables (knowledge and beliefs, values, worldviews, norms, personality traits, emotions and personal stories, attitudes and intentions, and habits and past-behaviours) that can determine behaviours as outlined in Section 2.4. These determinants can also influence travel behaviour. A variety of research that applies some or all of these determinants will be examined below to identify what influences travel behaviour and if any new influences originated from the COVID-19 pandemic.

2.5.1 Examining Travel Mode Choice

Howarth and Ryley (2012) use TPB to identify the factors that influence travel behaviour. Their research identifies the reasons for choosing the private car as a mode choice such as "convenience, independent, freedom, comfort, flexibility, security and status" (p.263). While the car can come with all of these benefits, it also holds negative attributes such as contributing to poor air quality, the time lost due to congestion and its impact on climate change (Howarth and Ryley, 2012, p.263). Their research also finds that the travel mode choice of an individual can be influenced by personality type, family, or if they are employed or retired (pp.263-281). It is evident that a number of factors can influence an individual's mode choice and when considering the private car these factors can be perceived as positive (convenience, safety, flexibility) and negative (time, environmental impact). Göransson and Andersson (2024) also find that reliability and frequency are motivating factors for public transport use, however they note that this area requires further research to understand how these factors influence mode choice. A greater understanding of what influences individuals' mode choice in an Irish context is necessary when considering climate change mitigation and achieving transport emission reductions targets. Given that nearly 70% of all journeys in Ireland are made by the private car (NTA, 2023), understanding what influences individuals to choose the private car over sustainable transport modes could provide further insight into the barriers to transport behavioural change, and identify enablers that could support individuals in choosing sustainable modes. As such, this research explores the factors influencing transport mode choice for users and fills the research gap outlined by Göransson and Andersson (2024) by exploring how reliability can influence transport mode choice.

2.5.1.1 Time, Cost and Safety

Gardner and Abraham (2007) found that reducing travel time, having personal space and the desire to be in control of the travel experience were some of the reasons participants continue to choose the private car for travel (p.196). Mugion et al.'s (2018) research highlighted that that a lack of loyalty and feelings of dissatisfaction toward public transport service quality in Rome could lead to individuals using their private cars more (p.1580). The study also identified that improved waiting times, service reliability and enhanced security could increase service use (*ibid*). Clayton et al. (2017) highlights how the bus can serve as a space for the user to be in control of their travel time and utilise this time to engage with activities for personal benefit such as reading and listening to music which can foster a positive experience of using the bus. Travel time serves as an important indicator for individuals' mode choice between the private car and sustainable transport modes, particularly when they have to transfer between sustainable transport modes to get to their destination (Ha et al., 2020).

In their report on climate and public transport tickets in Europe, Greenpeace (2023) ranked Ireland 13th out of 30 countries regarding the affordability, ticketing system, and availability of monthly or annual tickets. This report highlighted that while public transport is free for individuals aged 66 and over, people with disabilities and carers, there is no best practice for a ticketing system in the Ireland across public transport modes. In their city report, Greenpeace (2023) ranked Dublin in last place as no fixed price long term ticket options are in place for public transport. While the NTA has continued to keep fares at the discounted rate implemented in 2022 (NTA, 2024), this focus on cost alone may not be enough to incentive private car users away from their mode and onto public transport modes.

Eller and Frey (2019) conceptualise perceived safety as 'a state in which a person's most important needs are satisfied, and it is expected that this state will remain stable' (p.44). The perception of safety can vary depending on social and infrastructural factors such as travel mode, time of day, age and gender (Dubey et al., 2025; Stark and Meschik, 2018). Additionally, the ability to contend with the brief psychological arousal of fear in public spaces, such as when using public and active transport, are factors that can influence perceived safety (Dubey et al., 2025; Siegel, 1999). For active travel modes (modes of transportation that involve physical activity, typically walking or cycling), safety concerns such as injuries from poorly maintained and developed infrastructure, traffic-related injuries, poor interactions with private car users, and person-on-person crime exist for cyclists and pedestrians (Ferreira and Dias., 2025; Whannell et al., 2012; Heinen et al., 2010). The perceptions of safety can also differ for road users sharing the same space, with cyclists perceiving lower feelings of safety on roads shared with private car users (von Stülpnagel and Rintelen, 2024). Perceptions of safety can also influence transport mode choice. Waqas et al.'s (2018) case study on acceptability of sustainable transport behaviour in China found that participants who have a negative view of public transport and concerns regarding the safety of public transport will be more dependent on the private vehicle (p.17). These studies identify how safety is a motivating factor for mode choice, leading individuals to choose the private car as they perceive it as safer.

For example, given nine out of 10 adults aged over 50 years travel primarily by car (as a passenger or driver) in Ireland (Donoghue et al., 2017), there is an evident need to provide suitable sustainable transport infrastructure to support older people's travel needs. The barriers that older people experience when using sustainable transport modes include safety concerns around their ability to get on and off the

bus safely on their own, fear of trips or falls due to uneven pavements when walking and fear of harassment or attack at different times of the day (Henry and Baffoe, 2024; Musselwhite, 2021; Ravensbergen et al., 2021). These safety concerns highlight the varied experiences of older people when using sustainable transport modes and clarify the need for further research into these barriers for using public and active transport modes. In acknowledging this gap, this research responds to this need for further research by examining the transport experiences of older people and makes an important contribution based on original findings in understanding older peoples experience of transport and their varied needs when using different modes.

Transport studies examining safety and gender have found that women experience transport modes differently, particularly regarding their perception of safety (Dubey et al., 2025; Hörcher and Tirachini, 2021; Ouali et al., 2020, TII, 2020). Gender can influence transport behaviour as men and women experience transport differently due to factors like accessibility, safety, time of day, and social and physical vulnerability to crime (Dubey et al., 2025; Pourhashem et al, 2022; Stark and Meschik, 2018). Safety has also been identified as a potential barrier in the uptake of sustainable transport modes (Ibrahim et al., 2024). Recent studies have shown that women have reported feeling more unsafe on the metro and buses then men (Ouali et al, 2020). The experience of using active travel can also be influenced by gender, where women feel unsafe walking due to the presence of men (Souza et al., 2018).

Safety concerns related to transport can encompass fear of traffic accidents, but personal safety concerns are often related to the fear of harassment or attacks on public transport and when using active travel modes. Reported crimes in public settings against women are often lower than the empirical experience due to underreporting of these experiences (Gekoski et al., 2017; Loukaitou-Sideris, 2014). Underreporting of assault and harassment on public transport can be due to a lack of confidence in the reporting process, the social norming of the behaviour as something to be tolerated, or a lack of awareness or clear understanding of how and where to report the incident (Gekoski et al., 2017). These experiences of harassment and the perception of decreased safety on public and active transport can influence women's transport behaviour towards modes they perceive as safer such as the private car (Gekoski et al., 2017).

In an Irish context, the comprehensive research available about women's experiences of transport is limited. A study by Transport Infrastructure Ireland (TII) (2020) highlights how women experience

transport differently to men, particularly in relation to safety. There is an urgent need to examine the experiences of safety on public and active transport modes in Ireland, specifically understanding these experiences as they vary across gender. These insights could help to shape robust transport infrastructure and planning policies that consider the safety needs of individuals and assert the enhanced safety of sustainable transport modes to support the uptake of these modes and reduce transport emissions from private car use. This research addresses this urgent need by investigating how women experience transport in Ireland and produces novel insights into what women require to feel safer when choosing sustainable transport modes.

2.5.1.2 Information

The availability of information about public transport services is an important consideration for individuals in their choice of transport modes. Bamberg (2006) researched if moving participants to residential areas and providing them with public transport information would increase their use of public transport infrastructure. The study finds that when participants were given information that was tailored to them personally on how to use public transport for daily travel alongside financial incentivisation through one free day-travel ticket, participants were more likely to increase their public transport use (p. 834). It is evident from this study that there is potential to alter individuals' transport behaviour through financial incentivisation and providing appropriate information on how to use the transport modes. However, these considerations require further exploration to understand how they contribute to behavioural change in an Irish context, given that the frequent unreliability of public transport modes such as the bus have fostered colloquial terms such as 'ghost buses' which refer to buses that appear on the real-time information displays but never show up. When information about cancellations is not communicated it can bolster the perception that these modes are unreliable and influence individuals transport behaviour (Chowdhury et al., 2016).

Malhado et al. (2014) found that satisfaction levels with the transport infrastructure could be linked to the amount of information available to the user (p.115). When users have more information about public transport infrastructure, they are more likely to use the public transport on offer (*ibid*). Tertoolen et al. (1998) identified similar findings in their study on attempts to reduce private car use. When car users were offered information on the environmental impact of their mode choice but no information on ways to change this, participants changed their attitudes toward that mode (pp.178-179). However, there was no behavioural changes noted in mode choice among the participants (pp.178-179). Therefore, it is

important to provide individuals with the reasoning for a behavioural change and offering them the skills to enact such behavioural change (Terlau and Hirsch, 2015, p.168; Heimlich and Ardoin, 2008, p.231). This research acknowledges the importance of understanding how the availability and accessibility of information influences individuals transport behaviour and examines this gap to provide novel insights into supporting behavioural change towards sustainable modes.

2.5.1.3 Active Travel

Active travel, where individuals walk or cycle, are "socially inclusive…. And [sic] are encouraged by the World Health Organisation… as they maximise the health benefits from transport through increased physical activity and [sic] reduce exposure to air pollution" (Koehl, 2020, p.3). Active travel is seen as more accessible to individuals in higher income households, therefore highlighting a barrier to this mode choice during the pandemic (Honey-Roses et al, 2021, p.11). COVID-19 saw changes in how people travel, as public transport use declined, and active travel increased (Zhang et al., 2021, p.79; de Haas et al. 2020; Huang et al. 2023). This behavioural change can be associated with the lockdown and travel restrictions that were implemented to reduce the spread of the disease. This indicates that enforced behavioural change can alter individuals' relationship with active travel as a travel mode.

In Colombia, Nurse and Dunning (2020) found that the fleet of publicly available bicycles increased to reduce the reliance on public transport due to the pandemic. Abdullah et al.'s (2020) study of travel behaviours across a number of countries found that while the travel distances had reduced due to the pandemic, "the shift from private cars to non-motorized modes (i.e., walking and bicycles) was not significant" (p.100266). DeWeese et al. (2021) found that sustainable trips to a university in Montreal, Canada, including active travel, decreased, while private car usage increased during the pandemic (p.10). Harrington and Hadjiconstantinou (2022) found that the UK is a car dependent society, which has posed a barrier to switching to active travel during and after the pandemic (p.7). Nikiforiadis et al. (2020) note that mobility options were offered in Thessaloniki, Greece that would prevent spreading the virus. These options include cycling lanes, shared space schemes and increasing the size of walking paths (p.3) with an emphasis on promoting these active travel modes "for reasons of mobility and resilience" (Nikiforiadis et al., 2020, p.3). As these studies demonstrate, providing individuals incentivisation through increased availability of active travel modes could increase their choice of sustainable travel modes. However, further research is required to examine how this would work as COVID-19 becomes endemic and the associated health and travel restrictions are lifted. This research addresses this gap by examining how

incentivisation could support active transport uptake in a post-COVID-19 world and contributes to a greater understanding of the types of incentives that transport users are motivated by.

Campisi et al (2020) found that survey respondents who were in support of working from home were 4.2 times more likely to increase their use of the bicycle when compared to participants who were neutral on working from home (p.18). Public transport declined by 80% in Budapest during the pandemic, whereas cycling and bike sharing only declined by 23% and 2% respectively (Bucsky, 2020, p.4). It is evident from the research discussed that the attitudes and behaviours towards active travel have changed globally due to the pandemic. As active travel is beneficial for the mitigation of climate change, continued research on the demand for active travel is required. An investigation in an Irish context is necessary to understand if there is a demand for active travel post-pandemic and what this means for transport policy when considering the improvement of the infrastructure to meet these potential demands.

2.5.1.4 Electric vehicles

While electric vehicles cannot serve as the only solution to the mitigation of climate change and the reduction of carbon dioxide (CO_2) required to achieve emissions reductions targets, they do present a complementary solution alongside significant travel behavioural change (Marsden et al., 2020). Haider et al. (2019) found that consumers in India were resistant to purchasing an electric vehicle due to a variety of factors such as "low perceived battery safety and inability of the vehicle to be served by local mechanics…power availability issues, lack of charging infrastructure, battery life concern, government policy, high maintenance cost and [sic] limited driving range" (pp.3735-3736). O'Neill et al. (2019) found a similar situation in Ireland when examining electric vehicle uptake where participants highlighted a concern with the range capacity of the vehicle (p.121). The attitudes towards electric vehicles present a barrier to the uptake of the sustainable mode choice. Similarly, Berkley et al. (2018) found that the availability of charging stations is a concern for individuals in the UK who were considering purchasing an electric vehicle. As the technology for electric vehicles evolves, so must the information provided to the consumers. Ensuring that up-to-date information on the range, safety and security of the mode choice, alongside the improvement of the infrastructure to support the mode, could offer a potential pathway for electric vehicle uptake in the future. While electric vehicles do offer a solution to the emissions issue related to internal combustion engines, they will still contribute to the congestion issue on roads, and the social norming of private car use and therefore other sustainable choices need to be considered such as public and active modes of travel.

2.5.2 Norms and Travel Mode Choice

Social norming of transport behaviour can influence individuals' mode choice. Redshaw's (2006) study on car culture identifies how the private car serves as an important component of younger people's perception of success and status. This has been echoed in Heinonen et al.'s (2021) study that finds younger people attaching a poverty stigma to using public transport modes, which reinstates the social norm of private car use. In their research on how people discuss transport, Guiver (2007) finds that the way individuals talk about public transport versus the private car can shape the perception of, and reliance on, the private car. These social norms associate with the private car can create an entrenched experience of using different transport modes, which can reinstate the social norm and in turn develop a culture of private car use.

Bamberg et al.'s (2003) study on habitual car use found that offering users information about their mode choice by a "new decision context and an intervention" can impact changes in behavioural intention towards the mode, which can determine behaviour (p.106). This study identified that offering an intervention, which was the opportunity to test the services of the public transport system for free for one day alongside information on how to use the service, influenced nearly 17% of participants to use the public transport system who had not previously used the modes for daily travel (pp.100-102). The study highlights that coupling incentives with information could change individuals transport behaviour, which has the potential to support a reduction in transport emissions.

Ingvardson and Nielson (2019) found that an individual's personal beliefs regarding the importance of public transport for the environment and society can positively influence the satisfaction and frequency of travel on public transport modes (p.23). The researchers suggest that future ad campaigns for public transport should include information on how the mode choice is environmentally sustainable (Ingvardson and Nielsen, 2019, p.25). In France, advertisements from car manufacturers will now have to encourage active and public modes of transport and failure for companies to comply will result in monetary fines (Parker, 2022). In contrast, Kroesen and Chorus (2018) found "that changing attitudes (via promotional or information campaigns) may not be as effective as typically thought" and focus should be placed on changing the travel behaviours as this can be more effective (p.39). It is evident that the use of advertising campaigns to enact attitude and behaviour change is contested in research. However, this section of the literature review has highlighted that providing information alone will not change travel behaviour. Instead, addressing infrastructural issues such as reliability, safety and access to information

alongside utilising incentives and disincentives could support transport behavioural change (Terlau and Hirsch, 2015, p.168; Heimlich and Ardoin, 2008, p.231; Bamberg, 2003).

2.5.3 Cognitive Dissonance, the Attitude-Behaviour Gap and Travel Mode Choice

Juvan and Dolnicar (2014) note that "cognitive dissonance theory focuses specifically on explaining the attitude-behaviour gap" (p.79). Their research found that a cognitive dissonance exists between participants whose holidaying behaviour does not align with their attitudes towards protecting the environment (p.91). Davison et al.'s (2014) research on air travel attitudes and behaviours, found that the attitudes expressed by participants are not a consistent measure of behaviour (p.20). The research found that a cognitive dissonance is present between the attitudes they express concerning the environmental impact of flying versus their lack of behavioural change with air travel (p.21). Oswald and Ernst (2020) found that participants engaged with carbon offsetting measures when conflicted about their use of air travel versus their environmental attitudes. They conclude "that general environmental attitudes alone do not substantially shape behaviour choices in the travel domain" (p.18). While cognitive dissonance is not discussed in Oswald and Ernst (2020) the results of their research are comparable to that of Davison et al. (2014). Higham et al. (2016) examined the attitude–behaviour gap among Australians who expressed concerned about climate change, finding that although participants expressed concern, they were unwilling to reduce air travel due to its affordability (p. 350). The attitude-behaviour gap is an example of the cognitive dissonance at play in the environmental sphere of transport mode choice uptake. While participants in the various research discussed express pro-environmental attitudes, their behaviour is not consistent. There is an urgency to evidence these cognitive dissonances that pose a barrier to the uptake of sustainable modes of travelling if climate change mitigation targets are to be achieved.

2.5.4 Travel Attitudes and Behaviours: Conclusion

This section has examined how Ajzen's (1991) *Theory of Planned Behaviour* has been applied to research in the transport sector to determine what influences travel behaviour. Pronello and Gaborieu's (2018) eight psycho-social variables that determine behaviour have also been examined in the context of travel behaviour research. A variety of factors can influence travel behaviours such as having a family, employment status, proximity to amenities and proximity to public transport infrastructure (Howarth and Ryley, 2012). When enforced behavioural change was required due to the planning of the 2000 Olympic Games, Brown et al. (2003) found that participants changed their travel behaviour when provided with sufficient information on mode choices. Similarly, Waqas et al (2018) found that participants who were aware of traffic issues and had knowledge of the sustainable benefits of different transport modes were

willing to use these modes. Bamberg (2006) and Malhado et al. (2014) found that providing information was an influencing factor for participants mode shift. Tertoolen et al. (1998) found that providing information could influence the attitudes of participants, however the environment for behavioural change needs to accommodate the attitude change. Not feeling safe can negatively impact a participant's use of public transport, particularly women and older people, and shift them to the private car (Waqas et al., 2018; Mugion et al, 2018; Gardner and Abraham, 2007).

Incentivisation can influence individuals to use different transport modes (Bamberg, 2006; Bamberg et al 2003). There are contrasting opinions on the influence of ad campaigns in altering an individual's behaviour where some research finds it can influence the behaviour (Ingvardson and Nielsen, 2019) and other research finds it insufficient in driving behavioural change (Kroesen and Chorus, 2018). These contested opinions highlight the tensions surrounding attitude and behavioural change methods. However, research has noted that offering information on why an individual should change their behaviour will be ineffective unless the environment for behavioural change can accommodate it (Terlau and Hirsch, 2015, p.168; Heimlich and Ardoin, 2008, p.231). While electric vehicles are becoming more accessible to the wider public, there are still barriers to the uptake of this mode (Parkhurst and Clayton, 2022; Clayton, 2022). Haider et al. (2019) and O'Neill et al. (2019) found that the resistance to uptake of electric vehicles in India and Ireland respectively were due to factors such as range anxiety, safety concerns and effective policy governing the sale of the vehicles. As electric vehicles are projected to become the dominant mode of private transport in Ireland after 2035 due to the banning of sales of internal combustion engines in the EU (European Parliament, 2022), the study of attitudes and behaviours towards this mode requires further research (O'Neill et al., 2019). Cognitive dissonance and the attitude-behaviour gap present a barrier to the uptake of sustainable travel modes and behavioural change. Participants who express pro-environmental attitudes highlight a cognitive dissonance or attitude-behaviour gap in the behaviours they take (Oswald and Ernst, 2020; Higham et al., 2016; Juvan and Dolnicar, 2014; Davison et al., 2014). These behaviours include expressing concern for the environment whilst still taking cheap flights and carbon offsetting due to guilt around flying.

Disruptive events which can range from road works causing reduced public transport services to pandemics, can influence transport attitudes and behaviours. Marsden et al. (2020) note that physical disruptions to transport behaviours can come from sources such as the closure of a bridge due to repairs or flooding that has impacted rail services (p.90). Disruption events that can influence travel behaviour

can be both major and minor (Kent et al, 2017). The COVID-19 pandemic has disrupted individuals travel behaviour globally. The pandemic's impact on transport attitudes and behaviours is still being researched and will require longitudinal study. The following section will examine travel behaviours through the lens of the COVID-19 pandemic to understand how the pandemic has influenced travel behaviours over time.

2.6 COVID-19 and travel behaviour

The COVID-19 pandemic created an environment for mass enforced behavioural change (de Haas et al., 2020). The measures introduced to stem the spread of the virus varied across the world with some countries introducing travel restrictions, lockdown orders and fines for breaking these measures (de Haas et al., 2020). In Ireland, these measures included lockdowns with travel restrictions limited to a 2km, 5km, and 10km radius at different stages of lockdown, restrictions on travelling outside of the radius unless necessary (such as for work and health appointments, and reduced passenger numbers on public transport (CSO, 2025). These enforced behavioural changes have impacted how individuals interact with and view transport (Przybylowski et al., 2021; de Haas et al., 2020; Dong et al., 2021).

Brown et al. (2003) examine enforced behavioural change through the reduction of car parking spaces during the 2002 winter Olympics in Utah, U.S.A. The study found that when participants who had previously expressed dissatisfaction with public transport had to change their mode choice to public transport, they found greater satisfaction than previously expressed due to their increased productivity they experienced on board such as working or studying (p.154). This also led participants to continue using public transport after the parking spaces became available again (Brown et al., 2003, p.154). This research serves as an example of how utilising disincentives can force behavioural change, which has some echoes of Skinner's (1984) work on operant conditioning outlined in Section 2.2. Brown et al. (2003) highlights how enforced behavioural change has the potential to alter individuals' attitudes towards mode choice in a positive manner. While the COVID-19 pandemic served as an example of how enforced behavioural change can influence individuals travel behaviour, further research is required to examine what type of disincentives could force individuals' behaviour from the private car to sustainable transport modes for sustained changes in travel behaviour. The following section will examine the impact of the pandemic on travel behaviours and attitudes.

2.6.1 Fear of Safety and Contamination

Li et al. (2022) applied TPB in their study on COVID-19 and travel behaviours. They conducted a survey to assess intentions to travel post pandemic and the results showed a significant change to post pandemic

travel behaviour where users intended to switch to private modes of transport (Li et al., 2022, p.5). However, the actual behaviours could not be assessed in this study as the pandemic was still occurring and restrictions were still in place (Li et al, 2022, p.5). Przybylowski et al. (2021) et al. (2021) found that passengers in Gdansk, Poland were influenced to use public transport when they felt safe and comfortable. The feelings of safety and security was a motivating factor for individuals to reduce their use of public transport during COVID-19 and something that needs to continue to be examined as the pandemic becomes endemic (Dong et al, 2021; Przybylowski et al., 2021; Abdullah et al., 2020; Nikiforiadis et al., 2020; De Vos, 2020; Harrington and Hadjiconstanrinou, 2022; Parker et al., 2021). This fear of contamination leading to a fear of safety on public transport has been a contributing factor leading users to switch to the private car during the COVID-19 pandemic (de Haas, 2020; Zhang and Lee, 2021; Koehl, 2020; Zhang et al., 2021; Harrington and Hadjiconstanrinou, 2022).

Shakibaei et al. (2021) found that participants reduced their social, recreational and leisure activities before a positive COVID-19 case was reported in their region (p.8). This highlights the social consciousness of individuals and their ability to alter their own behaviour to reduce fear of contamination (Shakibaei et al., 2021). De Vos (2020) found that there is a need during a pandemic to maintain public transport levels for individuals who do not have access to a car and who tend to be unable to work from home (p.2). As COVID-19 is no longer a global health emergency, future research is required to understand if these attitudes surrounding fear of contamination on public transport continues to influence travel mode choice in a post-COVID-19 world. The first survey outlined in the methodology Chapter 4 was developed at a time when COVID-19 was still considered a global health emergency. This first survey was therefore interested in framing safety broadly as it related to each transport mode.

2.6.2 Remote Working

There has been a behavioural change in the work commute due to the pandemic, resulting in an increase in the number of employees working from home more often (De Vos, 2020). Tiikkaja and Viri (2021) found that public transport ridership has reduced due to the COVID-19 pandemic and surmised that this could be due to the increased frequency of working from home (p.3). Huang et al. (2023) found that individuals who are working from home are travelling shorter distances and reducing their travel times compared with before the pandemic (p.206). Similarly, Hossain et al. (2023) found that the increase in remote workers has led to a reduction in travel time and the number of trips taken (p.23). They also found that active modes of transport like the bike are being used more due to this change in working pattern, influenced by the pandemic (p.23). As remote working becomes common practice globally, there is a need

to examine how this will impact workers relationship with travel. This is important in the context of reducing greenhouse gas emissions from transport as individuals who are working from home more will have a different daily commute which will no longer require them to travel to the office. Examining the attitudes and behaviours of workers who switched to remote working due to the pandemic and continue to remote work after the pandemic will identify these changes to their relationships with transport and travel.

2.6.4 COVID-19 and Travel Attitudes and Behaviours: Conclusion

The COVID-19 pandemic has highlighted a number of influences on travel attitudes and behaviours. The enforced behavioural change caused by the pandemic has meant individuals across the world have had to abide by travel restrictions, lockdown orders and face potential fines for breaking these rules, fundamentally altering their attitudes and behaviours (Przybylowski et al, 2021; de Haas et al., 2020; Dong et al, 2021). Individuals around the world noted feeling unsafe on public transport due to the fear of potentially spreading and contracting the virus, leading to a reduction in public transport ridership (Dong et al, 2021; Przybylowski et al., 2021; Abdullah et al., 2020; Nikiforiadis et al., 2020; De Vos, 2020; Harrington and Hadjiconstantinou, 2022; Parker et al., 2021). These changes in behaviour and attitude toward public transport requires continued research as COVID-19 becomes endemic in society and the associated pandemic restrictions are lifted.

Remote working became common for many workers due to the pandemic, resulting in a reduction of private and public transport use (Tiikkaja and Viri, 2021; De Vos, 2020). The commuting behaviour of individuals now working from home has shown that individuals' trip length, travel time and number of trips taken has reduced (Hossain et al., 2023; Huang et al., 2023). Examining if individuals will continue to work from home following the pandemic and how this will influence their attitudes and behaviours to travel will be an important area of research for transport planning in the future. There has been a noted increase in active modes of travel due to the pandemic (Hossain et al., 2023; Huang et al., 2023; Zhang et al., 2021; de Haas et al., 2020; Nurse and Dunning, 2020). This increase in active modes of transport and the decline in public transport use due to the pandemic is an important longitudinal area of research when considering the need to reduce CO^2 emissions and mitigate GHGs.

2.7 A note on housing development in Ireland

In examining the attitudes and behaviours towards transport modes in Ireland it is important to address the development of housing in Ireland that has influenced the reliance on, and social norming of, the

private car. McManus (2018) outlines the development of suburban Ireland and highlights how housing estates were more common in larger cities, while in contrast, smaller towns typically featured ribbon development, where one-off houses were built along rural roads, a pattern that dominated suburban growth until the 1990s. To curb the increase of ribbon development the Sustainable Rural Housing Guidelines for planning authorities was published in 2005, which outlined that ribbon development would be restricted in areas where populations were lower than 5000 people (Government of Ireland, p.3). These guidelines clarified what ribbon development would cover for future planning guidelines, indicating that future planning should consider how it may exacerbate ribbon development where '5 or more houses exist on any one side of a given 250 metres of road frontage' (p.55). While these housing guidelines, which have not been updated since 2005, seek to reduce the ribbon development in rural areas, ~96% of all new dwellings built in rural areas between 2011 and 2025 (up to 3rd quarter of the year) were single houses (CSO, 2025).

The guidelines further identify the purpose of restricting ribbon development, which include an emphasis on road safety, for the future provision of infrastructure and to avoid 'undermining the viability of urban public transport because of very low densities' (p.19). As such, the development of rural areas was already contesting with the viability of public transport infrastructure due to the historic development of housing in this way, and the purpose of future development is to avoid exacerbating these issues. Given this continued development of low-density housing in rural areas of Ireland, this research is concerned with understanding how the development of housing continues to pose a barrier to transport behavioural change due to the provision of transport services in these lower density areas.

2.8 Conclusion

This chapter has examined how attitudes and behaviours are formed and what influences them. Ajzen's (1991) *Theory of Planned Behaviour* and Pronello and Gaborieau's (2018) study on pro-environmental travel behaviour offer frameworks and variables to understand travel behaviours. This review has outlined how the TPB is the most suitable framework for examining how behaviour is influenced for this thesis as it examines attitudes, subjective norms, perceived behavioural control and their influence on intentions. The expansive literature on what influences travel behaviour has identified how mode choice can be influenced by improved services, shorter waiting times, improved availability of information and feelings of security on public transport (Mugion et al, 2018; Malhado et al., 2014; Tertoolen et al., 1998; Terlau and Hirsch, 2015; Heimlich and Ardoin, 2008). Mode choice can also be influenced by employment status, grocery shopping and commitments to school collection and drop offs (Howarth and Ryley, 2012). Reasons

for choosing the private car included comfort, security and flexibility (Howarth and Ryley 2012). Fear of safety, the lack of trust in the vehicle and range anxiety showed a resistance to purchasing electric vehicles in India, Ireland and the UK (Haider et al., 2019; O'Neill et al., 2019; Berkley et al, 2018). The literature has identified how personal and infrastructural safety, comfort, convenience, time and cost are important psycho-social factors that can influence transport behaviour. Thus, this research addresses the need for further research by examining how these factors stand as both barriers and enablers to supporting individuals' pro-environmental behaviour and contributes findings that expand the knowledge of what is needed to support sustainable transport behaviour.

The attitude-behaviour gap and cognitive dissonance have also been discussed in this chapter in relation to individuals' environmental attitudes versus their mode choices (Oswald and Ernst, 2020; Higham et al., 2016; Juvan and Dolnicar, 2014). This research is concerned with examining if a behavioural gap exists between individuals' attitudes and their behaviours and how this could pose a barrier to future transport behavioural change.

COVID-19 has presented an interesting opportunity to examine how enforced behavioural change impacts travel behaviour in the short term. Koehl (2021) notes that the pandemic has highlighted how "behavioural shifts can happen at a very large scale" (p.3). The pandemic enables a further examination of how enforced behavioural change through disincentives, coupled with incentives, could be utilised to support individuals in choosing sustainable transport modes and will be explored further in this research. Individuals in Ireland experienced a series of lockdown events that enforced travel behaviour changes (Conway et al., 2021). Manzira et al. (2022) note that COVID-19 has had a clear impact on mode choice for users in Dublin and that these changes in mobility will stay in place for the longer-term (p.15). However, transport emissions have continued to rebound in a post-COVID-19 Ireland, indicating that these mobility changes have not remained (EPA, 2025).

Finally, this literature review has examined how ribbon development has facilitated the scattered development of housing across lower density areas in Ireland which poses a barrier to providing transport infrastructure that can meet the needs of rural communities. This barrier may exacerbate the reliance individuals have on the private car due to a lack of suitable sustainable transport infrastructure, which is an area that requires further exploration. This thesis is therefore both timely and urgently needed as it explores the transport attitudes and behaviours of individuals and seeks to understand what is required

to overcome the barriers to behavioural change to support Ireland's climate change goals. In achieving this aim, this research will identify the current attitudes and behaviours towards different transport modes, explore the barriers to transport behavioural change, and assess how proposed incentives could support transport behavioural change. This concludes Section 2 of the thesis. The following chapter begins Section 3 and will outline the research methodology used to examine the research aim and objectives of this thesis.

Section 3:

Methodology and Methods

Chapter 3: Methodology Overview

3.1 Introduction

This section of the thesis will outline the research philosophy, ethics, and methodology used for this research in three chapters. Chapter 3 discusses the pragmatic research philosophy adopted for this study and outlines the ethical considerations taken for the collection of data. This section presents the methodology in chronological order of proposed data collection. As such, Chapter 4 discusses the methodology used to collect and analyse the data for the first round of surveying, while Chapter 5 discusses the qualitative approach taken to collect and analyse the interview data. Finally, Chapter 6 discusses the approaches taken for data collection and analysis in the second round of surveying.

The COVID-19 pandemic has presented an opportunity for research and reflection on the current state of transport and of user perception of transport in Ireland. The development of this research began in September 2021 when COVID-19 was still classified as a global health emergency. In Ireland, measures that were still in place when this research was being developed from September to December 2021 included mandatory mask wearing in indoor spaces, advice to work from home unless necessary, a 50% reduction in the capacity of venues for indoor cultural and sporting events, and an 8pm closing time for bars, cinemas, live events, restaurants and theatres (CSO, 2025). As such, the research initially aimed to capture attitudes and behaviours towards transport and travel in Ireland through a COVID-19 lens.

As seen in Chapter 2, the literature review identified a gap in Irish literature on travel behaviours and their impacts on climate change, including in the context of COVID-19. However, this research continued during the phasing out period of restrictions, where public transport went back up to 100% capacity, mask wearing was no longer mandatory, and COVID-19 was eventually downgraded by the WHO in May 2023 (CSO, 2025). As such, the focus of this research developed, where the first round of surveying was concerned with the experience of transport during and after COVID-19, and the second round of surveying and qualitative interviews were interested in how attitudes and behaviours were changing post-COVID-19, the barriers to transport behavioural change, the future development of the transport sector, and the role of incentives in supporting transport behavioural change.

This chapter outlines the methodological approach used to address the central research aim, which seeks to assess attitudes and behaviours towards transport in a post-COVID-19 Ireland and understand how

behaviour could change over time to support Ireland's climate change goals. To achieve this research aim, a mixed method approach was used to examine transport behaviour, adopting a triangulated method with qualitative interviews and quantifiable survey results to strengthen the validity and reliability of the findings (Creswell, 2021; Bryman, 2016; Punch, 2014). These methods included two rounds of quantitative survey data collection to capture attitudes and behaviours towards transport and travel in Ireland and, 12 interviews with eight different stakeholders/organisations from the transport sector to gain an understanding of the current state of transport infrastructure and development in Ireland.

The insights garnered from this mixed method approach will provide policy recommendations for the improvement of current transport infrastructure in Ireland, feeding into the government's aim to reduce transport emissions through increased transport behavioural change. The following methodology section will outline the data collection and analysis methods for survey 1 and 2 and the 12 interviews conducted, outlining how these methods address the research aim and objectives.

3.1.1 Research Philosophy

This research utilises a pragmatist philosophical stance which has been identified as an appropriate framework for mixed methods research (Teddlie and Tashakkori, 2010). A pragmatist stance outlines how beliefs and actions are continually interacting to create new experiences (Morgan, 2014). In utilising this stance, ontology is considered to be constantly evolving alongside the interplay between the objective world and human interpretation (Maarouf, 2019). John Dewey (1997) examines the interaction between beliefs and actions in creating experiences. Figure 2 below is taken from Morgan (2014) and outlines Dewey's model of experience, which shows the coexistence and cyclical nature of beliefs and actions in creating experiences. Dewey's work on pragmatism was interested in where our beliefs come from and what our actions mean (Morgan, 2014).

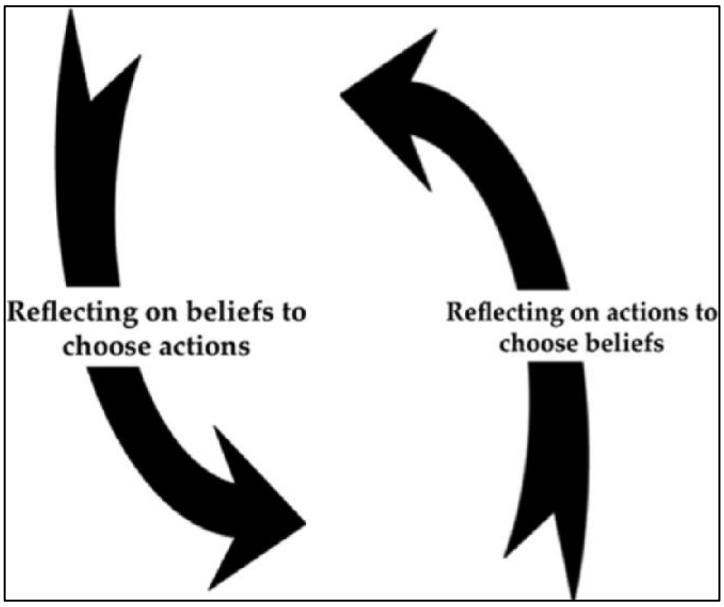


Figure 2: Dewey's model of experience taken from Morgan (2014).

Through a pragmatist approach, epistemology is considered instrumental, meaning that knowledge is substantiated and validated by its practical utility and consequences (Dewey, 1997). In this approach, pragmatism considers the interplay that exists between epistemology and ontology in shaping what we know and how we know. Given that this research is interested in how transport related attitudes and behaviours coexist, a pragmatist approach allows the research to seek knowledge that develops actionable understandings of the central research aim and to develop knowledge that is not just theoretical, but practical. In contrast to monistic approaches such as positivism or constructivism, which prioritises singular, absolute understandings that are often concerned with either/or outcomes (Nguyen-Trung et al., 2025; Guba and Lincoln, 1994), a pragmatist approach provides space for research outcomes that are both practical and applicable for stakeholders.

Utilising this approach allows for both inductive and deductive reasoning to provide meaningful insights. Critically, this philosophical approach justifies the use of mixed methods and data triangulation for data collection. This data triangulation approach is beneficial to this research as understanding the complexity of transport attitudes and behaviours requires us to gain both statistical insights and contextual depth to produce well rounded and actionable research findings. As such, pragmatism was chosen as the guiding research philosophy for this thesis due to its practicality and applicability.

3.1.2 Ethics

Ensuring that research is conducted in line with ethical standards is fundamental when gathering data from human participants in social science research (Fisher and Anushko, 2008). Given that this research was interested in the experiences of transport users, it was essential to ensure that research participants were informed of their role prior to taking part in the study. Perrault and Keating (2018) noted that providing brief and clear informed consent forms increases the likelihood that online survey participants will read them prior to taking part in the research. As such, online survey participants in this study were given a brief but clear plain language statement and consent form that contained essential information about their participation. Furthermore, these forms outlined the confidentiality that participants would have within the research and their right to withdraw at any time (Fisher and Anushko, 2008). To ensure this research was in line with the university ethical standards, an ethical application was made to the faculties research ethics committee outlining the research's approach, data collection methodology, and plans for secure storage and deletion of participants information.

Ethical approval was granted by the DCU Faculty of Humanities and Social Sciences Research Ethics Committee, approval number DCU-FHSS-2022-024, which is outlined in Appendix J. Survey data was collected in line with GDPR policy and participants remained anonymous in this data collection. A copy of the plain language statements and consent forms which were included at the start of the two rounds of surveys can be viewed in Appendix A B, D and E. Interview data was also collected in line with GDPR policy and participants were provided the opportunity to remain anonymous in this research. Participants were provided with different levels of anonymity and pseudonymisation and selected their chosen level prior to the interview. All interview participants provided their informed consent, with some participants requesting a different level of anonymity during and following the interview to enable them to provide more detailed responses. The plain language statement and consent forms provided to interview participants can be viewed in Appendix G and H. The plain language statements and informed consent forms provided to survey and interview participants outlined their role in the research, what their data was used for and their ability to remove themselves and their data from the study at any time.

This section has outlined the research philosophy and given an overview of the ethical considerations for this research. The following chapter will examine the data collection and analysis for survey round 1.

Chapter 4: Survey 1 Data Collection and Analysis Methods

4.1 Introduction

Although international literature has explored themes such as commuting behaviours, active travel, travel risk perception, and climate, research examining these factors and their influence on travel behaviour within an Irish context, particularly considering the impact of COVID-19 and its aftermath, has been limited. The objectives which this first round of surveying is concerned with addressing are to identify the current attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland and to examine the barriers to transport behavioural change that develop from this round of surveying. This round of surveying will enable an examination of these attitudes and behaviours towards transport and travel and enable a further understanding of the motivations and barriers to behavioural change in Ireland and what this can mean for Ireland's climate change goals. This chapter will reflect upon similar research methods used in transport research to understand what determines best practice for data collection in a period where COVID-19 still existed and a time where COVID-19 was downgraded and no longer considered a public health emergency of international concern.

Section 4.2 introduces quantitative methods of research, and Section 4.3 and 4.4 clarify why online surveys were the chosen quantitative data collection method used in this study, noting how COVID-19 was an important consideration for the first round of surveying. In Section 4.5, details of how the survey questions were written are discussed. Section 4.6 and 4.7 give an overview of the survey software used. Sections 4.8-4.10 outline the pilot study, survey sample size and survey launch. Finally, details of the approach taken to analyse the survey data using Partial Least Squares Structural Equation Modelling (PLS-SEM) are described in Sections 4.11-4.13.

4.2 What are the Quantitative Methods of Research?

In addressing the central aim of this research, the methodology is focused on collecting and analysing individuals' experiences of transport and travel in Ireland. Creswell and Guetterman (2024) describe research as a set of steps which are used to "collect and analyse information to increase our understanding of a topic or issue" (p.27). The authors note that quantitative research aims to identify a gap in the research and address this gap through examining the literature around the question, collecting data, and analysing the results (p.40). Creswell and Guetterman (2024) propose a literature review to identify the gap that one's own research is filling and to justify doing the research. The literature review

process therefore helps to identify the research questions that underpin the study (Creswell and Guetterman, 2024, p.40). Variables such as attitudes and behaviours are often examined in quantitative research to understand if these variables influence each other (Creswell and Guetterman, 2024, p.45). As such, following an examination of the literature in Chapter 2, this research examines service reliability, safety, cost, time, theory of planned behaviour aspects (attitudes, perceived behavioural control, subjective norms, intentions and pro-environmental transport behaviours) and COVID-19. These themes have subsequently been analysed to identify evidence of cognitive dissonance (the attitude-behaviour gap), and to explore attitudes and behaviours of transport users in detail.

Queirós et al. (2017) note that quantitative research seeks to gather data that will allow the researcher to perform statistical analysis. The data, which is generally representative of the population, is collected in a systematic way and analysed using statistical software such as SPSS and SmartPLS (Queirós et al., 2017). Data that is not representative can be weighted to become representative (Kolenikov, 2019; Royal, 2019). Methods of quantitative research examined by Queirós et al. (2017) include field experiments, simulation, surveys, correlation studies and multivariate analysis. Their study found that of the 16 million quantitative studies they considered in the 10 years prior to their study, over five million of those papers used surveys as their research methodology. Furthermore, Couper (2017) identifies how surveys will continue to be a valuable method for data collection due to their ability to provide both descriptive and analytical data on individuals' and wider societies. It is evident from the literature that using surveys for data collection can contribute to a wider understanding of individuals attitudes and behaviours, which is a central focus of this research.

Utilising a descriptive quantitative approach when examining attitude and behaviour variables offers some valuable affordances for this research project. As noted, this approach enables a representative capture of the population which can provide a clearer insight into the mobility patterns of individuals in Ireland. Given the aim of this research is centred on examining attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland, a research method capable of eliciting a representative sample of the population of Ireland was essential. While the survey provides a descriptive understanding of attitudes and behaviours towards transport and travel, it serves as a foundation for examining the causal relationships between variables, which are outlined in greater details in the data analysis methodology in Section 4.11. The next section will provide an examination of surveys as a data collection method.

4.3 Using Online Surveys as a Data Collection Method

While paper surveys are still in use, they are a time-consuming task that cannot ensure if participants will fill in and return the surveys (Ball, 2019). There are many advantages to deploying a survey online, including cost, wider audience reach, and data automation and analysis (Ball, 2019; Nayak and Narayan, 2019; Couper, 2017). While Ball (2019) notes how online surveys can be advantageous over interviews surveys also remove the opportunity for participants to seek clarification on questions they feel are confusing. Online surveys, such as web-based or email surveys have long been researched as viable data collection methods that are constantly evolving alongside technology advancements (Granello and Wheaton, 2004; Lefever et al., 2007; Evans and Mathur, 2008). In their 2004 article, Granello and Wheaton analyse online data collection through web-based and email surveys as viable forms of data collection in the future. However, in critique, the article observes that sample representativeness and response rates are limitations of online surveying (Granello and Wheaton, 2004). Similarly, Lefever et al. (2007) view online data collection as a newer form of data collection. Their research finds that for web-based surveys to be effective forms of data collection, they need the user to have a very basic level of computer literacy (Lefever et al., 2007). Couper (2017) outlines that while the methodology for conducting surveys has changed as technology develops, they continue to remain a valuable data collection method. Taherdoost (2021) notes that when using online surveys, it is important to consider that samples may be missed due to individuals not having access to the internet.

When comparing online survey data collection to more traditional paper-and-pencil forms of survey data collection Lefever et al. (2007) note “Online data collection carries the potential of accessing a large and geographically distributed population, along with being time and cost efficient for the researcher” (p.581). Andrade (2020) finds online surveys as being free, easy and quick forms of data collection. However, they note some limitations to this data collection method noting that “There is no way of identifying, understanding, and describing the population that could have accessed and responded to the survey, and to whom the results of the survey can be generalized” (p.576). Furthermore, Andrade (2020) notes that participants in online surveys have access to the internet and are computer literate, with an implicit self-selection bias as they choose to take the survey out of personal interest, therefore skewing the survey findings and their reliability. Wright (2005) finds a similar limitation with self-selection bias when using online surveys as data collection methodology. The author notes that researchers have a limited ability to generalise their findings to the public due to the biases that exist in online survey participation. Additionally, Wright (2005) finds that there are issues with uptake online due to limitations with accessing

community groups, concerns over 'spam surveying' and a distrust in unwanted emails containing surveys. Nayak and Narayan (2019) reiterates the concerns over sample generalisation when using web-based surveys noting "the researcher cannot ensure the sample population is mainly from the targeted population" (p.34). Ball (2019) notes that online surveys present a disadvantage for accurately capturing a representation of the population, including those without access to the internet such as those in remote locations and elderly people.

In contrast, Sandelowski (1995) highlights the importance of answering the research question, where utilising responses from individuals just to fulfil the statistical representativeness of the survey may overlook the experiential insights that the survey is seeking to uncover (p.182). To overcome some of the issues discussed in this section with achieving a representative sample when using online surveys, researchers have suggested that representative populations can be sought by comparing the survey sample to the general population (Ali et al., 2020). Other methods of ensuring a representative population include filtering respondents before they fill in the survey through questioning their suitability (Douenne and Fabre, 2020). Lim et al. (2021) sought representativeness in their sample by comparing the sociodemographic results for their surveys to the national census. Royal (2019) discuss representation issues in their study:

> Nonrepresentative data pose one of the greatest validity threats in survey research. Samples that are underrepresented and/or overrepresented based on demographic subgroups can introduce bias that distorts both the accuracy and the inferences made about the results (p.48).

This research sought a representative sample of the Irish population to effectively generalise the results and to accurately represent the population by reaching a sample size of 384 in each of the two rounds of surveying. Section 4.9 outlines the sample size calculations used in more detail. To achieve this number, the survey was shared widely across social media, through university and environmental emailing lists and through snowballing techniques requesting that participants share the survey widely (see Section 4.10 for more details). Similarly, this chapter discusses how using post-stratification weighting can help to correct for sample bias using sub-demographics for survey research. In Kolenikov (2016) post-stratification weighting is defined as adjusting weights so that total weights are equal to the total population. The purpose of doing this is to ensure underrepresented groups in the survey are aligned to match their representation in the population (Kolenikov, 2016). This allows surveys to be continued without being

stratified prior to the survey when the data is not known (Kolenikov, 2016). Royal (2019) lays out six steps that can be followed from creating a table with population and other variables such as sample size or demographics, to weighting these variables in the post-stratification process. Poortinga et al. (2019) used a post-stratification weighting to account for unequal probabilities of selection and any sampling and non-response errors. In Perrotta et al. (2021) a post-stratification weighting process was used to adjust for any issues related to non-representativeness in their sample. A post-stratification weighting process was utilised for this research to ensure that representativeness was achieved if the sample size was not reached.

4.4 Online Surveys and COVID-19

Online surveys became a dominant form of data collection during the COVID-19 pandemic due to health and safety concerns (Torrentira, 2020). Dong et al. (2021) also recognised the need to use online surveys to avoid spreading COVID-19. Additionally, they note that where infectious disease research is conducted, surveys are the most commonly used data collection method (Dong et al. 2021). Wright (2005) notes that online surveys are used to access hard to reach communities and to communicate with "people who may be hesitant to meet face-to-face" (np). Therefore, online surveys serve as a safe and suitable form of data collection during a pandemic event. When this project started there was still a number of restrictions in place as the COVID-19 case numbers were high. Utilising an online survey was the safest option to avoid contracting or potentially spreading the virus. Online surveys were therefore used for both quantitative data collections in 2022 and 2024. This was because of the affordances of online surveys identified above in Section 4.3, and the facility to compare datasets, even when COVID-19 was no longer a global health emergency.

One of the objectives of the first round of surveying was concerned with examining attitudes and behaviours towards transport and travel in Ireland before and during the COVID-19 pandemic. A thorough examination of the literature has shown that online survey-based data collection is a commonly used research methodology in transport research such as those demonstrated in Dong et al.'s (2021) online survey to examine post-COVID-19 travel satisfaction and Abdullah et al.'s (2020) global online survey to explore COVID-19's impact on travel behaviour. While, among others, Abdullah et al. (2020), Dong et al. (2021) and Zhang et al. (2020) launched their online surveys to a global audience, the research on COVID-19 travel behaviour has been a mix between global data collection and country specific data collection as Nikiforiadis et al.'s (2020) Greek study, Przyblowski et al.'s (2021) Gdansk study and Enger et al.'s (2020)

Chinese study demonstrates. However, there has been few COVID-19 travel studies using online surveys conducted in Ireland. Therefore, this research is a fundamental bridge in understanding public attitudes and behaviours towards transport as they evolve through and after a global health pandemic. These learnings can support how the future shaping of transport behaviours is supported to encourage an increase in sustainable transport modes and reduce transport emissions.

4.5 Writing the Survey Questions

Ball (2019) notes that an effective online survey should fulfil a number of criteria for it to be reliable. These include an introduction page that outlines what the survey is about, what the participant's role is, the ethical approval details for the survey and details of the researcher's affiliation to a university or workplace. These criteria were considered and implemented when designing the survey. Gürbüz (2017) presents the stages of developing a survey and includes defining the problem and forming the questions, drafting the survey, consulting with experts to review the survey and piloting the survey before it is launched in its final form (Gürbüz, 2017).

Roopa and Rani (2012) identify the types of questions asked in a survey. These question types included close-ended questions where example response choices include yes or no, don't know or not applicable, multiple-choice questions and Likert scale questions where participants are asked to select their level of agreement with a statement on a scale e.g. 1 = Strongly agree to 5 = strongly disagree (Roopa and Rani, 2012, p.274). For this survey, multiple choice questions and close-ended questions were used, while Likert scale questions were the most common question type used as they provide reliable data, are easy for users to understand and allow for easier statistical analysis due to their ease of quantifying the results (Tanujaya et al., 2022). Where a participant felt their response was not listed for multiple choice questions, they had the option to select 'Other' and detail their response to the question asked.

A series of question types were adopted in survey 1 to ensure the data could be measured accurately. Appendix C outlines the questions and scales used in the survey. Dichotomous scales were used for questions requiring a yes/no answer such as question 16 in appendix C which asks, 'have you taken any actions in your own life to address climate change'. Responses to dichotomous yes/no questions were then prompted to provide written examples to expand on these insights. Likert scales were used primarily on a 5-point scale from strongly agree-strongly disagree such as in question 12 in appendix C which asks respondents to indicate their agreement with the statement 'The Irish government have handles COVID-

19 well'. Utilising these response options was beneficial for initial coding of the data for the purpose of analysis where 1= yes and 0= no, and for Likert scales where 1= strongly agree, 2= agree, 3= neutral/don't know, 4= disagree, and 5= strongly disagree. The following section will detail writing the questions under each theme.

4.5.1 Writing the Survey Questions: Environment

As highlighted in Chapter 2, attitudes and behaviours toward climate change and mobility were identified as key aspects that require a greater understanding if the State is to support societal transitions to a net-zero economy by 2050. As such, the themes examined in the survey are environment as it relates to climate change and sustainable behaviour, mobility, COVID-19 restrictions, and socio-demographics.

The initial questions for environment were based on the broader theme of attitudes and behaviours toward the environment. Drawing on the work of Milfont and Duckitt (2010), Domingues and Gonçalves (2020) and Severo et al. (2021), items for the attitude, behavioural intentions, and pro-environmental behaviour questions were adapted from these studies. These indicators included questions relating to attitudes towards government action on climate change, environmental awareness during COVID-19, pro-environmental transport behaviour and behavioural intentions as they relate to sustainable transport modes such as public and active transport. Section 2.6 in Chapter 2 provides further details of these studies. The questions under the theme of environment address two of the research objectives. Research objective one seeks to identify the current attitudes and behaviours towards transport and travel, while research objective two seeks to explore the barriers to transport behavioural change. The environmental attitudes and behaviours expressed in response to these questions help to address the research aim, which is to outline what the attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland are. This allows further understanding of how behaviour could change over time to support Ireland's climate goals.

4.5.2 Writing the Survey Questions: Mobility

In Chapter 2, the literature review highlights how mobility was identified as a key aspect to behaviour change. The questions developed for the mobility theme support the first two research objectives as they provide insights into the travel behaviours of individuals' and determine if individuals travel in a pro-environmental way. Questions relating to individuals mobility were adapted from the literature, influenced by the research of Dong et al. (2021), Campisi et al. (2020), Hoogendoorn-Lanser et al., (2015), Aloi et al., (2020), Nikiforiadis et al., (2020), Castaldo et al., (2021), Kallbekken et al., (2021), Scorrano et

al., (2021), Zhang et al., (2021), Przybylowski et al. (2021), Gutiérrez et al. (2020), Honey-Rosés et al. (2020), Nurse and Dunning (2020), de Haas et al. (2020) and Abdullah et al. (2020). Section 2.5 in the literature review provide further details of these studies. Questions in this section were developed to examine attitudes to private car versus public transport, shared transport and modes of active travel and the social norm of using the private car or flying. These questions examine mobility over time to address if pre-COVID-19 travel behaviours differed from during-and-post-COVID-19 travel behaviours. These examinations of mobility further support the research aim of examining travel attitudes and behaviours in a post-COVID-19 Ireland.

4.5.3 Writing the Survey Questions: COVID-19 Restrictions

Seale et al. (2020) investigates attitudes and behaviours to COVID-19. Specifically, their paper examined willingness to engage with COVID-19 restrictions and mitigation measures. This led to the design of questions in the survey around support for travel restrictions in Ireland under different waves of the pandemic and the various lockdowns the Irish government imposed. Seale et al. (2020) also provided the foundation for questions on individual compliance with COVID-19 restrictions and questions on attitudes towards complying with legislation and policies aimed at mitigating climate change. The questions under the theme of COVID-19 restrictions examine how participants responded to the COVID-19 restrictions, either through compliance or non-compliance. These questions were asked under the different waves of COVID-19 in Ireland to examine if participants attitudes and behaviours were the same as the pandemic progressed. Questions were then posed in a similar way about compliance with hypothetical future climate change restrictions to reduce travel emissions and reach Ireland's climate goals. The purpose of such was to examine individuals' willingness to restrict their own travel behaviour to support Ireland's climate goals, which addresses the research aim of this study.

4.5.4 Writing the Survey Questions: Socio-Demographics

The socio-demographics section of the survey was largely informed by the same section in the Irish census (CSO, 2022). Questions about age, occupation, income, educational attainment, and number of children in the home were taken from the Irish census.

4.6 Survey Design

This survey was conducted online, and a number of online survey websites were tested for their suitability to fulfil the requirements of the questions. There are a number of surveying websites available online that enable the user to create bespoke surveys including SurveyMonkey, Google Forms and Survey123. These online platforms will be discussed in the following section.

4.7 Survey Software

A number of online survey instruments were initially tested for survey distribution and implementation, including Survey Monkey, Google Forms and ArcGIS Survey123. Survey123 Connect was chosen because it allows for greater editing of questions and more control of the display, which were found to be limited across other survey platforms during testing. For instance, SurveyMonkey does not provide the same level of question design editing as some features are provided at an additional cost. This question design editing was considered an important feature for providing a clear display and ease of question interpretation for the user. Similarly, the output of results data provided issues with data interpretation for the Google Forms platform compared with the Survey123 Connect platform. The chosen platform, Survey123 Connect has been used widely for data collection in other studies (Vasey et al., 2024; Aburas, 2024; Gary et al., 2022) further supporting its use as a suitable tool.

4.8 Pilot Study

Conducting a pilot study can determine the feasibility of conducting research, the effectiveness of the collection methods and can identify any research procedural issues before officially launching the survey (In, 2017; Connelly, 2008; van Teijlingen and Hundley, 2001). Additionally, while a pilot survey can be time consuming in the timeline of the project, it identifies previously unforeseen difficulties and gives the researcher the opportunity to amend these errors before launching their survey to a wider audience (In, 2017; Connelly, 2008; Hassan et al., 2006; van Teijlingen and Hundley, 2001). Lancaster et al. (2004) also notes that if unsatisfactory results are produced from the pilot, the main study should still proceed if adjustments are made to the method. As sample sizes are small for pilot studies the main study may differ greatly (Lancaster et al., 2004; Hassan et al., 2006; van Teijlingen and Hundley, 2001).

The purpose of piloting for this PhD survey was to ensure all questions could be interpreted and understood by the pilot study participants and therefore understood by the main survey's participants. As such, a sample size was sought to test these aspects of the survey. Hertzog (2008) notes that a sample

size of 10 participants may be sufficient if the purpose of the pilot study is to assess how clear the instructions, question phrasing and formatting are. Johanson and Brooks (2010) state that a pilot sample size of between 24-36 is ideal for scale development studies while Julious (2005) notes a sample size of 12 is the rule of thumb. Thabane et al. (2010) suggest that "sample size calculations may not be required for some pilot studies" (p.5). As this pilot study was interested in how the questions would be interpreted and understood, a sample size of 14 was obtained as it provided sufficient diversity to identify issues such as ambiguous wording, technical glitches, or respondent fatigue (Presser et al., 2004). The survey was piloted in mid-June 2022. Pilot study participants were given the opportunity to offer feedback on the survey. Feedback from sample survey participants resulted in minor modification to the wording and format of some survey questions to improve clarity and the overall user experience. Due to these changes, the pilot sample responses were not included in the main sample.

4.9 Survey sample size

Grafström and Schelin (2014) describe a representative sample as "a scaled-down version of the entire population, where all different characteristics of the population are present" (p.279). Omair (2014) finds that without a representative sample, research cannot be generalised to the wider population (p.142). Krejcie and Morgan (1970) note that while calculations have been created to determine sample size for research, a table for "easy reference" had yet to be designed. Krejcie and Morgan (1970) uses the following equation to determine an appropriate sample size based on the population size:

$$S = X^2 NP (1 – P) \div d^2 (N – 1) + X^2 P(1 – P)$$

[Where:]

S = required sample size

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = population size

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (.05) (p.607).

The table associated with this equation indicates that a population size of 1,000,000 or more would need a sample of 384 participants. This is due to the sample size remaining constant after reaching 384 samples, meaning that achieving a sample over this number will not significantly improve the statistical accuracy of the results (Krejcie and Morgan, 1970). The results from this calculation are similar to the confidence

level calculation where a 95% confidence level and 5% margin of error are used when using an online calculator (Qualtrics, 2022). Kadam and Bhalerao (2010) describe the central limit theorem which the confidence level is based upon noting:

> When a population is repeatedly sampled, the average value of the attribute obtained by those samples is equal to the true population value… In a normal distribution, approximately 95% of the sample values are within two standard deviations of the true population value. This confidence interval is also known as risk of error in the statistical hypothesis testing (pp.9-10).

As such, using a 95% level means that "95 out of 100 samples will have the true population value within the range of precision specified" (Kadam and Bhalerao, 2010, p.10). While there is also a probable chance that these 95 samples do not represent the population, post-stratification weighing can be used to adjust the sample and represent the population after the study has been completed (Kolenikov, 2016; Royal, 2019; Kadam and Bhalerao, 2010). This can be done by weighting samples based on current census data to account for under or oversampling of different socio-economic groups which can then enable the sample to be generalised to the entire population.

Burmeister and Aitken (2012) note that "Sample size calculators are available online at no cost for research teams to access and are simple to use. However, if preliminary decisions have not taken place to determine the relevant components of the sample size calculation, then a calculator offers no practical advantage" (p.274). As discussed above, a sample representative of the Irish population was sought for this PhD research, which fulfils the preliminary decision that Burmeister and Aitken describe. Using Krejcie and Morgan (1970) would mean this survey would need a sample size of 384 participants. Similarly, using the Qualtrics sample size calculator online indicated that with an Irish population of over 5,000,000, there would need to be 385 participants to complete the survey to act as a representative sample of the Irish public.

4.10 Survey Launch

Following the finalisation of edits from the pilot study, the survey was officially launched online on 19th July 2022. To participate in the online survey, participants had to be living in Ireland since December 2019 (prior to COVID-19) and over the age of 18. This enabled the capturing of experience of travel throughout the period of the COVID-19 pandemic in Ireland and as it was becoming endemic, which supports the

research aim of examining attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland to understand how behaviour could change over time to support Ireland's climate goals. This survey was distributed on social media apps such as Twitter, Instagram, and WhatsApp, on university email lists, and to phone contacts with the aim of snowballing the survey participation (Dusek et al., 2015). The survey was closed in October 2022.

A total of *n* = 336 participants responded to the survey. Valid responses were determined by participant's Eircode (Irish postcode) where possible, gender and age. Eircodes were collected to assess the geographical representativeness of the data. Following an examination of these criteria, a total of *n* = 314 valid responses were reported. Twenty-two responses were removed as respondents reported living outside of the Republic of Ireland or they reported a gender identity outside of the binary male or female, as representativeness could not be sought with a wider gender inclusivity due to a lack of comparative Irish census data.

4.11 Survey 1 Data Analysis Methods

Research objective one of this thesis examines current attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland, while research objective two is concerned with exploring the barriers to transport behavioural change. In line with these objectives, Ajzen's (1991) Theory of Planned Behaviour (TPB), discussed in Chapter 2, was identified as the most suitable framework to examine these objectives by investigating how attitudes, subjective norms, perceived behavioural control and behavioural intention influence pro-environmental travel behaviour.

This thesis proposes a novel expansion of the Theory of Planned Behaviour, referred to as TPB+, to create a model that integrates psycho-social variables not extensively studied in transport behaviour research using the traditional TPB. While the TPB has been applied to understand transport behaviour, outlined in Chapter 2 of the literature review, it has not widely accounted for individual's perception of government responsibility during crises such as COVID-19 or climate change, and how these perceptions can influence behavioural intention and actual behaviour. Research by Clayton (2024), Fisher et al. (2022), Clayton (2019) and Dechezleprêtre et al. (2022) highlights how political identity and government action can influence individual's climate attitudes and climate action. This research builds upon these findings by exploring how perceptions of government action towards crises can influence individuals' transport behaviour.

This thesis focuses on assessing attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland, with an emphasis on how behaviour could change over time to support Ireland's climate change goals. As such, this expansion of the TPB was deemed necessary. This TPB+ addresses a gap in traditional TPB research by examining the role of the government responses to crises such as climate change in influencing individuals' behavioural intentions and behaviours.

Furthermore, while the traditional TPB conceptualises perceived behavioural control as an individual's perception of ease in conducting the behaviour (Ajzen, 1991), this research focuses on how factors such as safety, cost, and time serve as barriers to behavioural change. As outlined in Chapter 2, these factors play a significant role in influencing travel behaviour. Therefore, expanding the TPB and utilising a TPB+ was necessary to examine how infrastructural constraints can pose a barrier to transport behavioural change. The diagram in Figure X below outlines the TPB+ used for this research.

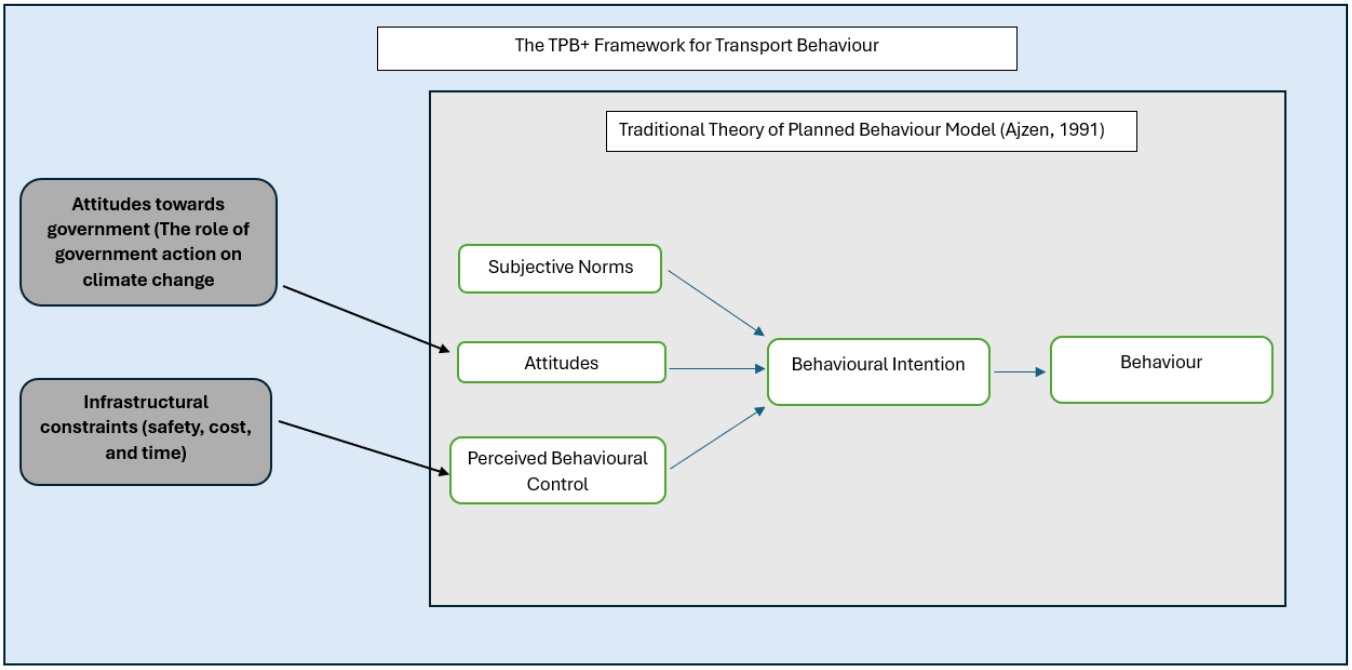


Figure 3: Proposed TPB+ Framework

Five hypotheses were developed to test the survey results using the TPB based on an examination of the literature outlined in Chapter 2. These hypotheses were developed as the literature in Chapter 2 identified gaps in further understanding how individuals' travel behaviour is influenced by government action on climate change, the role of the car, and the perception of safety, cost and time in predicting travel behaviour. As such, the hypotheses outlined in Table 1 address the gaps identified in the literature by

exploring the relationships between the TPB constructs; *attitudes*, *subjective norms*, *perceived behavioural control* and *intentions* in influence *pro-environmental travel behaviour*. This section of the research utilises the TPB framework to test the hypotheses outlined in Table 2 below. Specifically, the statistical analysis outlined in Sections 4.12-4.13 will assess how these TPB constructs predict individuals' intention to adopt sustainable transport behaviour.

Hypothesis 1 (H1)	Individuals who view the government's approach to climate change as effective are more likely to intend to use sustainable transport.
Hypothesis 2 (H2)	Individuals are more likely to intend to travel sustainably if they perceive that others view private car use and flying as environmentally unfriendly.
Hypothesis 3 (H3)	Individuals' beliefs about private car benefits, as they relate to speed, safety, and cost, influences their intentions to continue to use that transport mode.
Hypothesis 4 (H4)	Individuals who intend to travel more sustainably are more likely to actually do so.
Hypothesis 5 (H5)	Individuals who believe that private car usage is fast, safe, and cheap are more likely to use it.

Table 2: Hypotheses for structural model.

To examine how the TPB impacts travel behaviour, this research investigates each of these hypotheses, including the place of government responses to climate change as a motivating factor in transport behavioural intention and pro-environmental behaviour. Sustainable mode choices such as public and active travel are examined as key transport choices in the Irish context to determine if individuals' behavioural intention is actualised in their pro-environmental transport behaviour. The following section outlines the methodology used to test these hypotheses.

4.11.1 Quantitative Data Analysis: Socio-demographic Characteristics Survey 1

A sample size of n = 384 participants was sought to fulfil the requirements of a representative sample for Ireland. Whilst n = 314 valid responses were received, others have also reported issues with non-representative sample sizes in climate related social science research (Clarke et al., 2023; Harrington and Hadjiconstantinou, 2022; Clarke et al., 2018). While generalisation was not achieved due to this non-representative sample, the data remains valid for testing the proposed TPB model and supports analytical generalisation (Polit and Beck, 2010). Sample biases were identified in this research when comparing the sample population for this study to the 2022 Irish Census data under various socio-demographic details.

The gender of survey respondents is nearly equal where the male population (*n* = 158) represents 50.3% and female population (*n* =156) represents 49.7%. Among the survey respondents, older respondents were under-represented. Finally, respondents were significantly more likely to have a third level degree and overall higher levels of educational attainment when compared with the Irish population.

Uptake for online surveys can be impacted by gaining access to community groups, individuals' concerns over 'spam surveying' and a distrust in unwanted emails containing surveys (Wright, 2005). Additionally, access to and literacy of the internet is required to complete an online survey, which can block individuals from disadvantaged groups from participating (Andrade, 2020; Nimrod, 2018; Wright, 2005). This may explain underrepresentation of individuals in the 60-74 age group and an overrepresentation of individuals in the 18-29 and 30-44 age groups.

Additionally, overrepresentation relative to national census data was visible in the educational attainment of the survey respondents. The survey was administered online via social media, snowballing and through various emailing lists. This may be reflected in individuals with higher-than-average educational attainment being overrepresented. When surveys are administered online, there exists an implicit self-selection bias where individuals who have access to the internet choose to take the survey out of personal interest and thus potentially skew findings (Andrade, 2020). Full details of the representativeness of the survey sample are found in Table 3.

Demographic factors		Survey respondents	Irish Census Data (2022)
Gender (%)	Male Female	50.3 49.7	49.3 50.7
Age (%)	18-29 30-44 45-59 60-74	31.9* 37.6* 24.8 5.7*	20.4 31.3 28.4 19.9
Employment Status (%)	Working for payment or profit Looking for first regular job Unemployed Student or pupil Looking after home/family Retired from employment Unable to work due to permanent illness	81.3* 0.6 0.6* 11.8* 1.9* 3.5* 0.3*	64.0 0.9 5.5 7.4 6.8 10.5 4.9

Educational Attainment (%)	Intermediate/Junior Certification	1.6*	14.6
	Leaving Certificate	11.2*	21.4
	Vocational Qualifications	6.7*	22.5
	Bachelor's degree or equivalent	33.1*	26.2
	Masters/PhD or equivalent	45.5*	15.3
	Other	1.9	N/A

Table 3: Sociodemographic characteristics of respondents and 2022 Irish census data. Note: *significant at p<.05 compared with 2022 Irish census data.

This section of the research seeks to examine how the TPB constructs of attitudes, subjective norms, perceived behavioural control and behavioural intention influence pro-environmental behaviour in the context of transport and travel in Ireland. To analyse these causal relationships, a suitable data analysis method was sought. Data analysis tools such as SPSS, Python and R offer methods for causal relationship analysis. However, the advantages of using a Structural Equation Model (SEM) for causal relationship analysis are best suited to this research. Specifically, when examining relationships between variables, SEM analysis allows for the modelling of direct and indirect effects of the TPB constructs (attitudes, subjective norms, perceived behavioural control, intentions, and pro-environmental behaviour), which is of particular benefit to this study as the first research objective seeks to identify the current attitudes and behaviours towards transport and travel. Furthermore, utilising an SEM can identify complex relationships between variables such as attitude-behaviour or intention-behaviour gaps. This benefit directly addresses the second research objective of this study which is seeking to explore the barriers to transport behavioural change. Research from Ong and Puteh (2017) note that for research seeking a cause-and-effect analysis structural equation modelling is a suitable methodology, which further supports the use of SEM in this study. The following section will examine SEM as a data analysis tool.

4.11.2 Structural Equation Modelling

Structural equation models are a second-generation multi-variate technique for statistical analysis and have risen to prominence in social science research in the last 20 years (Hair et al., 2017). SEM are used to examine the relationships between latent variables and observed variables (ibid). Latent variables, such as attitudes, are unmeasured variables and are typically assessed through multiple observed variables (ibid), such as individual's responses to statements about their attitudes towards governments response to climate change.

Covariance Based Structural Equation Modelling (CB-SEM) is used primarily for testing theories such as the theory of planned behaviour, whereby the model will confirm or reject the theory (Hair et al., 2017,

p.4). Hair et al. (2017) state that a CB-SEM functions by 'determining how well a proposed theoretical model can estimate the covariance matrix of a sample data set' (p.4). For non-normally distributed data, Partial Least Squares Structural Equation Modelling (PLS-SEM) has been recommended for use over CB-SEM (Hair et al., 2017). PLS-SEM is a more recent advancement in SEM methodology. A PLS-SEM is used in exploratory research where the researcher can develop their own theory, or to advance existing theoretical insights (Dash and Paul, 2021; Hair et al., 2019, p.5) and it is an appealing method for analysis as it does not assume distributional assumptions on the data (Hair et al. 2019, p.3)

A PLS-SEM approach was taken to analyse the survey data as this research is concerned with measuring the TPB using a number of novel indicators to measure each latent variable (Lowry and Gaskin, 2014). For instance, rather than examining individuals' own attitudes towards climate change, this research aimed to understand individuals' attitudes towards government responsibility for taking climate action. This novel reframing of attitudinal statements within the TPB model, where individuals were asked about their perceptions of *government climate actions* rather than their own attitudes towards taking climate action, was adopted following largely positive public perceptions of the State's response during the COVID-19 emergency. The aim of altering the attitudinal statements within the TPB construct was to examine perceptions of government action for a similar emergency i.e. climate change. The purpose of this is to identify if attitudes measuring government response to the climate crisis impact transport behavioural intention and pro-environmental transport behaviour, which has not been heavily researched in the context of the TPB. In the context of this research, which is utilising the theory of planned behaviour as its theoretical lens, the SEM used statements from the survey to examine the relationships between the latent variables of *Attitudes* (e.g. The Irish Government cares about climate change), *Perceived Behaviour Control* (e.g. Private car usage is safer than public transport) and *Subjective Norms* (e.g. Private car use is environmentally friendly) on the variable *Behavioural Intention* (e.g. I would drive less to reduce travel emissions) and the indirect influence these latent variables have on the latent variable *Pro-Environmental Behaviour* (e.g. I use public transport more than the private car). Figure 4 below provides an overview of the TPB, its constructs and the theoretical relationship between latent variables for this research using the hypotheses outlined in Table 2 above. This figure shows the proposed framework used for the model.

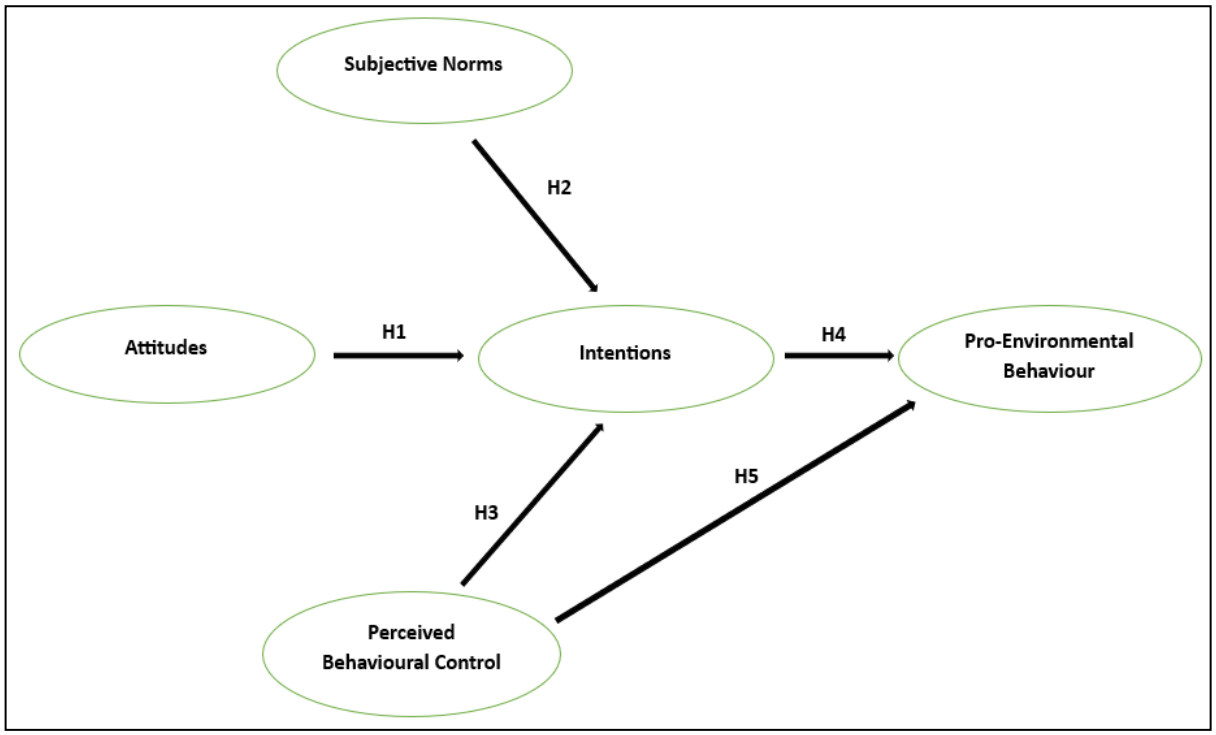


Figure 4: Proposed Framework for Structural Equation Modelling. See Table 1 in Section 2.3 for hypotheses.

4.11.2.1 Pre-testing and Data Fit

Table 4 below shows how each question statement from the survey was grouped under each TPB construct to be measured in the model. Further details of the literature from which these statements items were derived and subsequently adapted to this study can be found in Section 2.5 of Chapter 2. Responses for the five TPB constructs were measured using a 5-point Likert scale ((1 = Strongly agree, 2 = Agree, 3 = Neither agree or disagree, 4 = Disagree, and 5 = Strongly disagree. Subjective Norms, Attitudes, Pro-Environmental Behaviour and Intentions measures were not normally distributed. Perceived Behaviour Control measures were more normally distributed. Following this, the scale scores were measured to check for the scale's reliability. The Cronbach's Alpha Coefficient was used to test the reliability of the scales.

Statements	**Variable being measured**
Private car usage is safer than active travel	Perceived behavioural control
Private car usage is safer than public transport	Perceived behavioural control
Private car usage saves money over public transport	Perceived behavioural control
Private car usage is cheaper than active travel	Perceived behavioural control

Private car usage saves time over public transport	Perceived behavioural control
Private car usage is faster than active travel	Perceived behavioural control
The Irish government cares about climate change	Attitudes
The Irish government is handling the climate crisis well	Attitudes
I would comply with restrictions to help combat climate change	Intentions
I would drive less to reduce travel emissions	Intentions
I would fly less to reduce travel emissions	Intentions
I would use public transport more to reduce travel emissions	Intentions
Private car use is environmentally friendly	Subjective norms
Flying makes an individual environmentally friendly	Subjective norms
I use active travel more than public transport	Pro-environmental behaviour
I use active travel more than the private car	Pro-environmental behaviour
I use public transport more than the private car	Pro-environmental behaviour

Table 4: Statements used to measure latent and observed variables.

4.11.2.2 Model Generation and Testing

Following the confirmation of the variable reliability, the data model was generated. SmartPLS was employed as model software after a PLS-SEM model was chosen for analysis. This software was chosen due to its user-friendly interface which enables the straightforward creation of the PLS-SEM without any detailed programming experience required to build the model. Figure 5 below shows the model, with variables and their paths.

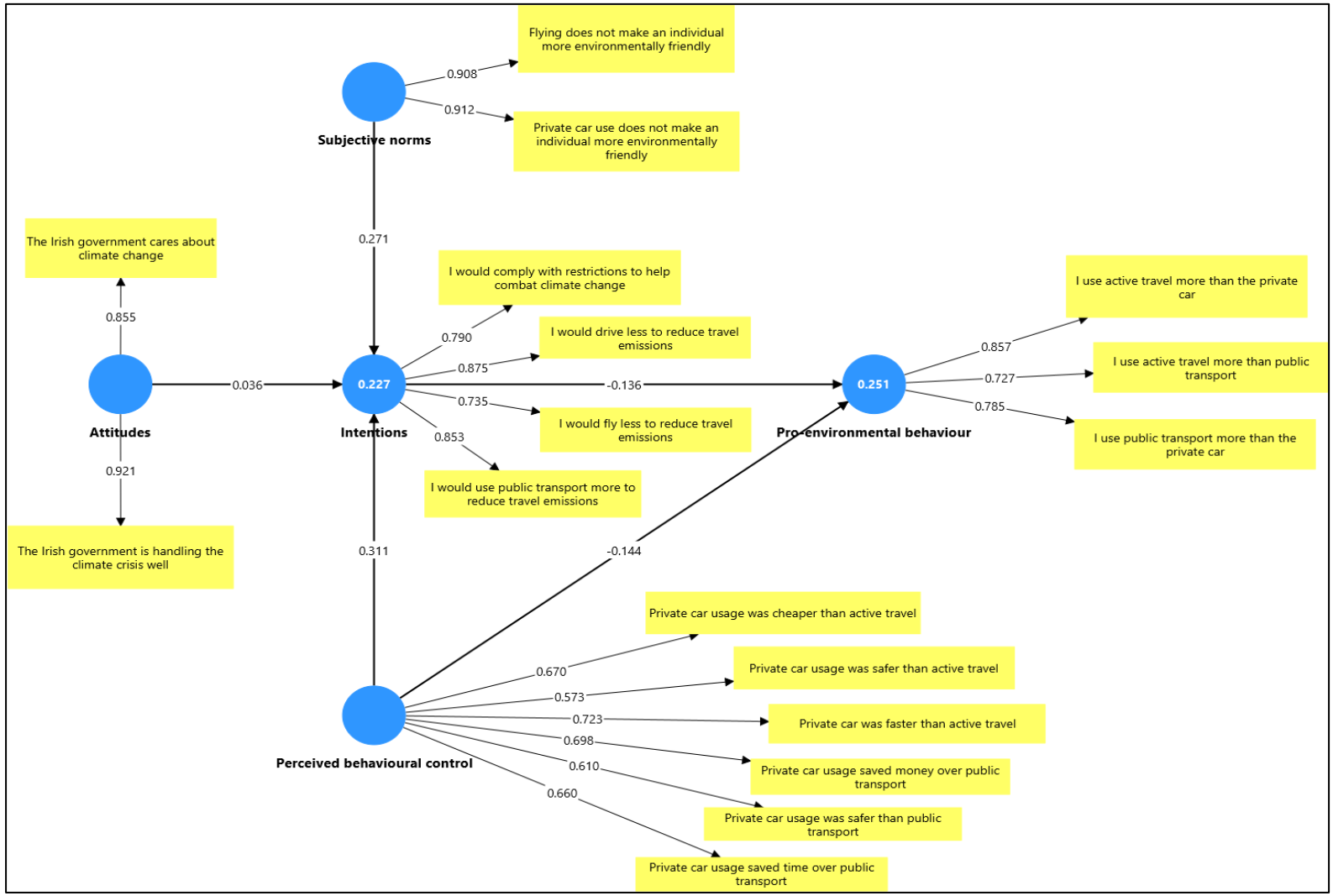


Figure 5: PLS-SEM showing the variables and paths.

To examine the significance of the relationships in the model a bootstrapping procedure was conducted. The bootstrapping procedure was conducted with a subsample of 5000 samples. As per best practice outlined in Hair et al. (2019) steps were taken to validate the PLS-SEM using a number of tests. This included examining reliability and validity (outer variable loadings, internal consistency, convergent and discriminant validity and goodness of fit). Outer loadings, also referred to as indicator reliability, measure the extent to which the indicators share commonalities which is measured by the construct (Hair et al., 2017, p.113). Composite reliability measures how well variables measure a latent construct in the model, and these were calculated for all five of the TPB constructs. Convergent validity tests were conducted, and these show the convergence of each construct as it explains variance in its items. The heterotrait-monotrait ratio (HTMT) was used to measure the discriminant validity of constructs in this research. To test if the regression results were biased, collinearity was examined using Variance Inflation Factor (VIF) testing. While there are no established measures of goodness of fit for PLS-SEM and fit measures should be used with extreme caution (Hair et al., 2019; Hair et al., 2017, p.112), model fit measurements can be conducted for the PLS-SEM. Tests such as Standardized Root Mean Square Residual (SRMR), which quantify the divergence between the observed and estimated covariance matrices, and Normed Fit Index (NFI), which compares the chi-square (χ^2) of the model and compares it to a meaningful benchmark (Ringle et al., 2024), are often used. As such, SRMR and NFI were used as measures of goodness of fit for this model (ibid). These tests are outlined in further details in the results chapter Sections 7.3-75.

4.12 Conclusion

This section has outlined the ethical considerations applied in this research. The use of online surveys administered using Survey123 Connect was justified for use in this research as it effectively supports the collection of individuals' attitudes and behaviours towards transport and travel in Ireland. This section further describes how the survey questions, under the themes of the TPB, environment, mobility, COVID-19 and climate change restrictions and socio-demographics, were developed utilising the literature outlined in Chapter 2 to capture these perspectives. Additionally, this section has examined how the first survey supports the research aim and first two research objectives, specifically to understand the transport related attitudes and behaviours of individuals and to examine the barriers to transport behavioural change. An examination of the data analysis methods utilised for the first round of surveying in this research outlined how in utilising a causal relationship perspective to analyse the results, a PLS-SEM was identified as the most suitable data analysis software to examine the TPB in the context of this

study. The development of the theory for this study was guided by the research aim and the first two research objectives to further understand how individuals experience transport in Ireland and the barriers to transport behavioural change. Hypothesis were developed to test the TPB in the PLS-SEM and the results of these tests can be viewed in Chapter 7. The following chapter will examine the data collection and analysis methods for the second round of surveying.

Chapter 5: Qualitative Data Collection and Analysis Methodology: Interviews

5.1 Introduction

The first survey outlined in Chapters 4 sought to capture the attitudes and behaviours associated with transport in Ireland and identify influences on travel behaviour. However, a greater depth of understanding of the current transport infrastructure needs to be garnered to understand this transport behaviour. To capture these perspectives, and to identify the barriers to transport behavioural change (objective two) this research used qualitative research methods to complement the results captured through the quantitative data collected (Mars et al., 2016; Grosvenor, 2000). Grosvenor (2000) notes that qualitative methods complement quantitative results by capturing a depth of understanding in travel behaviour. The following section discusses the different types of qualitative research methods considered for this research, including semi-structured interviews which were the chosen methodology.

In this chapter, methods of qualitative data collection are discussed in Section 5.2 which include ethnography, focus groups and interviews. Section 5.3 outlines how the interview guide was developed for this research while Section 5.4 discussed how interview participants were recruited. Section 5.5 outlines the piloting conducted for this portion of the research and Section 5.6 discusses how the interviews were conducted. Finally, in Section 5.7 the qualitative data analysis methods are detailed.

5.2 Qualitative Data Collection Methods

The following section outlines the qualitative data collection methods considered for this research. These methods include ethnography, focus groups and semi-structured interviews. This section will discuss the suitability of each of these methods for this study and why semi-structured interviews and focus groups were utilised as the qualitative data collection method for this research.

5.2.1 Ethnography

The ethnographic research method involves observing a group's behaviours over a period of time, listening to conversations between individuals in the group and also asking questions to provide insights into the group's attitudes and behaviours (Gobo and Cellini, 2021; Bryman, 2016; Reeves et al., 2008). While understanding the behaviours of transport users is a core part of this research, the qualitative portion of the study is concerned with the utilisation of transport infrastructure to facilitate behavioural change, insights which could be provided by individuals working across transport sector. Furthermore, at the time of this research design when COVID-19 restrictions such as mask wearing and reduced social

gatherings were in place, continued weariness around COVID-19 existed for particular groups of interest such as older people. As such, ethnography was not deemed a suitable methodology for this portion of the research.

5.2.2 Focus Groups

Focus groups were considered as a qualitative data collection method for this research due to their ability to gather individuals from multiple organisations into one space to capture a breadth of insights on the research topic (Wilkinson, 2021; Cyr, 2016). While focus groups are often interested in facilitating a conversation between interview participants on a set of questions or themes (Wilkinson, 2021), they were deemed impractical as the primary method for this portion of the research. Focus groups can be difficult to organise for professionals due to scheduling conflicts (Smithson, 2008). Furthermore, this research sought to interview transport stakeholders at different levels, such as governmental, non-governmental and advocacy organisations. Given this consideration, ensuring each participant was given a dedicated amount of time to explore the research themes was important. As such, focus groups were not chosen as the primary qualitative data collection method for this section of the research. However, when one organisation put forth multiple participants for interview, a focus group was utilised to facilitate this.

5.2.4 Interviews

Valentine's (2013) study on interviews as a research methodology notes that greater detail can be captured from conducting interviews as a data collection method. The different types of interviews include structured interviews where interviewees are asked a set list of questions that typically have closed 'yes' or 'no' responses (Alshenqeeti, 2014). These types of interviews, while providing insight into the set of questions, do not provide the depth of detail being sought in this study. Unstructured interviews provide greater flexibility of direction for interviews where interview questions are asked in the context of the conversation occurring (Bryman, 2016; Kitchin and Tate, 2013). While this style of open-ended questioning can provide depth to the findings (Punch, 2014), this research aimed to capture responses relative to the research objectives, therefore an unstructured approach was not taken.

In semi-structured interviews the interviewer uses an interview guide that has a set list of questions to guide the interview (Bryman, 2016). Within this style of interview there is flexibility in how the interviewee chooses to respond and based upon their responses, additional follow-up questions not included in the interview guide can be asked (Bryman, 2016). This style of interviewing enables the interviewer to cover the questions outlined on their list and explore research themes that may not have been previously

considered by the interviewer (Bryman, 2016; Kitchin and Tate, 2013; Valentine, 2013). This interview style allows for a more conversational approach to occur also (Kitchin and Tate, 2013). This style of interviewing was chosen as it ensured the research objectives were covered but there was also space to explore further themes that the interviewees introduced. This is a valid style of interviewing given that the participants were experts or specialists in their areas and had nuanced and sophisticated perspectives on key aspects of this research enquiry, as such, it was used in this research.

5.3 The Interview Guide

The interview questions were developed following an exploration of the literature in Sections 2.5-2.7 and the themes identified from the first round of surveys: attitudes and behaviours to transport, suitability of current public and active transport infrastructure, cognitive dissonance, the role of government in handling climate change, safety on public and active transport and the communication around safety.

While the interview guide (Appendix I) outlines the broad themes and guiding questions for the interviews, further questions were added and expanded upon based on the interview participant and their organisation. Due to the semi-structured nature of the interviews, topics that arose when the interviewee responded to each question were explored further where relevant to the research (Bryman, 2016; Kitchin and Tate, 2013). For example, interviewees from COPE Galway were asked more questions about the suitability of public transport and active travel infrastructure for older people as this theme arose strongly in their interviews. Similarly, an engineer in Donegal County Council, was asked further questions about the policy that guides transport development in county councils in Ireland. Thus, the flexibility afforded by semi-structured interviews made this method appropriate for in-depth research to further the key objectives of this thesis.

5.4 Recruiting Interviewees

Key stakeholders in the transport sector were identified as potential participants. These included participants directly involved in transport policy, implementing new transport infrastructure, and communicating changes and updates in the transport system. It also included organisations that advocate for individuals who are disadvantaged in their access to transport such as older people and people in rural areas. The views from this target sample complemented the findings from both surveys to create a broader understanding of the current state of transport in Ireland. They also support this project in its remit to provide policy recommendations that encourage transport behavioural change from private transport to public and active transport modes. A purposeful sampling method was used to recruit

participants to enable an in-depth understanding of the suitability of transport for older people, rural communities and the current state of transport infrastructure and future development (Flick, 2022). A list of potential interviewees was collated, and an email was drafted for participant recruitment outlining the purpose of the interview, their role in the research, why they were selected as a potential interviewee and the expected time commitment (Kitchin and Tate, 2013). This email can be viewed in Appendix K. As these interviews were largely capturing sectoral-based perspectives, they were not seeking to be a representative sample of the Irish population. As such individuals were contacted through their organisations and from further snowballing from recruited interviewees (Kitchin and Tate, 2013).

Forty-two organisations were contacted by email and phone. Three organisations advised they could not facilitate an interview at the time of contact and three organisations advised they would pass on the details of the interview request internally in their organisation. Nine organisations advised that they could take part in these interviews but due to consistent unavailability they did not take part, and the remaining 25 did not respond to the email request. Eight organisations situated in rural and urban areas agreed to take part in an interview. A total of 12 individuals were interviewed. Seven interviews were with individuals from different organisations, and a focus group was conducted with five members of a team from the same organisation. The focus group interview was conducted in a similar way to the semi-structured individual interviews with some flexibility given to interviewees to respond to their colleagues' insights (Punch, 2014; Kitchin and Tate, 2013).

5.5 Piloting

To test the interview timing and flow, and clarify the interview guide, a pilot interview was conducted with an interview participant in July 2023 (Flick, 2022; Turner, 2010). Following this pilot interview, minor changes were made to one question in the interview guide to ensure clarity of understanding. As this was the only question rephrased in the interview guide this pilot interview was included in the overall data analysis for the interviews.

5.6 Conducting the Interviews

The role of the interviewer includes creating an environment in which the interviewee is at ease, keeping the interviewee on track with the interview's theme by asking relevant questions and providing reassurance through active listening and non-verbal responses such as nods (Kitchin and Tate, 2013,

p.215; Valentine, 2013). The location of the interview is an important consideration and can contribute a relaxed environment for the interview if they are familiar with the location (Valentine, 2013, p.118; Herzog, 2005; Warren, 2002). Interviewees were given the opportunity to meet in person where possible or to meet over zoom. Six interviewees chose to conduct their interview over zoom, while two interviewees chose to be interviewed in person at their preferred location.

The interviews lasted between 30-90 minutes. Short-hand notes were taken during each interview, to support probing questions (Valentine, 2013). After each interview, reflexive notes were made detailing initial themes that stood out, points that may be of interest in the next interview and reflections in relation to the survey data. These notes were used as a contextual tool when it came to analysing the interviews (Lofland et al., 2022; Aronson, 1995). Following the end of each interview, interviewees were asked if they had any additional questions or queries and were thanked for their participation. The interviews were recorded on a password protected device with the participants consent. These recordings were then saved to a secure, encrypted folder on a password-protected computer prior to transcription. The interview recordings were then transcribed verbatim. Further reflexive notes were made during transcription of themes that stood out and points of difference against existing data and literature (Braun and Clarke, 2019; Bryman, 2016; Valentine, 2013).

5.7 Qualitative Data Analysis

The results of Survey Round 1 identified a gap in understanding the barriers and motivations to transport use for older people, while also highlighting the need to further explore transport infrastructure and its development as a barrier to sustainable transport uptake. Therefore, the interview portion of this research complemented the survey data, and addressed research objective two, which is concerned with exploring the barriers to transport behavioural change.

Ahmed et al. (2025) compares the common approaches to qualitative data analysis noting that a grounded theory approach is less flexible due to its requirement for theory generation, while interpretative phenomenological analysis (IPA) is rigidly tied to a philosophical stance (Ahmed et al., p2). While content analysis has a high level of flexibility and is suitable for mixed methods studies, the coding of the data remains largely descriptive (ibid). Thematic analysis is theoretically flexible (Ahmed et al., 2025; Nowell et al., 2017) and is concerned with interpretation and meaning (Ahmed et al., 2025), which is a central focus of this research. Furthermore, thematic analysis is an accessible approach to qualitative data analysis as

it provides flexibility in uncovering a rich and contextual understanding of the data (Nowell et al., 2017). This approach to data analysis seeks to identify important and relevant patterns that are applicable to the central research questions being examined (Braun and Clarke, 2019). As such, thematic analysis was selected as the most suitable qualitative data analysis methodology under a pragmatic philosophical approach due to its ability to systematically address the practical 'what' and 'why' of the research aim and objectives.

Braun and Clarke (2019) note that coding data often involves both inductive and deductive approaches to analysis which this study utilised. In this research, the inductive approach allowed the identification of themes and codes without using predetermined theories or hypotheses to guide the coding. The deductive approach utilised existing knowledge derived from the literature review and Survey Round 1 results to guide the coding into predetermined groups relative to the research objectives.

Interview transcripts were managed and coded using NVivo software (version 15) which is a software package for managing and analysing qualitative data. Utilising Braun and Clarke (2016) and Ahmed et al. (2025), the thematic analysis proceeded using a four-step analysis approach as follows:

1. Familiarisation

During the transcription process, the interviews were closely listened to, and notes were taken of key themes arising in the transcripts. Once all of the interviews were transcribed, a document containing every theme that was noted from each interview was created and compiled with the notes previously made after conducting each interview. This document was reviewed to identify the common themes occurring across interviews and to begin the familiarisation process with the data. The recordings were then deleted.

2. Generating initial codes

The transcripts were imported into NVivo and read line by line a second time. Quotes were coded that responded to the broad themes identified at stage one (deductive coding). A third read of the transcripts captured additional codes unrelated to the pre-determined themes (inductive coding). A total of 218 initial codes were generated through this process.

3. Searching and reviewing themes

The 218 codes were reviewed one by one, refined, and grouped under 20 broader themes such as 'public transport safety' and 'active transport safety'. These themes were reviewed in relation to the whole data set to ensure coherency of coding.

4. Defining themes

The final step of the coding procedure was to refine these 20 groups to reflect the research objective: barriers to transport behavioural change. Four themes and 10 subthemes were created as outlined in Figure 6 below.

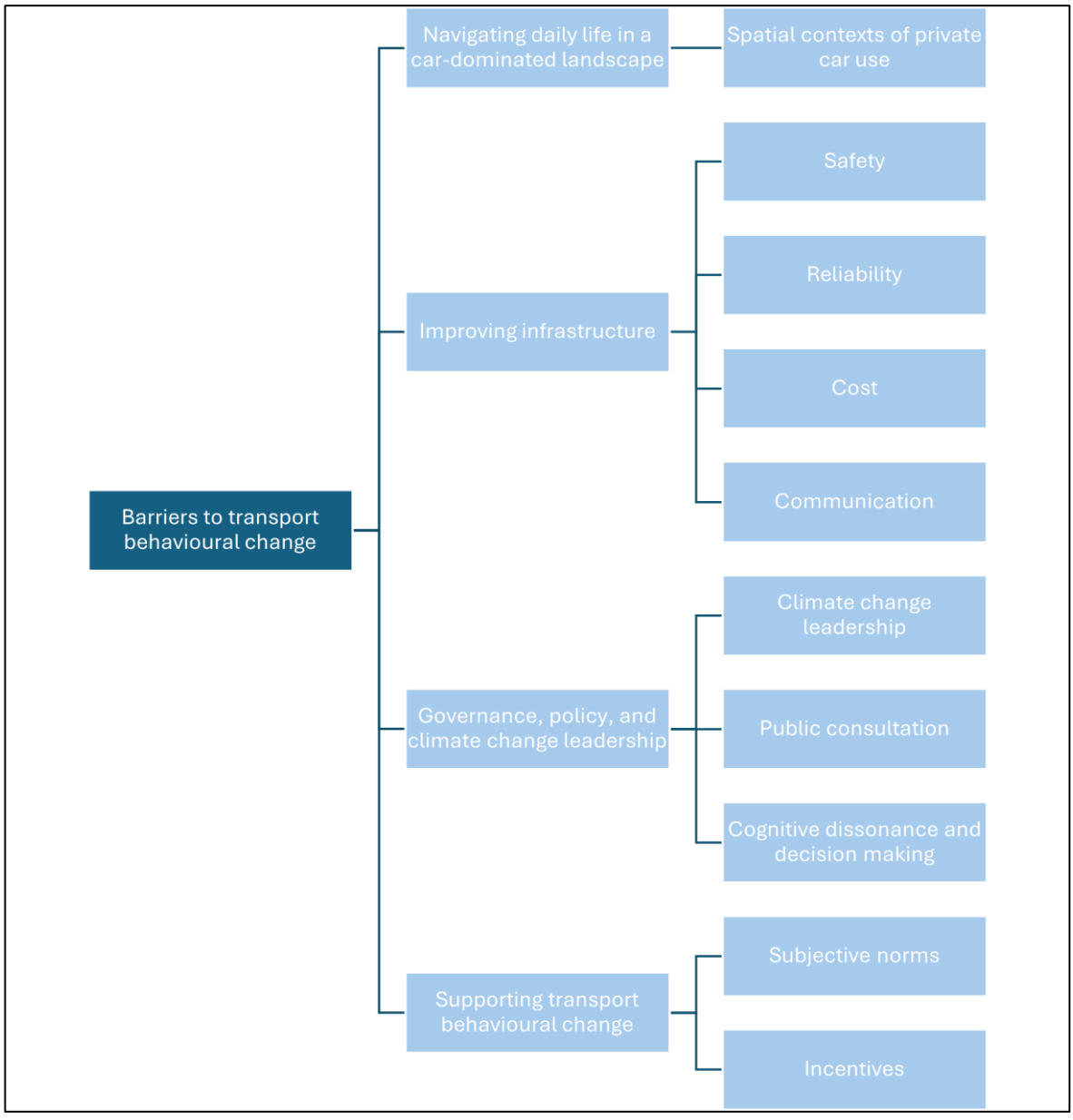


Figure 6: Overarching research objective, four supporting themes and 10 subthemes.

5.8 Conclusion

This chapter has examined the qualitative data analysis methods which were used for this study. These interviews sought to address the research aim of this thesis by focusing on the first two research objectives: identifying the current attitudes towards transport and travel in a post-COVID-19 Ireland and exploring the barriers to transport behavioural change; and assessing if the proposed incentives could support transport behavioural change. The analysis of these interviews utilised NVivo to conduct thematic analysis on the interview transcripts. The use of NVivo enabled the generation of meaningful insights into the interview participants perspectives on the current state of the transport sector. This chapter concludes the qualitative phase of data collection and analysis. An inductive and deductive approach to thematic analysis was utilised, providing flexibility in addressing the 'what' and 'why' of research objective two. The use of thematic analysis developed the four distinct themes and their associated 10 subthemes which are presented in the results Chapter 8. These interview findings expand the understanding of the experience of transport use for different sociodemographic groups, including older people and people living in rural areas of Ireland, alongside providing insight into what is required to develop and implement future transport infrastructure.

Chapter 6: Survey 2 Data Collection and Analysis Methods

6.1 Introduction

Chapter 4 detailed the survey methods used in this research to understand public attitudes and behaviours to transport in Ireland. In Chapter 6, methods related to a second round of surveying on attitudes and behaviours are provided. The implementation of a second survey emerged following analysis of data from both the first survey and from interview data. Drawing on these findings, a second survey subsequently sought to expand understanding of the first research objective: identifying the attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland. It also focused on addressing the second research objective, which sought to further identify the barriers to transport behavioural change. Specifically, whilst Chapter 4 examined attitudes and behaviours as it relates to transport in Ireland, the purpose of a second survey was to examine several contributing factors towards current transport attitudes and behaviours in greater depth and to examine responses between different cohorts of the population.

As detailed in Section 7.1, the data from survey 1 highlighted a significant disparity between individuals workplace attendance and their transport behaviour post pandemic. While the frequency of commuting changed post-COVID-19, the modes and distances remained largely unchanged from pre-pandemic levels. This suggested that the enforced behavioural shifts caused by COVID-19 were insufficient to disrupt long-term car dependency. Given the rebound in national transport emissions following the lifting of restrictions (EPA, 2025), the methodological focus of this research shifted from observing pandemic-driven changes in behaviour to assessing how incentives could serve as behavioural change motivators. As such, survey 2 was developed to identify the specific drivers and inhibitors of behavioural change by presenting participants with a series of targeted incentives. This second round of surveying was administered in a post-COVID context where the pandemic was downgraded and no longer considered a global emergency (WHO, 2023). This round of surveying was considerate of the results of the first survey and interviews which highlighted that safety, cost, and time were important indicators of travel behaviour. As such, the focus of Survey 2 sought to move beyond the unique circumstances of the pandemic to identify supports that could facilitate a more sustained long-term shift toward sustainable transport modes.

Section 6.2 provides an overview of the approach taken in designing a second survey, including the themes examined. In Section 6.3, an overview of the survey design is provided. Finally, details of the approach taken in analysing the survey data are described in Section 6.4.

6.1.1 Utilising a Second Round of Surveying

A second round of surveying was deemed essential to build upon and further explore specific findings that developed from the first survey and to address the gaps outlined in Chapter 2 relating to the factors influencing mode choice. Survey 1 provided initial insights into the intention-behaviour gap that existed among participants and revealed that their perceptions of safety, cost and time influence their mode choice. To further expand on these insights, survey 2 was designed to further uncover the specific barriers to behavioural change by focusing on perceptions of reliability through safety, cost and time. Furthermore, a second round of surveying was deemed necessary to further understand these differences in attitudes and behaviours across socio-demographic groups and to understand, to what extent incentives could support transport behavioural change, which directly addresses the three objectives of this research.

6.2 Writing the Survey Questions

Th second round of surveying sought to identify the perception of responsibility for climate change and transport emissions, why individuals choose their mode, when they feel safest waiting for and travelling on their mode, and measures that can be used to entice participants to use more sustainable mode choices in the future, such as improvements in current infrastructure and free fares. These barriers to transport behaviour and proposed incentives to encourage sustainable transport use were developed to respond to the research objectives and to further expand on emerging data insights evidenced from the first round of surveying. Specifically, analysis of data from the first survey highlighted a need to understand the motivation to use sustainable transport modes by investigating how feelings of responsibility, safety, and the provision of reliable infrastructure influences mode choice which was identified as a gap requiring further exploration in Chapter 2. Identifying the varying needs of transport users across different groups such as age, gender and transport modes also developed as a further research need from analysis of the first round of surveying. These questions were concerned with understanding how these experiences varied across different age groups, genders and mode users from public, active and private transport. A list of these survey questions can be found in Appendix C. As

outlined below, these results offer tangible policy recommendations to support transport decarbonisation in Ireland.

6.2.1 Writing the Survey Questions: Infrastructure

Questions about the motivations to use active travel were influenced by Carroll et al. (2021) who identified that commuters need incentives to alter their behaviour. They found that infrastructure is an important consideration for individuals who are thinking about walking as a mode choice, while time was important to those deliberating cycling as a mode choice (ibid). Aziz et al. (2018) also found that improving infrastructure would increase the likelihood of individuals choosing active travel modes. Survey questions were therefore developed concerning active travel modes to include the relevance of infrastructure in influencing mode choice and in promoting active travel modes as safe modes of transport. Questions on motivations to use public transport were covered under both safety and reliability of services that fall under the regularity of services and their financial accessibility. While research has been conducted on the potential impact of free public transport on travel behaviour (NTA, 2022), this survey is interested in identifying if public transport is still financially accessible to individuals and if reductions in fares could influence private transport users to switch modes.

6.2.2 Writing the Survey Questions: Safety

In Survey Round 1, questions on safety were concerned with the impact of COVID-19 on feelings of safety on public transport modes. Following the downgrading of COVID-19 in May 2023, the second round of surveying asked questions about personal safety, infrastructural impacts on safety and infrastructural improvements to increase feelings of safety on public and active transport modes. The development of these questions aimed to address how safety proposed a potential barrier to the uptake of sustainable transport responding directly to research objective two. Questions on safety have been developed following a consultation of the NTA's *Public Transport Passenger Personal Security Report* (2024). The report found that feelings of safety differ depending on the time-of-day passengers' travel. This experience is also differentiated by gender as per the TII report *Travelling in a Woman's Shoes* (2020). Singleton and Wang (2014) also identified that traffic safety influenced whether active travel modes were chosen. Furthermore, they found that 'higher densities of traffic signals and traffic calming' measures increased the likelihood of cycling (p.53). Questions were therefore developed in the survey that focused on safety to identify if certain measures such as improved infrastructure made individuals feel safer when considering using the mode.

6.2.3 Writing the Survey Questions: Responsibility

Questions on responsibility were expanded on from the first survey. While responsibility is an overarching theme in this survey, questions were asked directly about responsibility for greenhouse gas (GHG) related transport emissions and climate change. The questions examining personal responsibility and government responsibility on climate action and climate change have been developed following a consultation of the literature. These include Fudge and Peters (2011) work on personal responsibility versus government responsibility, and Severo et al. (2021) work on the impact of COVID-19 on social responsibility. Work by Stoddart et al. (2012) on the shared responsibility between individuals, governments, and corporations, and Fragnière's (2016) findings that individuals do possess at least some responsibility for reducing GHGs, informed the development of survey questions that ask individuals directly if they feel responsible for climate change.

6.2.4 Writing the Survey Questions: Question Types and Scales

Question styles adopted in this round of surveying were largely 5-point Likert scale questions using scales from strongly agree to strongly disagree and scales from always to never as they allow for easier statistical analysis (Tanujaya et al., 2022). There were also question styles that asked participants to select all options that apply to them and to order response options preferentially. For further details on these question types and scales, please see Appendix F which outlines survey 2. Similarly to survey 1, these question types were useful for coding the data for statistical analysis in SPSS, where 1= strongly agree, 2= agree, 3= neither agree or disagree, 4 = disagree, and 5 = strongly disagree and 1=always, 2= often, 3= sometimes, 4= rarely, and 5= never (Roopa and Rani, 2012). For questions that used select all that apply, items were coded as 1 = selected and 0 = not selected, as per best practice for utilising multiple response option data in quantitative analysis (Fowler, 2013).

6.3 Survey Design

The sample size calculated for survey 1 (384 participants) was also sought for survey 2 as this calculation for a representative sample size did not change since the first survey based on national census data. The sample size sought for the pilot was 10 participants as this pilot survey was primarily concerned with testing the ease of using the survey and the ease of understanding the survey questions (Hertzog, 2008). The survey was piloted in late July 2024, and responses was analysed and implemented in the first two weeks of August 2024. However, given that the piloting for survey 1 eliminated confusing dimensions of

the survey, it was unsurprising that the changes to survey 2 were relatively minor. This confirms the value of piloting as discussed in Section 4.8 (In, 2017; Connelly, 2008; Hassan et al., 2006; Presser et al., 2004; van Teijlingen and Hundley, 2001).

The survey went live in mid-August 2024 and closed at the end of October 2024. The purpose of this timeframe was to capture a large response rate. The survey was first sent to individuals who agreed to be contacted again after survey 1. These individuals provided their email addresses after the first survey and the link for the second survey was then emailed directly to them. A similar dissemination technique that was used in the first survey was employed again for the second round of surveying due to a good response rate geographically. The criteria for participating in the survey did not change, individuals had to be over the age of 18 and living in the Republic of Ireland.

The survey was advertised on social media platforms including Instagram and WhatsApp, and a greater effort was made to encourage snowballing by asking individuals to share the survey widely (Dusek et al., 2015). Alongside this, the survey was sent to environmental mailing lists and university emailing lists and a greater effort was made to send it to higher education institutes to increase the diversity of respondents alongside third level education. The survey was also sent to interview participants to share amongst their organisations to capture a wide selection of responses from hard-to-reach communities such as older people. The survey was closed at the end of October with n = 465 responses, an additional 18 participants did not fulfil the participation criteria, and a further 3 participants withdrew their consent and did not take part in the survey.

6.4 Analysing the Survey Data: Statistical Analysis in SPSS

The first round of surveying used a PLS-SEM approach to examine how the TPB framework could explore the relationships between multiple constructs. The second survey was developed following the results of the first survey and interviews and aimed to further explore the barriers to transport behavioural change through the lens of gender and age, alongside examining how proposed incentives might support transport behavioural change. As this required a more descriptive statistical approach, a different analytical tool was sought for survey 2.

Statistical analysis tools for analysing quantitative data include SPSS, R, Python and Stata. Some of these tools, such as Python and R, are programming languages and require a foundation in programming to

begin using this software for data analysis. Software such as Stata and SPSS are not open source and requires a paid license to use it. SPSS has an easy-to-use interface that can handle large datasets with a large number of variables and does not require previous programming experience like R or Python (Rahman and Muktadir, 2021). Additionally, as the university provides students with a licence for SPSS, it made SPSS a financially accessible option. As such SPSS was chosen as the data analysis software for this round of surveying.

The survey data was reviewed and cleaned in Microsoft Excel prior to importing it into SPSS. As per the requirements sought to fulfil a representative sample for the first survey outlined in Section 4.9, a sample size of n = 384 participants was sought. A total of n = 465 surveys were returned and n = 448 of these were deemed valid. Valid responses were determined by participants Eircode (postcode) where possible, gender and age. Participant responses missing socio-demographic details were removed from the study. While the criteria for fulfilling a representative sample of n = 384 was achieved, when the sociodemographic details outlined in Table 3 are compared to the 2022 Irish census, issues with representativeness of the sample occur. There was an overrepresentation of individuals aged 18-29 and an underrepresentation of individuals aged 45-59, 60-74 and 75+. Similar to the first round of surveying, students/pupils were overrepresented in this survey when compared to the Irish census.

The overrepresentation of individuals with a Masters/PhD in the first survey led to an emphasis on ensuring the survey was shared beyond third level contacts, however, the survey was also sent to university mailing lists and individuals in education outside of third level universities, which has had an impact on the overrepresentation of students/pupils in survey 2. Similarly, individuals with higher-than-average educational attainment are overrepresented in this survey when compared to the Irish census. However, as noted previously, a self-selection bias can occur with online surveys (Andrade, 2020). The full details of the representativeness of the survey sample are viewable in Table 4. While further efforts were made to increase the representativeness of the sample in this survey by contacting organisations that work with disadvantaged communities and older people, underrepresentation of some socio-demographic groups still exist.

Post-stratification weighting was conducted on the survey data in SPSS using weights that were based on the 2022 census data for each of the categories outlined in Table 5 (Perrotta et al. 2021; Royal, 2019; Poortinga et al., 2019; Kolenikov, 2016). While post-stratification weighting can assist in overcoming

representative issues in survey data, weighting cannot robustly account for underrepresented groups in this study (such as older people). As such, while this data is not nationally representative of the Irish public based on 2022 census demographic data, the findings garnered from this round of surveying still provide meaningful insights into transport experiences of individuals across Ireland. Furthermore, this research utilised a mixed-method approach to provide thematic depth into transport experiences from expert stakeholders in the transport sector and paired these with the quantitative results to provide a rich understanding of the current state of transport in Ireland. Aligning with the pragmatic approach adopted for this research, these findings enable a nuanced examination of the 'why' behind the transport behaviours of individuals in this research. Consequently, these findings provide a robust, evidence-based foundation for identifying specific barriers to transport behavioural change and informing policy recommendations for the Irish transport sector.

Demographic factors		Survey respondents	Irish Census Data (2022)
Gender (%)	Male Female	44.9 55.1	48.9 51.1
Age (%)	18-29 30-44 45-59 60-74 75+	49.8* 26.3 14.7* 8.5* 0.7*	19.7 28.7 26.0 18.2 8.5
Employment Status (%)	Working for payment or profit Looking for first regular job Unemployed Student or pupil Looking after home/family Retired from employment	60.2 0.9 1.5* 30.2* 2.2* 4.9*	62.2 0.9 4.7 7.2 7.3 17.7
Educational Attainment (%)	Intermediate/Junior Certification Leaving Certificate Vocational Qualifications Bachelor's degree or equivalent Masters/PhD or equivalent Other	1.6* 29.3* 7.8* 28.0 32.0* 1.3	15.7 21.6 15.7 32.0 14.8 N/A

Table 5: Socio-demographic characteristics for Survey 2 respondents compared with 2022 Irish census data. Note: *significant at p <0.001 compared with 2022 Irish census data (Central Statistics Office, 2024).

6.4.1 Statistical Testing in SPSS

These tests are used to address the second and third research objectives of this thesis which are concerned with exploring the barriers to transport behavioural change across specific socio-demographic

cohorts and assessing if the proposed incentives could support transport behavioural change. SPSS provides a number of parametric and non-parametric tests to determine the significance of variable relationships. Parametric tests are suitable for data that is normally distributed, while non-parametric tests are suitable for data that is non-normally distributed (Pallant, 2020). In this study, non-parametric tests have been used as the data is not normally distributed. The two tests used to examine this data are Mann-Whitney *U* tests and Kruskal Wallis tests. The Mann-Whitney *U* test is used to test the medians of two independent groups and in this research, it is used to examine the relationship between gender and barriers to sustainable transport uptake (Pallant, 2020). The average sample size needed for Mann-Whitney *U* tests is between 10 and 20 samples (Nachar, 2008). The Kruskal-Wallis test is similar to the Mann-Whitney *U* test, but it can compare more than two groups at a time (*Ibid*). In this research the Kruskal-Wallis test is used to examine the relationship between age groups and barriers to sustainable transport uptake, and mode users and their attitudes towards proposed incentives to encourage transport behavioural change. An acceptable sample size per group in a Kruskal-Wallis test is $n \geq 5$ samples to ensure the p- value is accurate (Ostertagova et al., 2014).

A number of Mann-Whitney *U* tests and Kruskal-Wallis tests were conducted to examine experiences of safety, infrastructure and incentives across different demographic groups. Where necessary, post-hoc pairwise comparison testing was conducted using Dunn-Bonferroni tests to further examine the results of the Kruskal-Wallis tests (Pallant, 2020). The results for these tests can be viewed in Chapter 9.

6.5 Conclusion

This Chapter has highlighted the rationale for a second survey as part of the objectives of this thesis. Additionally, it has examined the data analysis methods which were used for the second round of surveying. This round of surveying was deemed essential as the analysis of the first round of surveying, alongside the literature review outlined in Chapter 2, highlighted how safety, cost and time developed as core findings that required further investigation.

The second round of surveying sought to address the research aim of this thesis by focusing on three of the research objectives: identifying the current attitudes towards transport and travel in a post-COVID-19 Ireland; exploring the barriers to transport behavioural change; and assessing if the proposed incentives could support transport behavioural change and examine how these could be supported by disincentive measures. The analysis of this survey utilised SPSS to conduct non-parametric testing on the survey results

to further examine the relationship between gender and age on transport attitudes and behaviours. The use of SPSS enabled a statistical analysis of the non-normally distributed data to garner further insights into the attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland, and to understand how behaviour could change over time to support Ireland's climate goals.

6.6 Overall Methodology Conclusion

This section of the research examined the available research methods for collecting and analysing data from a mixed methods approach. These chapters identified that using surveys to collect data on individuals' transport attitudes and behaviours was the most suitable collection method for the quantitative portion of this research due to its accessibility as an online survey and its ability to reach a wider audience. This was particularly important during the restrictions put in place during the COVID-19 pandemic, as other options for research design were not possible. PLS-SEM was identified as the most suitable analysis methodology in survey 1 as it enables an effective examination of the TPB constructs (Chapter 4), while non-parametric test in SPSS enabled an examination of the relationship between variables such age and gender with feelings of safety, accessibility, reliability and incentivisation on transport modes in survey 2 (Chapter 6). Similarly, semi-structured interviews were identified as the most suitable data collection for the qualitative research as they provide the opportunity to examine research themes with the flexibility to explore themes that the interviewees bring up. Thematic analysis enabled a flexibility in the development and understanding of themes that arose within the interviews (Chapter 5). The results from the two rounds of surveying and qualitative interviews will be examined further in the next section.

Section 4:

Presentation of Results

Chapter 7: Presentation of Survey 1 Results

7.1 Introduction

This section of the thesis presents the results from the first round of surveying conducted between July-October 2022. As outlined in Chapter 4, a quantitative data collection approach using online surveys was deemed the most appropriate method of data collection for this portion of the research. This data collection addresses the overall research aim by examining the first two research objectives. Through a series of online surveys, a greater understanding of the current attitudes and behaviours towards transport modes has developed, which enables a greater exploration of the barriers that hinder transport behavioural change.

The preliminary analysis of travel behaviour compared individuals pre- and post-pandemic behaviour and highlighted a complex shift in commuting frequency. While commuting to the office or college five days a week was standard practice for many people before COVID-19, the results in this research show that these behaviours have shifted. Currently, only 22.3% of respondents maintain a five-day in person attendance, while 19.4% of respondents have shifted to in-person attendance of only 1-2 days per week. Despite this shift in in-person office and college attendance, other travel behaviours have remained largely similar to pre-pandemic patterns. 45.5% of respondents indicated that work remains the primary reason for travel among respondents post-COVID-19, while 55.3% of respondents report no change in their total daily travel distance. Furthermore, 70.1% of respondents reported that their travel modes remained unchanged post-COVID-19, with over 40% of respondents relying on their private cars as their primary mode post pandemic.

These results indicate that while COVID-19 altered how often people work remotely, it did not fundamentally alter how they travel. Given the increase in remote working caused by the COVID-19 pandemic and the legal right to request working from home opportunities in Ireland, these changes in office attendance are expected. However, this research has highlighted how the distances and transport modes are the same as pre-pandemic behaviours, which indicates that remote working has not entirely reduced the reliance on the private car for commuters.

Therefore, the focus of this research shifted toward understanding how to support a more substantive change in individuals travel behaviour to encourage a reduction in transport emissions and meet climate change goals. While the pandemic served as a hard disincentive for travel behaviour, the results of this research, and evidence that transport emissions have continued to increase since pandemic restrictions have been lifted (EPA, 2025), highlight that the pandemic was not enough to shift travel behaviour long term. This section examines survey 1 data to better understand the drivers and inhibitors that shape individual transport choices.

As outlined in Section 4.12, *n* = 314 online survey responses were received between July 2022 and October 2022. A breakdown of respondents by socio-demographic profile (age, gender, employment status, educational attainment) relative to Irish census data is also available in Section 4.12. Figure 7 below visualises the geographic spread of survey responses received for the first round of surveying where each dot represents the first three digits of respondents Eircode's (routing keys). Each dot can represent multiple responses if surveys were completed from respondents with the same routing key (e.g. D12 or A42).

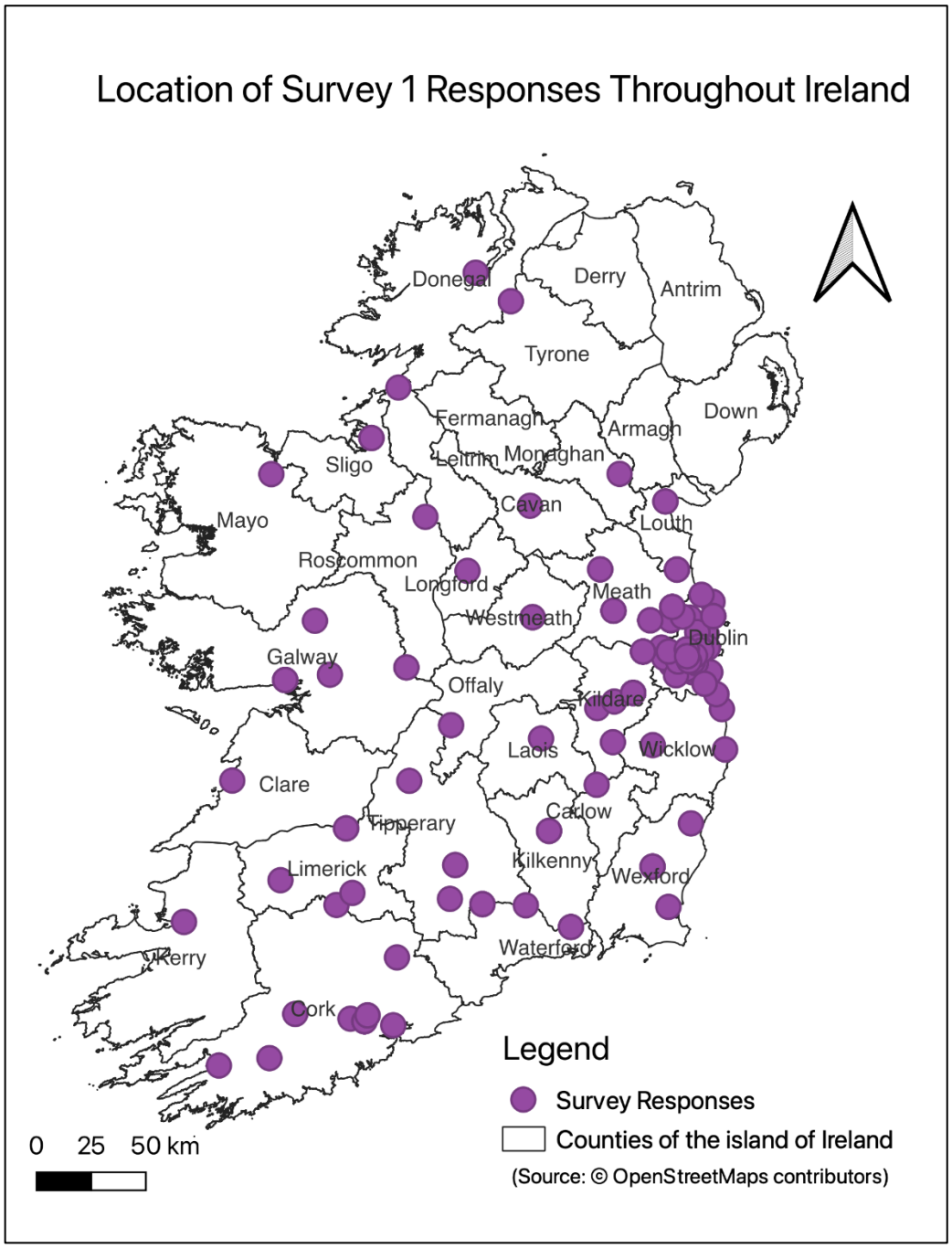


Figure 7: Eircode map showing geographic spread of Survey 1 responses

This chapter will outline the results from the statistical testing conducted using a PLS-SEM which allows for the testing of complex causal relationships between latent variables and will be used to analyse the underlying barriers and motivations to transport behaviour.

7.2 Measurement Model

As outlined in Section 4.11, a PLS-SEM approach was identified as the most suitable software for analysing the relationship between the TPB variables in the first round of surveying for this study. Steps were taken

to validate the PLS-SEM as per best practice outlined in Hair et al. (2019). This included examining the construct reliability and validity, outer variable loadings, internal consistency, convergent and discriminant validity and Goodness of Fit. Results of each of these are reported in further detail in the following sections.

7.2.1 Outer loadings

Outer loadings, also referred to as indicator reliability, measure the correlation between indicators (also known as observed variables) and the latent construct (also known as unobserved variables) (Hair et al., 2017, p.113). Outer loadings should be .708 or higher, while loadings of .70 are close enough to .708 to be accepted (ibid, p.113). Table 6 shows that five of six the outer loadings measuring the Perceived Behavioural Control construct are <0.70. However, Hair et al. (2017) has highlighted that weaker outer loadings are common in social science research. Given this, outer loadings with values between 0.40-0.70 should be analysed in relation to their impact on internal consistency reliability, which measures how consistent the results are of a set of indicators measuring the same latent construct (Hair et al., 2017, Hair et al., 2011). More specifically, if the indicator is deleted and the internal consistency reliability is increased, then the indicator can be deleted but its impact on content validity (how well the indicators are measuring the concept) should be considered. In this study, the Perceived Behavioural Control indicators in the model whose outer loadings are <0.70 were retained to ensure content validity of the Perceived Behavioural Control construct. This was done as these indicators are measuring safety, cost and speed, which are important factors that can influence transport mode choice as outlined in Section 2.5 (Abdullah et al, 2020).

Indicator	**Latent construct relationship**	**Outer loadings**
Private car usage is safer than active travel	Perceived Behavioural Control	0.573
Private car usage is safer than public transport	Perceived Behavioural Control	0.610
Private car usage saves money over public transport	Perceived Behavioural Control	0.698
Private car usage is cheaper than active travel	Perceived Behavioural Control	0.670

Private car usage saves time over public transport	Perceived Behavioural Control	0.660
Private car usage is faster than active travel	Perceived Behavioural Control	0.723
The Irish government cares about climate change	Attitudes	0.855
The Irish government is handling the climate crisis well	Attitudes	0.921
I would comply with restrictions to help combat climate change	Intentions	0.790
I would drive less to reduce travel emissions	Intentions	0.875
I would fly less to reduce travel emissions	Intentions	0.735
I would use public transport more to reduce travel emissions	Intentions	0.853
Private car use does not make an individual more environmentally friendly	Subjective norms	0.912
Flying does not make an individual more environmentally friendly	Subjective norms	0.908
I use active travel more than public transport	Pro-environmental behaviour	0.727
I use active travel more than the private car	Pro-environmental behaviour	0.857
I use public transport more than the private car	Pro-environmental behaviour	0.785

Table 6: Outer Loadings.

7.2.2 Reliability and Validity

The reliability and validity scores of the PLS-SEM tests are outlined in Table 7 below. The Cronbach's α is used to measure internal consistency reliability of indicators in the PLS-SEM (Hair et al., 2019; Cronbach, 1951). The values of a Cronbach's α test will produce lower values when compared to composite reliability tests as the Cronbach's α is an unweighted test (Hair et al., 2019). As such, the results of the composite reliability tests should also be reported, and these results are outlined in Table 7 also. As per best practice, composite reliability values between 0.6-0.7 are acceptable in exploratory research, while values between 0.7-0.9 are considered satisfactory to good (Hair et al., 2019, p.8). In this research, the Cronbach's α are all >0.7, which are satisfactory. Composite reliability (rho_a) is the measure that falls between an underestimation from the Cronbach's α and an overestimation from the composite reliability (rho_c). The composite reliability (rho_a and rho_c) in this study is >0.7. Given these results are in line with best practice outcomes outlined in Hair et al. (2019), the model's internal reliability is therefore satisfied. These results highlight that the data used in the model is consistent and provides reliable insights to give meaningful results about the relationships in the model.

Construct	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Attitudes	0.738	0.779	0.882
Intentions	0.834	0.864	0.887
Perceived Behavioural Control	0.742	0.751	0.820
Pro-Environmental Behaviour	0.703	0.708	0.834
Subjective Norms	0.793	0.794	0.906

Table 7: Internal consistency and reliability scores.

7.2.3 Convergent and Discriminant Validity

Convergent validity, measured using the average variance extracted (AVE), examines the extent to which the construct accounts for the variance in the corresponding indicators (Hair et al., 2017, p.113; Lowry and Gaskin, 2014). The AVE should be ≥0.50 which indicates that the latent construct accounts for at least 50%

of the variance of its indicators (Hair et al., 2019, p.9). Table 8 shows that attitudes, intentions, pro-environmental behaviour, and subjective norms each have an AVE ≥0.5 as per best practice outlined previously. However, perceived behavioural control has an AVE of 0.432 which is below the ≥0.5 threshold. In their study, Muhamad Safiih and Azreem (2016) note that an AVE score >0.4 is acceptable to assert convergent validity of the construct provided the composite reliability score of the construct is ≥0.6 (p.46). The composite reliability score for perceived behavioural control, outlined in Table 7, is >0.6 which therefore meets convergent validity assumptions and is acceptable. These results show that the indicators used to measure each concept in the model are grouped appropriately and relate well to each construct they were designed to measure, which further validates the design of the model.

Construct	**Average variance extracted (AVE)**
Attitudes	0.789
Intentions	0.664
Perceived Behavioural Control	0.432
Pro-Environmental Behaviour	0.626
Subjective Norms	0.829

Table 8: Average Variance Extracted (AVE) measuring convergent validity.

Discriminant validity is a measure of how distinct a construct is from other constructs in the model, ensuring that they are measuring different things (Lucarelli et al., 2020; Hair et al., 2019; Muhamad Safiih and Nor Azreem, 2016; Lowry and Gaskin, 2014). To measure discriminant validity, the heterotrait-monotrait ratio (HTMT) was used in this research. As outlined in Hair et al. (2019), issues exist with discriminant validity if the HTMT ratio scores are >0.9, while a more stringent measure of >0.85 is recommended (p.9). The results from the HTMT ratio in this study are outlined in Table 9 below. These results show that no construct violates discriminant validity scores of >0.85. The results from the discriminant validity test show that each of the constructs in the model are distinctly measuring different things, which supports the design of the model.

Construct	Attitudes	Intentions	Perceived Behavioural Control	Pro-Environmental Behaviour	Subjective Norms
Attitudes	-				
Intentions	0.104	-			
Perceived Behavioural Control	0.188	0.482	-		
Pro-Environmental Behaviour	0.202	0.518	0.553	-	
Subjective Norms	0.427	0.462	0.462	0.410	-

Table 9: Heterotrait-Monotrait ratio (HTMT) measuring discriminant validity.

7.3 Structural Model

To ensure that the regression results were not biased in this study and that the indicators were measuring different things, collinearity was measured using the Variance Inflation Factor (VIF) as per best practice (Hair et al., 2019). VIF values > 5 indicate issues with multicollinearity. Collinearity issues can also occur for VIF values between 3-5. As outlined in Table 10 below, VIF scores are <3, ranging from 1.296-2.287, which indicate that there is a non-significant risk for collinearity.

Indicator	VIF
Flying does not make an individual more environmentally friendly	1.761
I would comply with restrictions to help combat climate change	1.718

I would drive less to reduce travel emissions	2.287
I would fly less to reduce travel emissions	1.735
I would use public transport more to reduce travel emissions	1.960
Private car usage saved money over public transport	1.484
Private car usage saved time over public transport	1.706
Private car usage is cheaper than active travel	1.427
Private car usage is faster than active travel	1.786
Private car usage is safer than active travel	1.474
Private car usage is safer than public transport	1.467
Private car use does not make an individual more environmentally friendly	1.761
The Irish government cares about climate change	1.518
The Irish government is handling the climate crisis well	1.518
I use active travel more than public transport	1.431
I use active travel more than the private car	1.683

I use public transport more than the private car	1.296

Table 10: Collinearity Statistics (VIF).

To examine the relationships in the hypotheses, outlined in Table 2 in Section 4.11, a bootstrap calculation, using 5000 subsamples, was performed as per best practice (Hair et al., 2019). This bootstrapping calculation enables the relationships in the hypotheses to be tested for significance. The R^2 value is a calculation which measures the variance explained in an exogenous construct by its predictor constructs. The exogenous constructs in this model are pro-environmental behaviours and intentions i.e., attitudes, perceived behaviour control and subjective norms predict both intentions and pro-environmental behaviour. The R^2 value ranges from 0 to 1 where higher values have greater explanatory power for the variance in the model (Hair et al., 2019). Variances of <.25 are considered weak (Hair et al., 2019). However, in some research areas, values as low as <0.1 can be considered satisfactory (Hair et al., 2019). Table 9 below outlines the R^2 values and show that 22.7% of the variance in the model can be explained by intentions and 25% of the variance in the model can be explained by pro-environmental behaviour, where both of these figures are statistically significant. Hair et al. (2019) note that valid R^2 values should be considered in the context of the research area and based on similar R^2 values from studies in similar fields. Li et al.'s (2021) study on travel behaviour intentions reported R^2 values as low as .11 (11%), while Zhang et al.'s (2024) study on post-pandemic travel behaviour intention reported R^2 values as low as .178 (17.8%). As such, these values are deemed acceptable for this research. As previously discussed in Chapter 2, transport behaviours are influenced by a number of complex psycho-social factors. These factors may explain why the low variance scores and will be explored further in Chapter 10.

Construct	**R^2 values**	**T values**	**P values**
Intentions	0.227	4.680	0.000
Pro-Environmental Behaviour	0.251	6.796	0.000

Table 11: R2 values of Exogenous Constructs.

A blindfolding procedure is used to test the predictive accuracy of the model by calculating the Q^2 values for the exogenous constructs (Hair et al., 2019). This value explains how well the model can predict new or unseen data. Q^2 values should be greater than 0 to indicate predictive relevance, while values ranging

from 0, 0.25 and 0.5 indicate small, medium and large predictive relevance (ibid). As per best practice, the Q^2 values were tested for this model. The results show that the Q^2 values for intentions and pro-environmental behaviour were 0.192 and 0.093 respectively. These results indicate that the model has a small predictive relevance in predicting transport related intentions and behaviours in real-world contexts. However, the model does have valid predictive power as both $Q^2 > 0$, which shows that the model provides better out of sample predictions than chance. These figures can be viewed in Table 12 below.

Construct	**Q^2 values**
Intentions	0.192
Pro-Environmental Behaviour	0.093

Table 12: Q^2 values of exogenous constructs.

7.4 Goodness of Fit

The Standardized Root Mean Square Residual (SRMR) quantifies the divergence between the observed and estimated covariance matrices and is used as model fit measure in PLS-SEM (Hair et al., 2019). However, utilising model fit measures in PLS-SEM should be considered with extreme caution as the PLS-SEM is focused on predictive accuracy rather than perfect model fit (ibid). Despite its limitations, SRMR values <0.10 have been suggested as an acceptable fit (Ringle et al., 2022).

The Normed Fit Index (NFI) is an additional measure of fit which compares the discrepancy in the chi-square of the proposed model against a baseline model where all variables are uncorrelated (Aghimien et al., 2024). NFI values closer to 1 indicate a good fit, with other studies reporting 0.6-0.9 to be an acceptable fit (ibid). The SRMR value in this model is 0.107 and the NFI value is 0.625 (outlined in Table 13), which both suggest a moderate model fit. However, as outlined in the literature, assessing model fit for PLS-SEM should be treated with extreme caution as it is not the primary focus of the model itself (Hair et al., 2019).

Measurement	**Saturated model**	**Estimated model**
SRMR	0.09	0.107

d_ULS	1.234	1.752
d_G	0.376	0.383
Chi-square	736.467	724.199
NFI	0.618	0.625

Table 13: Goodness of Fit measurements.

7.5 Hypothesis Testing and Path Analysis

As seen in Table 1 in Section 4.11, five hypotheses were proposed to examine attitudes, subjective norms, perceived behavioural control, pro-environmental behavioural intention, and pro-environmental behaviours in the context of transport in Ireland. These hypotheses were developed following a review of the literature outlined in Chapter 2 to support the research aim of assessing attitudes and behaviours of individuals towards transport and travel in a post-COVID-19 Ireland, and to further understand how behaviour could change over time to support Ireland's climate change goals. This survey was concerned with examining research objective one and two; to identify the current attitudes and behaviours towards transport and travel in a post-COVID-19 Ireland, and to examine the barriers to behavioural change among transport users. In light of the data presented above, the outcomes of the hypotheses testing are discussed below and can be viewed in Table 14. When assessing the significance of indicators, indicator weights closer to +1 or -1 indicate a strong positive or negative relationship (Hair et al., 2021). The results of the PLS-SEM showing the path coefficients can also be viewed in Figure 8 below.

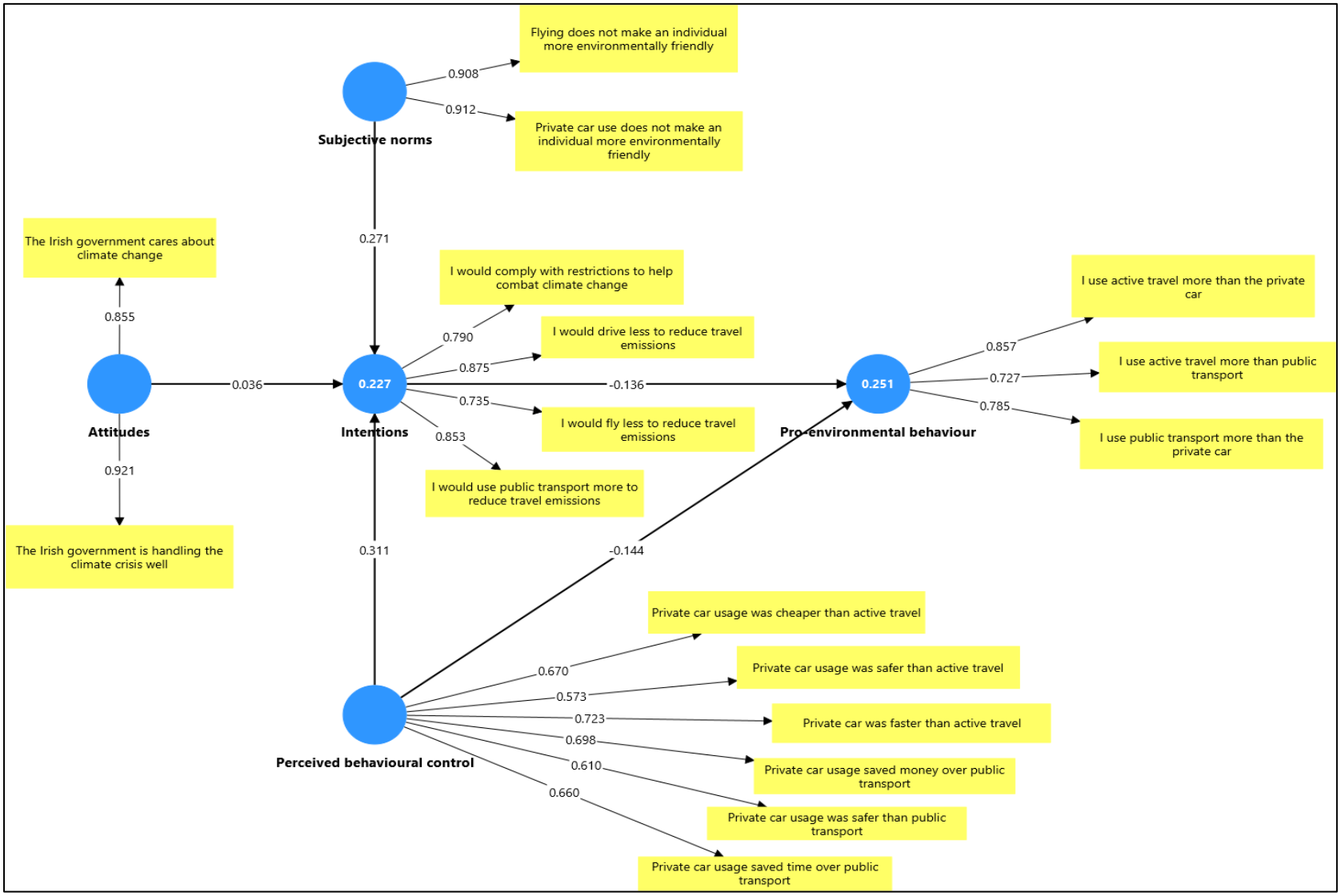


Figure 8: PLS-SEM showing the path coefficients

i. Hypothesis 1: Individuals who view the government's approach to climate change as effective are more likely to intend to use sustainable transport.

Attitudes towards government response to climate change did not have a significant influence on pro-environmental behavioural intention (B (Beta) = 0.036, p = 0.516) and therefore hypothesis 1 was not supported. The results indicated that individuals demonstrated limited intention to support efforts on climate action by intending to use sustainable transport modes, regardless of their belief about the effectiveness of the government's action on climate change.

ii. Hypothesis 2: Individuals are more likely to intend to travel sustainably if they perceive that others view private car use and flying as environmentally unfriendly.

The results of the PLS-SEM analysis indicated that there was a statistically significant relationship between subjective norms and pro-environmental behaviour (B = 0.271, p<0.001). These results suggest that social norms relating to the environmental harms associated with the private car and flying positively influences individuals' intention to reduce their use of these modes and increase their uptake of sustainable transport modes.

iii. Hypothesis 3: Individuals' beliefs about private car benefits, as they relate to speed, safety, and cost, influence their intentions to continue to use that transport mode.

The results of this analysis indicated that individuals perceive the private car to be safer, faster and cheaper than sustainable transport modes. The perceived benefits of safety, speed and cost associated with the private car do not limit individuals' intentions to use sustainable transport modes in this research, which is outlined in the positive relationship for hypothesis 3 (B = 0.311, p<0.001). These results suggest that while individuals value the perceived benefits of safety, cost and speed that the private car affords them, they still intend to use sustainable transport modes. This result is important given that individuals perceive the private car as advantageous in terms of safety, cost and speed. However, they still intend to use sustainable transport modes which indicates they want to act in a pro-environmental way.

iv. Hypothesis 4: Individuals who intend to travel more sustainably are more likely to actually do so.

Pro-environmental intentions to travel more sustainably do not positively influence pro-environmental transport behaviour (B = -0.136, p<0.001), therefore hypothesis 4 is not supported. The results of this research indicate that individuals expressed intentions to use sustainable transport options, including driving and flying less and using public transport more, does not translate into actual transport-related behaviours i.e., whether individuals actually use active or public transport options

more than the private car. Furthermore, these results indicate that individuals' use the private car more than active and public transport despite their pro-environmental transport intentions which suggests a cognitive dissonance to some extent. This intention-behaviour gap is important in understanding the current state of transport behavioural change and will be explored further in the discussion chapter.

v. Hypothesis 5: Individuals who believe that private car usage is fast, safe, and cheap are more likely to use it.

H5 hypothesised that individuals who perceive the private car as safer, faster and cheaper than sustainable modes are less likely to use sustainable transport modes which the results of this study support. The results indicate a negative significant relationship between individuals' sense of control towards the private car and their pro-environmental behaviour and therefore hypothesis 5 is supported (B = -0.144, p<0.001). When individuals perceive the private car as being advantageous in relation to safety, speed and cost, they are more likely to use it. These results highlight the importance of safety, cost and time in shaping individuals' perception of control over their transport mode choices and how these factors could influence their pro-environmental transport behaviour.

Hypothesis	**Relationship**	**Path coefficient (B)**	**T-Value**	**P values**	**Results**
H1	Attitudes -> Intentions	0.036	0.650	0.516	Not Supported
H2	Subjective Norms -> Intentions	0.271	3.919	0.000*	Supported
H3	Perceived Behavioural Control -> Intentions	0.311	5.804	0.000*	Not Supported
H4	Intentions -> Pro-Environmental Behaviour	-0.136	5.934	0.000*	Not Supported

H5	Perceived Behavioural Control -> Pro-Environmental Behaviour	-0.144	5.635	0.000*	Supported

Table 14: Results of the Hypotheses testing (*significant at the 0.001 level).

7.6 Conclusion

This chapter has outlined the results from the first round of surveying conducted in 2022. These results show that perceived behavioural control, measured by cost, time and safety, is an important influence on determining individuals' sustainable transport behaviour. Interestingly, while PBC stands as a barrier to sustainable transport uptake, it does not stand as a barrier to behavioural intention which indicates that individuals' intentions to use sustainable transport behaviour is strong, regardless of how advantageous the private car is perceived in terms of cost, time and safety. Furthermore, while individuals express pro-environmental behavioural intention, this does not significantly influence the uptake of sustainable transport which indicates an intention-behaviour gap that poses a barrier to sustainable transport behavioural change. The next chapter will examine the second round of surveying conducted in 2024 which further outlines the barriers to sustainable transport behaviour.

Chapter 8: Presentation of Interview Results

8.1 Introduction

The qualitative portion of this research examines insights from individuals working in the transport sector at a variety of levels such as policy making, advocacy, and transport infrastructural development, to capture an understanding of the state of public, active and private transport in both urban and rural areas in Ireland. Section 5.4 outlines how a qualitative semi-structured interview methodology approach allows for greater depth of understanding to be captured from interviewees while still addressing the central questions on the interview guide (Bryman, 2016; Valentine, 2013). Utilising this approach served as the most appropriate qualitative data collection method to complement the interviews as it allowed for flexibility during the interviews and space for new themes to emerge.

Eight organisations from both rural and urban areas across Ireland shared their insights of providing transport services to a range of individuals. These interviews were transcribed and analysed using a thematic analysis approach to capture an understanding of the state of transport infrastructure at both urban and rural levels in Ireland. This chapter presents the analysis by first discussing the sample profile of interviewees including sociodemographic details to identify where these perspectives are situated across Ireland. The chapter also outlines the four key themes (navigating daily life in a car-dominated landscape, improving infrastructure, governance, policy and climate change leadership, and changing behaviours through incentives and collective action) that have developed from the literature analysis (as seen in Chapter 2). It combines this thematic structure with interview coding conducted in NVivo. The subthemes that have developed from the literature and the coding process are then discussed to provide primary data related to the overarching themes. These themes and subthemes speak to the main aim of this research. They also help to unpack the state of transport infrastructure in Ireland and how this can facilitate transport attitude and behavioural change.

The interviewees in this research originate from organisations ranging from care for the elderly and rural transport advocacy to county council roads planning and customer experience specialists in the National Transport Authority. This range of insights from these key stakeholders provides a broad understanding of transport needs at both a top-down and bottom-up level. These insights also shed light on experiences of transport use, expectations of transport infrastructure development and the realistic delivery of infrastructure in the confines of policy and funding. Of the eight interviews that took place, twelve individuals were interviewed, with an equal male/female split. Interviewees who have chosen to be

anonymous in this research are referred to by their chosen work title. Interviewees who were satisfied with their full identity being disclosed are referred to by their full name.

The following organisations provided representatives to be interviewed:

1. **Irish Rural Link**. This organisation represents groups at a rural level who are disadvantaged or marginalised. A member of Irish Rural Link participated in an interview on behalf of the organisation.
2. **COPE Galway**. This organisation provides services for older people living alone, as well as people experiencing homelessness and domestic violence. Five members of COPE Galway chose to remain anonymous in their interview where they discussed the services they provide for older people.
3. **Donegal County Council Roads Department**. This department deals with implementing transport infrastructure in Donegal County. Damian McDermott is a Senior Executive Engineer in Donegal County Council and participated in an interview to discuss his role in providing transport infrastructure across Donegal.
4. **Iarnród Éireann**. This body delivers rail services across Ireland. A member of Iarnród Éireann chose to remain anonymous in their interview where they discussed the role of Iarnród Éireann in providing rail infrastructure in Ireland.
5. **The National Transport Authority (NTA)**. The NTA provides sustainable transport infrastructure across Ireland. John O'Flynn is the Head of Customer Experience for the NTA and discussed the role of the NTA in providing sustainable transport infrastructure in Ireland.
6. **Rail Users Ireland**. This is a national organisation for rail users. Colm Moore is the Liaison Officer for Rail Users Ireland and provided insights into user experiences across all public transport modes in Ireland.
7. **TFI (Transport for Ireland) Bikes** provides bike infrastructure outside of the Dublin region. Sean O'Dwyer is the Director of Telfourth which provides TFI bikes outside of Dublin and was interviewed to discuss the role of active travel infrastructure outside of Dublin.
8. **A member of Dáil Éireann** provided insights into the political aspects of transport in Ireland. A member of Dáil Éireann (until November 2024) chose to remain anonymous as they provided insights into the political and policy aspect of providing transport infrastructure across Ireland.

The research aim and objectives were developed through a search of the literature outlined in Chapter 2, and this informed the development of the interview questions. Additionally, the results of the first round

of surveying, conducted and analysed prior to the interviews, presented themes and further questioning that were identified as areas for further exploration for the interviews. As outlined in Chapter 7, the initial descriptive analysis of the first-round surveying highlighted how individuals' transport behaviour returned to pre-pandemic behaviour when the restrictions were lifted. As such, while COVID-19 arose during these interviews, it was largely in the context of lessons learned from the pandemic that could be applied to approaching climate change, and in the context of behavioural change supported through infrastructure development.

Upon completion of these interviews, a combination of deductive and inductive approaches was used in the development of the interview themes as the interviews were analysed line by line and thematically analysed using NVivo (Braun and Clarke, 2012). These interviews were initially grouped into larger topics such as 'Active Transport' and 'Safety'. However, as these interviews were further analysed line-by-line four key themes arose which address the second research objective of exploring the barriers to transport behavioural change and the third research objectives of assessing if incentives could support transport behavioural change. The key themes that emerged from the interviews address the barriers to transport behavioural change, which directly addresses the second research objective. These key themes are as follows:

- Navigating daily life in a car-dominated landscape
- Improving transport infrastructure
- Governance, policy and climate change leadership
- Incentives and collective action

The following section will examine these key themes that have developed from the qualitative interviews.

8.2 Theme 1: Navigating daily life in a car-dominated landscape

All of the interviews conducted identified a shared perspective regarding the barriers that arise when navigating daily life in a landscape that is dominated by the private car. The lack of suitable infrastructure and the transport and housing planning that has prioritised the private car has and continues to hinder individuals' ability to switch from the private car to public and active modes of transport. This lack of transport behavioural change has impacted the transport sector's emission reductions targets as transport emissions have continued to rebound since the COVID-19 pandemic (EPA, 2025). This experience is seen at both urban and rural levels. However, the lack of suitable public transport infrastructure at a rural level can exacerbate the likelihood of forced car ownership (Carroll et al., 2021). 71% of all trips in Ireland were made by car in 2023, while 82% of all trips in rural areas were made by car

(NTA, 2024). This high reliance on the private car for trips identifies an issue with the provision of public transport available across Ireland and particularly in rural areas of the country.

This lack of suitable public transport in rural areas has led to individuals in rural areas relying on their private car. A member of Irish Rural link noted that this lack of public transport has an impact on car dependency:

> …if you said to a rural person about public transport they'd be like 'what public transport'. So, I think very much like the, the attitude towards public transport is like the overall general attitude is it doesn't exist… For people in rural areas, we'd find among our members and our members members, that, I mean, the lack of transport is the lack of reliable public transport and that kind of robust public transport system in rural areas has been, I suppose, the forefront of why people depend on the car so much. (A member of Irish Rural Link)

A similar discussion about forced car ownership was discussed by Damian McDermott, Senior Executive Engineer for Donegal County Council. While he identifies the need for suitable public transport infrastructure to promote mode shifts from the private car to public transport, he notes that this cannot be facilitated without good road infrastructure:

> Again, the forced car ownership is a big thing in that like, you know, you have to have the car, but you can make the car more efficient, or you can, you can limit where the car goes. You can get the car as far as the outskirts of town if you've got a good bus system within the town, but you have to have that system down, and the buses don't work unless the roads are good. (Damian McDermott, Donegal County Council)

John O'Flynn, Head of Customer Experience at the National Transport Authority (NTA), expressed that the private car would be hard to replace in rural areas due to the current lack of public transport infrastructure in these regions. This is, in part, due to the dispersed planning of homes in rural areas:

> The car is still totally dominant. If you think about the origin, destination pairs that people have to go to, in other words, from their rural house to maybe someone else's rural house, or else from their rural house to a shop, etc. Public transport, in a traditional sense, will find it very difficult to fill all those gaps. (John O'Flynn, National Transport Authority)

He continues to note that while public transport in rural areas provides a number of benefits to individuals, the gap that is left in rural journeys may be hard to fill with current public transport

infrastructure. This again points to the dispersed planning of housing, which leaves gaps in the infrastructure's ability to connect all of these areas up:

> …it's the services you know, to be great for getting someone to and from college or something, or to and from, maybe the bingo on a Thursday night, or to and from a health centre. And that's, that's great. That's fantastic, and that's a great journey, but it doesn't always fully take care of the need for the car, because look, your friend's house is over in another part of Mayo, you know? And it's not, it's not served, you see, so, so, so that flexibility of a car going anywhere you want, it just, frankly, isn't, isn't addressed in full vital provision of these services… The service will be used. The service helps people save money. It helps people in their lives. Helps their kids get to college and as well as their grandparents get to different things. So, it's well worth investment, but it just in the in the rural area, it will not replace the car. (John O'Flynn, National Transport Authority)

This gap between public transport provision and continued dependency on the private car was also echoed in an interview with the member of Dáil Éireann, where they note that the dispersed settlement hinders providing public transport services that can rival the car:

> …the government has kind of said oh for rural public transport electric vehicles are a big part of the solution. Okay, they probably are, but they shouldn't be saying they're the only solution for rural public transport. Now, we do have a dispersed population, and it's hard to provide public transport, and not only a cost effective, but appealing, like, if your option to go to the next village is, let's say, it is every village every hour, let's say it takes you an hour to get there. You know, that's not a huge advantage. So, a dispersed population mitigates against providing fast and appealing public transport. And, if you don't try and capture the, you know, the people living in one off homes all over the place, then, you know, then they're going to be driving, right? So, we are somewhat hamstrung by that settlement pattern, you know if everybody lived in villages it'd be a hell of a lot easier. (Member of Dáil Éireann)

While John O'Flynn, Head of Customer Experience at the National Transport Authority (NTA) notes that ridership increases with service enhancements stating, 'every time we introduce a new service or even enhance an existing service in the rural area, we see significant growth in that service', a member of COPE Galway noted that there is still a lack of suitable infrastructure alongside these services, asking 'Where do you wait in the pouring rain?' when waiting for a public transport mode.

This desire for suitable infrastructure to complement public transport use was noted by Sean O'Dwyer (TFI Bikes) when he stated that 'you have to have a place for people to park the car' when switching

between the private car and public and active modes of transport. Filling this gap for last-mile transport with infrastructure such as park-and-ride infrastructure and door-to-door buses was also noted by a member of Irish Rural Link when discussing barriers to transport behavioural change in rural areas: 'there's that piece around the last mile transport, whether that's like, a car, I know, some of the, the local links [small rural bus services], like, a lot of them do have the demand response and they do the door-to-door services as well'. The barriers to switching from the private car to public transport is related to the lack of suitable infrastructure available at both an urban and rural level which has been identified by a number of interview participants.

While the development of roads infrastructure was not discussed in every interview, there was an emphasis on the value of improving roads and the road networks in Donegal in order to facilitate the availability of effective public transport and active travel infrastructure. Damian McDermott (Donegal County Council) has emphasised the importance of improving the currently 'very, very poor' roads infrastructure in the county. While there is an acceptance that rail will not be facilitated in Donegal due in part to its remote location from urban centres and the associated costs with establishing a railway network in such a remote setting, this leads to an emphasis on improving road infrastructure to facilitate the overall improvement of public and active transport modes by implementing 'a multimodal solution which do improve roads with active travel facilities'.

From the analysis of theme 1, the interview data reveals that the availability of suitable public transport infrastructure that meets the needs of individuals varies across Ireland and the experience of the availability of services differs from urban to rural levels. The results show that this barrier to transport behavioural change can influence individuals transport choices if their transport needs are not effectively met by the sustainable transport infrastructure. The next theme focuses on insights from interview participants on active travel infrastructure across Ireland.

8.3 Theme 2: Improving infrastructure

In this thematic area, four sub-themes emerged: those concerning safety, reliability, cost and communication. The following section will examine these subthemes in relation to the overarching theme of improving infrastructure.

8.3.1 Improving Infrastructure: Safety

Active travel was discussed in seven of the eight interviews conducted with participants. The experience of active travel differed for older people and the perspectives also varied at urban and rural levels. The investment in active travel infrastructure in Ireland since 2020 has surpassed €1 billion (NTA, 2024). However, interviewees have identified issues with the planning and implementation of active travel infrastructure across Ireland alongside the safety concerns with current infrastructure.

John O'Flynn has noted that the NTA are 'delivering 10 times more active travel infrastructure [than 5 years ago]' which has increased largely over the last five years. However, Damian McDermott feels that active travel infrastructure in Donegal is 'not far enough along, we're not far enough long' and that there has not been a lot done in relation to this infrastructure.

The member of Dáil Éireann notes that high levels of active travel will not be seen without building whole active travel networks. However, they state that 'we can't deliver whole networks overnight, we can deliver components of them quite quickly, and then time, when there will be time, we will build the networks'. The importance of building whole networks at once to facilitate behavioural change rather than building smaller parts of the network over time is also discussed by Damian Mc Dermott where he notes that 'The main thing is, when you build it, build it properly and build it complete. If it's all bits and pieces, nobody'll want to use it. If it's complete, and you encourage people to use it, then you're flying'. The importance of having full networks that are completed and connected to facilitate active travel is a current gap in the transport infrastructure that could aid transport behavioural change.

Safe and suitable infrastructure has presented itself as a barrier to active travel use among some users. A member of Irish Rural Link has noted that rural roads are unsuitable for active travel at present due to a 'space issue' that does not enable active travel and private car travel to coincide safely and effectively. Sean O'Dwyer notes that there are safety concerns for cyclists in regional cities also and that his personal experience of cycling has led him to not feel '100% safe' when cycling in these regions. The member of Dáil Éireann expresses safety concerns for cyclists on Irish roads where they note that they 'wouldn't ask anybody and suggest that they should cycle most of our roads. You know, that'd be, they're too dangerous too risky. And that's for men and women.'. They note that the infrastructure is needed to improve these safety concerns and that 'we simply have to have that infrastructure, you know, that's key with this. It doesn't, it simply doesn't happen without it'. However, they note that resolving the concerns around feelings of safety with cycling is not easily done and that 'It's hard to crack the safety piece in cycling

without delivering the infrastructure'. This emphasis on improving infrastructure to increase feelings of safety and improve ridership across modes has been echoed across these interviews.

When considering the safety of active travel from the perspective of older people, a member of COPE Galway noted that walking 'just doesn't come up with conversation because they've already just limited it out before we get to the conversation'. Ruling out active travel infrastructure occurs for older people because 'paths … wouldn't be … upgraded enough for a nice, smooth surfaces, or a trip free surfaces' according to a member of COPE Galway. These safety concerns regarding the suitability of the active travel infrastructure impact the use of active travel by older people. Another member of COPE Galway notes that 'If you are an older person who can walk, but you're a bit fearful, you're not gonna do it in my opinion'. Improvements in the active travel infrastructure could also benefit individuals who use wheelchairs and mobility scooters; however, a member of COPE Galway finds that 'a lot of work needs to be done' to make active travel infrastructure safer for older people and people with additional needs.

Perceptions of safety have also touched upon feelings of safety at different times of the day and also in certain locations. John O'Flynn (NTA) noted that most people feel safe. However, 'they're concerned about certain times of the day, and they're concerned about some geographic hot spots'. These concerns regarding safety in certain locations are also discussed by the member of Dáil Éireann where they note 'I don't feel safe walking around Dublin' and questions how the average woman would also feel regarding their safety. The member of Dáil Éireann suggested some improvements to increase feelings of safety, such as passive surveillance, lighting and policing. These suggestions for improving the safety infrastructure could aid ridership according to this participant where they note that these improvements need to be considered 'through the lens of those who are most vulnerable or feel most vulnerable. And unless we do, we're not going to get the level of ridership or participation in the sustainable goals that we need to get'. These suggestions could improve feelings of safety. John O'Flynn (NTA) notes that there are currently safety infrastructures in place on public transport modes such as CCTV and 'good lighting'. However, he notes that 'There's a couple of couple of spots that needs to be improved' in relation to Luas and train stations.

These interview insights have highlighted the safety concerns associated with both active travel and public transport modes across gender and age groups. While participants have shared positive insights into the current provision of safety infrastructure across modes, other participants have highlighted that much is still required in order for individuals to perceive public and active travel modes as suitably safe enough to

use. The next section will provide insights into the reliability, cost and communications aspects of transport services in Ireland.

8.3.2 Reliability of Services

Interview participants discussed the impacts of service reliability on individuals choosing public transport modes over the private car. Issues include unreliable services and waiting times for modes which can impact trust levels among users. Additionally, the connectivity of smaller services community level services, such as local links, with larger national service, such as trains, is an important factor in mitigating feelings of isolation for vulnerable transport users. John O'Flynn (NTA) notes that 'people are less satisfied with punctuality and reliability on the bus services', and Damian McDermott (Donegal County Council) notes that these issues with reliable services can lead to a lack of trust with users and 'if you haven't got the reliability that puts people, an awful lot of people, off'. Public transport services not showing up can be frustrating according to Colm Moore (Rail Users Ireland) and he notes that services being unreliable 'can have an effect. If I am expecting x, and y shows up, for me, a super user for public transport, that creates something between curiosity and consternation'. Interview participants have highlighted that user trust can be impacted by unreliable services which can also impact transport behaviour, pushing users to the private car.

Service reliability also includes how smaller services such as the Local Link connect up to larger national services such as the train, which have been launched under the BusConnects programme. A member of Irish Rural Link identifies a need for these services to be connected and notes that 'It doesn't always work in every area, you know, the Local Link or bus might be dropping people off to the train station and the next thing, the train is gone.' This issue with linking of services is also expressed by one member of COPE Galway where they note that 'they don't link up. Whatever services are there, they don't match up.' A lack of reliable services can increase older people's isolation according to another member of COPE Galway. They note that if older people 'can't get to an appointment, then that's increasing their dependence on somebody else, and it's also increasing their isolation, and they may not go to the appointment'. A key finding of these interviews notes that issues concerning the reliability of services can lead to a distrust in the service and impact individuals' mode choice if they cannot rely on the service showing up on time or its ability to link individuals with larger services.

8.3.3 Cost

Cost developed as a sub-theme in some of the interviews and discussion points included the increased cost of car ownership and the cost of implementing infrastructure. A member of Irish Rural Link notes that

the cost of the private car has increased and how this increased cost has an impact on vulnerable groups such as 'low-income families… older people, may be dependent on state pension'. This increase in the cost of fuel for cars has led to a shift in travel behaviour and increased train journeys according to a member of Iarnród Éireann. They note that these increased costs for using the private car 'has made it more attractive to travel by rail as well and travel by public transport over that time' which has increased the demand on Iarnród Éireann's services.

Discussions around safety and costs centred around the expressed desire for an increased staff and security presence that is hindered by funding. John O'Flynn (NTA) notes that the NTA are aware that individuals want an increased staff and security presence on public transport modes, however this is an issue 'that's more subject to budget'. When discussing the implementation of increased public transport and active travel infrastructure the member of Dáil Éireann notes that money is not the issue as 'it's not a necessarily a costly thing either, the money is there, you know, there's no shortage of money.' They note that the issue with implementing these increased levels of infrastructure across modes is with 'a political difficulty and there's the pure amount of people that are needed in the system. … every local authority doesn't have that level of planners and engineers and architects and the multidisciplinary teams that are needed to deliver those [services]'. Damian McDermott (Donegal County Council) notes a cost vs. benefit issue and that funding levels for transport can hinder the development in more rural areas such as Donegal:

> …they don't want to spend too much money, as I said, but the gains aren't great, you know, to do a length of greenway in Donegal, it's gonna cost same as doing it in Dublin except it only caters for a couple 100 people here but a couple of 1000 in Dublin. Where's the benefits? The benefits are greater. If you want to spread out evidence, you have to do the same infrastructure here as you have anywhere else. But that's cost, really it's costs, and the amount of money that's been put into transportation and roads transportation, for example, is traditionally not a lot, which makes it more difficult for us in rural areas like Donegal to be able to introduce these other things. (Damian McDermott, Donegal County Council)

He further notes that the need for roads development to enable the effective implementation of active travel infrastructure requires funding. However, he notes that the government are not 'funding the residual for Donegal, the residual road needs, they sort of say forget about roads altogether and jump straight into the greenways and active travel. But it can't happen. You have to work in tandem'. These funding requirements for improving roads infrastructure at the county level are also required alongside improving other modes. The cost of the private car and increased cost of fuel has been discussed as

contributory factors to individuals requiring public transport services to travel. Additionally, improving infrastructure around active and public transport and the safety of these services requires funding, which at a county planning level has been described as a need and at a political level has been discussed as being available, however differing opinions in politics and staffing issues lead to barriers for implementing these infrastructure improvements.

8.3.4 Communication

Communication of service enhancements and improvements developed as a sub-theme in these interviews as participants discussed the role of messaging in relation to new services, service improvements and public buy in. A member of Iarnród Éireann noted that the company had work to do in order to improve their messaging about new services being introduced: 'I think there's a big body of work that needs to be undertaken in this area. And you know, I mean … we haven't that plan, as well developed yet, as we should maybe'. The importance of increasing messaging about new services and service enhancements was also highlighted by the member of Dáil Éireann, where they also noted the importance of these messages in rural areas. They noted that the government 'need to get better at telling people what's happening because there is a narrative out there that you simply can't use public transport in rural Ireland'. They further highlight that individuals are not aware of the services available to them stating 'I think a lot of people don't know that the services exist' and that providing messaging about these service enhancements and introduction of new services 'could offer them some advantage'.

John O'Flynn (NTA) notes that when a new route is launched in Ireland, the NTA advertises the onward connections for these services and states that 'part of that messaging is, if there is an onward connection, which there normally is, to the wider network, it's either mentioned within the radio ad, for example, or are on the poster you'll see where to transfer'. However, some messaging can be wasted when advertised towards a 'geographically sporadic service' which can lead to 'wastage messaging' and these costs for advertising 'can be quite significant'.

A key finding under this sub-theme identifies how communicating enhancements to services and the introduction of new services requires effective messaging as outlined by the interview participants. However, while messaging of services is part of the introduction of new services, some of this communication can be wasted as services are not currently covering every part of the country.

8.4 Theme 3: Governance, policy, and climate change leadership

The role of the government and their governance of transport in Ireland was discussed throughout a number of interviews with participants. Three sub themes developed under this theme: climate change leadership, public consultation, and cognitive dissonance and decision making. Each of these sub themes will be discussed separately but are connected through their link to governance and policy and planning of transport infrastructure.

8.4.1 Climate change leadership

When discussing the role of government in relation to climate change the member of Dáil Éireann noted that there is a 'fundamental gap in political leadership' and that there is deflection in government and an attitude that 'somebody else needs to do something, its corporations, you know, the data centres, the big bad data centres, like, the data centres are 2% of our emissions'. They further highlight this deflection noting that:

> There's a very significant cohort, in my view, that will say, 'Yes, we must have radical climate action'. But technology will solve it, you know, we're on a glide path to net zero and in three, less than three decades now. And actually, we can maintain the kind of lives that we have, so long as we get onto that glide path. You know, and like that, that's, it's either dishonest or misinformed, or both. Because I don't see how we get on to that glide path without fundamental change in how we live our lives. (Member of Dáil Éireann)

When discussing what is required to meet climate change targets, Damian McDermott (Donegal County Council) notes that meeting climate targets in rural areas at the same level as urban areas will be hard to achieve:

> The bottom line is, every local authority has to come up with our climate action plan, and it has to be consistent with government policy. So, they're technically, they're supposed to meet the same goal, meet the same targets as the rest of the country, and that's a difficult thing to do in a rural community, and they'll do their best like you know, but I don't think it's reasonable to make them [rural local authorities] achieve it. (Damian McDermott, Donegal County Council)

A member of Irish Rural Link also discusses climate change targets at a rural level noting that 'even their [government] emissions target … the whole climate change and emission targets … but we need to reduce our reliance on the car, but … on what'. They discussed how individuals are encouraged to switch modes

by the government but highlights the lack of available sustainable modes to switch to from the private car in order to reduce transport emissions and meet climate targets at a rural level.

While there is an attitude that meeting these targets will be hard to achieve at both urban and rural levels, the member of Dáil Éireann finds that the current target of achieving 500,000 additional daily sustainable journeys (active travel and public transport) by 2030 is a low target. They note that 'If you look at the, as a percentage of the total number of journeys that are taken, so it's not, that's not a high target, as far as I'm concerned' and that in their view, 'we should be aiming much higher than that'. These perspectives on achieving climate targets differ at urban and rural levels where some interview participants at rural levels express how under-developed infrastructure hinders achieving climate change targets. They note that this lack of suitable transport infrastructure can limit the ability to switch from the private car to public and active transport modes and fulfil these emission reductions targets.

8.4.2 Public consultation

Another barrier to developing public transport infrastructure which was discussed in these interviews was public consultation during the planning process for transport development. Public consultation for transport enables public participation in the planning process of transport infrastructure in Ireland. Concerned individuals can share their views on the proposed infrastructure at the planning stage. A member of Iarnród Éireann notes that public consultation and engagement is very important to the work they do, particularly when projects costs are very high:

> But, you know, we've got to create active citizen engagement in a conversation on that, such that people you know actually are heard, have their viewpoints expressed or incorporated into and there's robust and honest discussion about what it is that has been proposed, and that everybody you know, gets an opportunity to, to be involved in that before we start saying, Okay, now we're going ahead with that… I think this is an area which you know, could deserve particular mention that those, those planning authorities, likes of us who are promoting this sort of significant change, need to comprehensively engage with those that it's going to impact, to those that are effectively gotten funded. (Member of Iarnród Éireann)

This active engagement of, and communication with, the public who will be impacted by these services is very important to the planning process according to this member of Iarnród Éireann. Conversely, Damian McDermott (Donegal County Council) finds that public consultation slows down the planning process. He

notes that through public consultation the public can object to the proposed project and that 'If they don't stop the project, they'll delay it significantly' and that this can slow down a project's development. He notes that by 'making sure a project is set out right, and it's important for policy, then technically, you shouldn't have a problem'.

Sean O'Dwyer (TFI Bikes) notes that the issues of objections slowing down the planning and implementation of new transport infrastructure can be due to NIMBYism. He notes that 'we like to say oh, yeah, I've done my part because I bought a Tesla you know, and buying a Tesla's not the solution you know, you know, having a proper, having a cycle lane outside your house for people to not even take a car of any sort in, that's the solution. But sometimes people don't want that'. Public consultation can provide active engagement in proposed new infrastructural developments; however, these consultations can slow the planning and implementation of services down, particularly in rural areas where services are still underdeveloped.

The planning of new transport infrastructure can also include the reallocation of road space to facilitate public and active transport corridors. These changes to road spaces can lead to opposition from road users. Damian McDermott (Donegal County Council) highlights the struggle with introducing new transport infrastructure that could disrupt private car users through the reallocation of parking spaces:

> Anywhere you take people's car park away or reduce road size, people have a say in it, and it won't always be positive, because you're affecting their daily commutes. They don't see the long term, so my generation don't see the long-term benefits of that. Now, not all of them obviously, but they don't. They'll be driving everywhere all their lives, you know. They don't see any other way. (Damian McDermott, Donegal County Council)

He further expressed this point when highlighting the impact that this reallocation of space can have on businesses which may lead to objections in removing car parking spaces for customers when footfall is already low in rural areas:

> And some have genuine concerns obviously, in rural areas, your footfall is not great a lot of the time you can't, you don't want to diminish that at all. If you got an old lady has to drive in there from the countryside to get her shopping, she's not gonna park half a kilometre or get a bus in and carry her shopping around with her. There has to be mechanisms to help that. Again, it's difficult, because you have to get the bus system working and for the bus system to work you have to allow

> that to mix with the cycling. You have to get rid of the cars for the bus to work. And you know, there's gonna be a good point which there's a conflict. (Damian McDermott, Donegal County Council)

A member of Dáil Éireann discussed the political aspects of reallocating road space and how this is typically decided at a local level:

> …we are hamstrung to a certain degree by the politics of it, the politics of reallocating road space is difficult so, generally, every project comes down to a decision on a local level. And then you have local councillors who are very receptive to the mood of the local electorate and then change, change is a huge challenge for a lot of people. (Member of Dáil Éireann)

The reallocation of road space can face some objections from individuals who use the private car for transport and are objecting to the removal of this space for public and active transport corridors. Additionally, business owners who require parking spaces for their customers where they are experiencing low footfall may also object to these plans for road reallocation for public and active transport infrastructure according to Damian McDermott (Donegal County Council). As discussed by these interview participants, the planning and development of public and active transport can be a contentious issue that can be time consuming and delay planning and implementation of transport networks.

8.4.3 Cognitive dissonance and decision-making

Cognitive dissonance has been discussed in Chapter 7 previously. There, survey participants revealed their intention to behave in a pro-environmental way while not seeing this through to actualised pro-environmental behaviour. In this section of the interview results, participants were asked if decision makers possessed any attitudinal or behavioural entrenchment that could influence policy development in a pro-environmental way. The member of Dáil Éireann noted that cognitive dissonance exists in government as there is a lack of leadership in showing pro-environmental behaviour:

> But I don't feel enough leadership has been shown, I think, a lot of talk and not enough, leading by example, you know. So where, the political system isn't at the point, it's gotten to the point where we accept change must happen. And it isn't that point where we show what change looks like in our own lives. You know, like, it frustrates me so much, you know, people will say, 'Oh, my God, my KeepCup you know, and I'm doing my bit.' Okay. While your SUV is parked outside and, you know, you're heading off on your holiday overseas and like, the political system has to show

> leadership, it simply has to, and there are a precious few examples of that, you still have like a big car park out there [outside of parliament buildings], you know, and it's heresy to suggest that it might be got rid of, you know. And not that getting rid of that car park would make any real tangible difference in terms of emissions, but it'll be a strong signal to people of Ireland who these politicians represent that they're going to take some, make some kind of change, you know, make life a little bit harder for themselves. Because they're asking the population to make life harder for themselves to accept changes for climate action. That's a big one. It's a very big one, you know, getting over that dissonance and you know, that idea that, yes, we're on board, but it's for somebody else to do something, you know we're not there yet. (Member of Dáil Éireann)

When discussing cognitive dissonance of decision makers, Damian McDermott (Donegal County Council) notes that the attitudes of politicians are driven by the electorate who vote them in and that the politicians will follow what the electorate believes:

> The politicians don't drive that. The people behind them drive that. So, you know, they don't they don't take a stance say, Oh, I'm against greenways. If everyone that's voting for them has a different stance, they only follow, it has to come up from the ground. And the people on the ground have to see benefits, you know. (Damian McDermott, Donegal County Council)

When discussing if the attitudes of decision makers can influence decision making John O'Flynn (NTA) noted that personal attitudes can influence the level of emphasis that is placed on projects and how these individual attitudes need to be understood further in order to see changes in decision making:

> …I think our individual attitudes definitely do influence the level of emphasis we put on certain needs or messages, or campaigns, or projects… So, I think yes is definitely the answer to that question, but it's probably teasing out exactly kind of what those barriers are and how to address them is probably and who's right, even you know, because it's those attitudes are based on points of view. It's not necessarily that I'm right and they're wrong. It could be just that we're each maybe defending our own point of view. I could be coming at it from a customer experience point of view. Someone else might be coming out from a kind of a cost management point of view, you know. And they both need to, I suppose, find an equilibrium, you know? (John O'Flynn, National Transport Authority)

A member of Iarnród Éireann noted that an older and more male-led demographic in their organisation can lead to established mindsets which can be in opposition with progress:

> We have that sort of mindset, conservative mindset. We were a very engineering led organisation for a male organisation, 88% male if you want the absolute number on it, so almost nine out of 10 and also quite aged. So average age of coming up on 50 in the organisation. So, all of those demographic components, bring with it a certain sort of a mindset. You know, and that then can act as a barrier towards bringing about a totally new system change. So, you know, first thing in bringing about any change is recognising the status quo (Member of Iarnród Éireann)

These interview results have highlighted how cognitive dissonance can influence the decision making in organisations. Interview participants outlined how entrenched attitudes can range from considering how certain actions are environmentally aware while others are not considered. Furthermore, these results have shown that when a team is dominated by one demographic, such as men, decision making can be influence by this. These results highlight the role that cognitive dissonance plays in decision making for transport and outlines ways that this barrier could be changed.

8.5 Theme 4: Supporting transport behavioural change

When discussing what can impact behavioural change, interview participants discussed the benefits of incentives to encourage transport behavioural change. Additionally, they highlighted that a lack of leadership and collective action could be influencing transport behavioural change. This section will examine this theme under the subthemes of incentives and subjective norms.

8.5.1 Subjective norms and collective action

When discussing barriers to behavioural change, Colm Moore (Rail Users Ireland) noted that 'one of the big things missing is leadership'. John O'Flynn (NTA) discussed Dr. Pete Lunn's work on collective action and how the lack of collective action can pose an issue to transport behavioural change: 'One thing he [Dr. Pete Lunn, ESRI] used to refer to I remember [during] Covid, was that there was a collective action problem, he used to say…basically, like, you will follow the rules if your neighbours followed rules, kind of a thing.' John O'Flynn continues to note that if climate change was considered to be a collective action problem, then perhaps using your private car would be seen differently due to a social pressure and this could change public transport use:

> And I always found that interesting in the context of public transport, because it's the same kind of thing really, like you're kind of like, maybe with your car, and you're thinking, it's raining, I'll just take the car, like all my neighbours are doing it. And what effect can I have there? Whereas, if it was a collective action problem, and everybody understood it to be, and there was some little bit of, I don't want to say guilt, but if there was some kind of little bit of social pressure, almost, I think that would be very useful, but that social pressure isn't there. No one has any issue with their neighbours driving to Donegal and back for no reason. (John O'Flynn, National Transport Authority)

Sean O'Dwyer (TFI Bikes) expressed a similar perspective on collective action, where he notes how attitudes need to shift to a collective action mindset rather than individual mindset when discussing behavioural change. He notes that individuals have been become more focused on individual action rather than collective action:

> …I think attitudes lately have changed to focus in on the minority and almost forget the majority. And so we've got to switch that a little bit. (Sean O'Dwyer, TFI Bikes)

When discussing the development of transport infrastructure and behavioural change, Colm Moore (Rail users Ireland) identifies how new changes in infrastructure can lead to resistance among users to change their behaviour. He specifies how the Bus Connect Programme, which seeks to improve public transport in five regions (Dublin, Cork, Galway, Limerick, and Waterford) by redesigning the network and improving infrastructure (Bus Connects, 2025), has caused resistance among users:

> …with a journey planner, it doesn't quite work like that. You need to say, I only want to consider tram, or I only want to consider bus. Or, I don't want to have to change mid route, even if it would be substantially quicker. And I think that's one of the things that created a lot of resistance from some people about Bus Connects. They're not used to changing buses, they're used to having a direct bus. They are resistant to changing, even if it would mean that they have more options, and it would get them there sooner.

When asked what role the NTA could play in encouraging behavioural change John O'Flynn (NTA) noted that the NTA could provide these services and promote their services through effective communication and messaging as previously discussed:

> …I think providing those services is all that we can do at the moment, and then promoting them, and the ridership goes up. (John O Flynn, National Transport Authority)

8.5.2 Incentives

Other methods for encouraging behavioural change include incentives for transport users. Incentivisation to encourage transport behaviour change was discussed by Damian Mc Dermott (Donegal County Council) where he noted that providing free buses would encourage people to reduce their use of the private car:

> …you have to make it easy for people. You have to, and that means, like, my personal opinion in rural areas in Donegal, if you want to force people out of their car and onto busses, it should be free buses. Do It. Like It's a cost overall but do it with free buses. (Damian McDermott, Donegal County Council)

He also notes that providing active travel infrastructure can change people's transport behaviour, where one of the bigger areas of challenge is school runs:

> It may slow things down in the short term, but we feel if we can put in active travel facilities, good enough ones, people may move somewhat out of cars. Our big problem will be up there, be things like school runs. The domesticated traffic is bad generally, but inside the nine o'clock it's crazy, and it's mostly the school run. (Damian McDermott, Donegal County Council)

The member of Dáil Éireann finds that implementing infrastructure that can be done quickly does change transport behaviour and this links back to improving the perspective of safety within the transport infrastructure:

> …there's different kinds of infrastructure. But what I call the grid infrastructure, which is just like very quickly putting down separators [between active travel and other road users], they're very effective. And we have quite a few of those schemes in [redacted county]. And we can see it, we can see it, I see girls cycling to school, who certainly we're not cycling to school before because of that very simple, quick infrastructure. And the other infrastructure like which is the more permanent and better designed, costs a lot more, and takes a lot more time. (Member of Dáil Éireann)

Encouraging individuals to change their transport behaviour is influenced by a number of factors according to these interview participants. These factors include leadership from a top-down perspective, a change in attitudes from the individual to collective action, effective communication of transport infrastructure changes, the role of incentivisation through free fares and altering the perspectives of safety through new infrastructure.

8.6 Conclusion

These interview findings have outlined how the availability, suitability and development of transport infrastructure underpin the ability to influence transport behaviour in Ireland. These interview findings highlight how transport is not experienced equally at urban and rural levels and that this understanding must be considered when implementing emissions targets at a national level and when developing transport infrastructure. Similarly, when communicating service enhancements and new transport services in rural areas, wastage messaging must be considered for areas that currently cannot access these new services. These insights from the 12 interviews with eight organisations outlined in this chapter address the central research aim of this thesis, the second research objective which is concerned with exploring the barriers to transport behavioural change, and the third research objective examining incentives to encourage sustainable transport uptake.

The themes and subthemes (navigating daily life in a car-dominated landscape, improving infrastructure and ensuring safety within these networks, improving transport infrastructure through reliability, cost and effective communication, governance, policy and climate change leadership, and changing behaviours through incentives, leadership and collective action) align with the research aim which seeks to understand the transport related attitudes and behaviours of individuals in Ireland.

When developing new transport infrastructure, the reliability of these services must also be considered and this reliability can be measured through a number of factors such as waiting times, connections to larger national services and infrastructure that shows up at its scheduled time. Improving the safety of public and active transport must be considered and these safety measures should also consider factors such as age and gender when developing these measures for each mode. Addressing the barriers to developing transport infrastructure must include the influence of political leadership and political will, road space reallocation and public consultation's role in the planning process. Finally, the role of cognitive dissonance in the attitudes of decision makers should also be addressed as a barrier to advancing transport infrastructure. Identifying these barriers and proposing methods for transforming transport infrastructure will be discussed in the next section of this research. The following chapter will present the results from the second round of surveying conducted in 2024 which further outlines the barriers to sustainable transport behaviour.

Chapter 9: Presentation of Survey 2 Results

9.1 Introduction

The previous chapters explored the first round of surveying and interview data and identified how perceived behavioural control, measured through cost, time and safety, influences pro-environmental behaviour and intentions concerning transport and travel in Ireland. Furthermore, the results of survey 1 highlights a gap between individuals' behavioural intentions and their pro-environmental behaviour.

As Section 7.1 highlights, the results of survey 1 demonstrated that the hard disincentives introduced during the COVID-19 pandemic were not sufficient in maintaining long-term transport behavioural change when the national travel restrictions were lifted. Given this, the focus of this research was shifted toward garnering insights into how to support more substantive long-term change in travel behaviour away from the private car and towards public and active transport in the absence of imposed travel restrictions.

To further explore this, the second round of surveying sought to understand this gap between behavioural intention and pro-environmental behaviour and the role of the private car in influencing individuals' pro-environmental behaviour. This round of surveying addresses research objective two in understanding the barriers to transport behavioural change, and research objective three which examines how incentives may support transport behavioural change.

As outlined in Section 6.4, n = 448 valid survey responses were received between mid-August 2023 and mid-October 2023. A breakdown of respondents by socio-demographic profile (age, gender, employment status, educational attainment) relative to Irish census data is also available in Section 6.4. Figure 9 below outlines the geographic spread of survey responses received for this round of surveying where each dot represents the first three digits of respondents Eircode's (routing keys). Each dot can represent multiple responses if surveys were completed from respondents with the same routing key (e.g. D12 or A42).

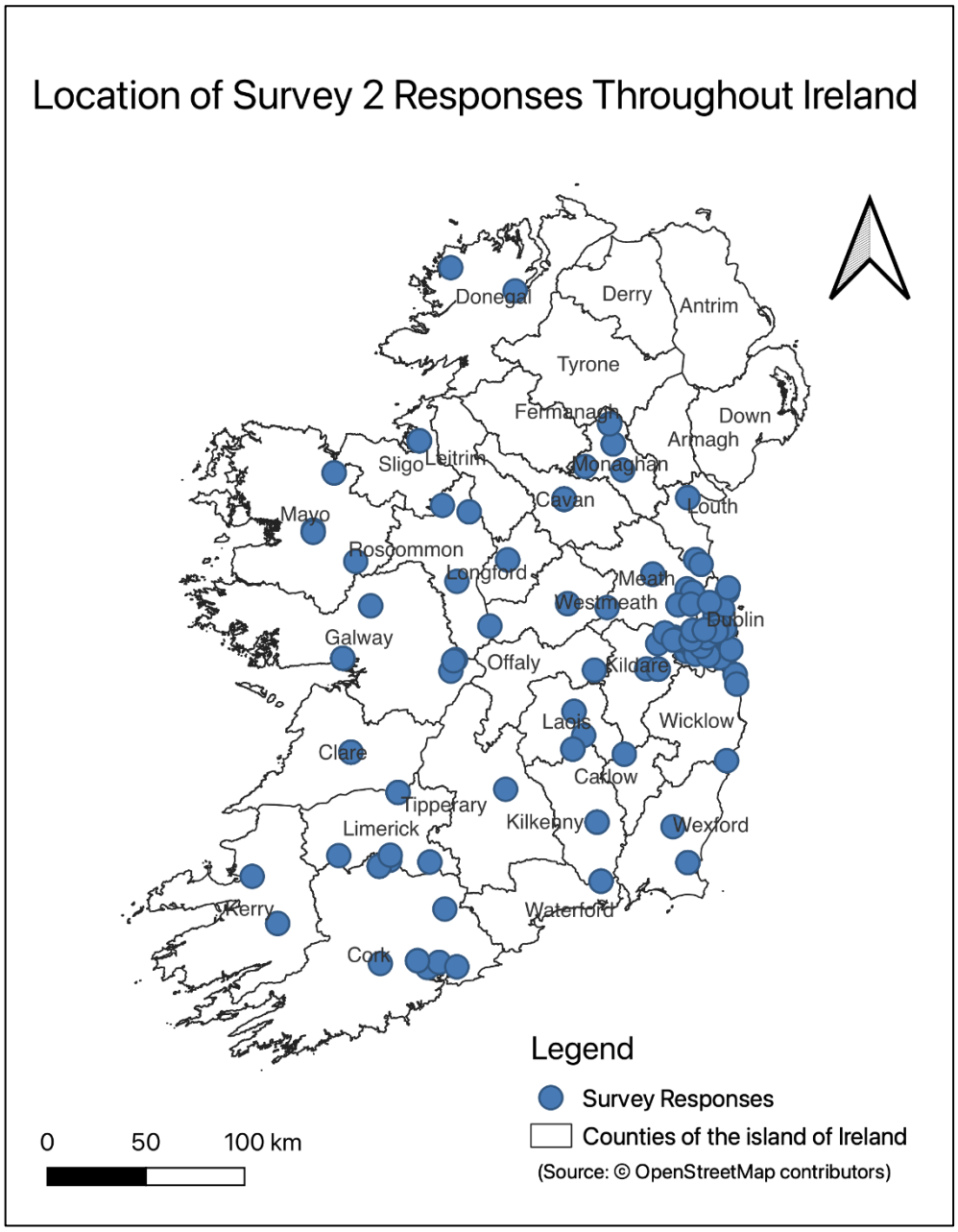


Figure 9: Eircode map showing geographic spread of Survey 2 responses

Building on the results from the first survey and interviews with eight transport related organisations in Ireland, the second round of survey questions were developed. A review of the literature in Chapter 2, examination of the results from the first survey, and interview results revealed key themes that required further exploration including safety, suitability of infrastructure and incentives as a method of transport behavioural change. The second survey, conducted online between August 2024 – October 2025 and detailed further in Chapter 6, focused on individuals' experiences of public and active transport in Ireland, particularly regarding their experiences of safety and their attitudes towards incentivisation to change

transport modes. The following chapter presents the results from this round of surveying using statistical testing conducted in SPSS.

9.2 Gender and safety by transport mode

Experiences of safety and the perception of safety on different transport modes were gathered from respondents during this survey. Through a consultation of the literature, previously discussed in Section 2.5, gender and safety on different modes of transport developed as an area for further research. As outlined in Chapter 2, gender can influence individuals experience of transport, specifically as it relates to safety (Dubey et al., 2025; Hörcher and Tirachini, 2021; Ouali et al., 2020, TII, 2020). Perceptions of safety can prevent women from choosing sustainable transport modes, impacting their decision to take the bus or to cycle or walk (Ouali et al, 2020; Souza et al., 2018).

To further explore these experiences of safety as they relate to gender, these survey results were analysed to understand if any gendered experience of transport exists among transport users in Ireland. These surveys were analysed using gender and different transport modes to identify if there was any gendered experience of transport in Ireland that influenced individuals transport behaviour. A series of Mann-Whitney *U* tests were conducted to examine the relationship between gender and feelings of safety when waiting for different transport modes, travelling on transport modes and the experiences of harassment or intimidation on board these modes. For active travel modes, the sample size for males and females who use a scooter was less than the average sample size needed for a Mann-Whitney *U* and Kruskal-Wallis tests and as such was not included in the testing.

The questions in the following tests were taken from different sections of the survey which can be viewed in Appendix F. As such, the following set of questions were asked under two different Likert scales; 1 = strongly agree, 2 = agree, 3 = neither agree or disagree, 4 = disagree, and 5 = strongly disagree; and a frequency scale where 1 = always, 2 = often, 3 = sometimes 4 = rarely, and 5 = never. Table 15 below provides an overview of the results from the statistical testing conducted in SPSS for gender and safety by transport mode. This section will outline these results in further detail.

Mode	**Statement**	**Group**	**N**	**Median**	**Mean rank**	**U**	**Z score**	***r***	***p*-value**
		Females	197	3.00	188.09	17550	-3.86	.19	<.001

Public Transport	**I feel unsafe on public transport**	Males	223	4.00	230.3				
	Witnessing harassment or intimidation on public transport influences my decision to use public transport	Females	197	2.00	182.66	16480.5	-4.68	.23	<.001
		Males	223	2.00	235.1				
	Experiencing harassment or intimidation on Public Transport influences my decision to use public transport	Females	197	2.00	189.79	17886	-3.43	.17	<.001
		Males	223	2.00	228.79				
Bus	**I feel safe waiting at the bus stop**	Females	102	3.00	162.26	11297.5	6.46	.41	<.001
		Males	152	2.00	104.17				
	I feel safe travelling on the bus/coach	Females	102	2.00	126.04	7974.5	.405	.025	.685
		Males	152	2.00	129.68				
	I **feel safe from harassment or attacks on the bus/coach**	Females	102	3.00	156.89	10749.5	5.5	.34	<.001
		Males	152	2.00	107.78				
Train	**I feel safe waiting for the train**	Females	28	2.00	52.31	1589	2.91	.27	.004
		Males	85	1.00	71.25				
	I feel safe travelling on the train	Females	28	2.00	59.0	1246	.47	.04	.638
		Males	85	2.00	56.34				
	I **feel safe from harassment or attacks on the train**	Females	28	2.00	74.43	1650	3.26	.31	<.001
		Males	85	2.00	51.59				
Luas/tram	**I feel safe waiting for the Luas/tram**	Females	16	3.00	24.06	249	2.25	.36	.031
		Males	22	2.00	16.18				
	I feel safe travelling on the Luas/tram	Females	16	4.00	23.78	244.5	2.13	.35	.042
		Males	22	2.46	16.39				

	I **feel safe from harassment or attacks on the Luas/tram**	Females	16	4.00	24.88	262	2.68	.43	.01
		Males	22	2.00	15.59				
Active Transport	**I feel safe walking**	Females	141	3.00	195.55	6127	-7.775	.44	<.001
		Males	168	2.00	120.97				
	I feel safe cycling	Females	13	3.00	49.35	550.5	-.733	-.07	.0463
		Males	96	3.00	55.77				

Table 15: Results of Mann-Whitney U testing conducted in SPSS for gender and safety by transport mode. (Highlighted results indicate significant at the $p = 0.05$ level).

I feel unsafe on public transport

In response to the statement 'I feel unsafe on public transport' (where 1 = always and 5 = never), results showed that females reported feeling significantly less safe (*Md* = 3.00, *n* = 197, mean rank = 188.09), compared to males (*Md* = 4.00, *n* = 223, mean rank = 230.3, *U* = 17550, *z* = -3.86, *p* = <.001, *r* = .19).

Bus/coach

a. I feel safe waiting at the bus stop

In response to the statement 'I feel safe waiting at the bus stop' (where 1 = always and 5 = never), results showed that females (*Md* = 3.00, *n* = 102, mean rank = 162.26) reported feeling significantly less safe, compared to males (*Md* = 2.00, *n* = 152, mean rank = 104.17, *U* = 11297.5, *z* = 6.46, *p* = <.001, *r* = .41).

b. I feel safe travelling on the bus/coach

For this statement, response options ranged from 1 = strongly agree, 2 = agree, 3 = neither agree or disagree, 4 = disagree, and 5 = strongly disagree.

When assessing feelings of safety while travelling on the bus/coach, there was no significant difference in the responses between males (*Md* = 2.00, *n* = 152, mean rank = 126.04) and females (*Md* = 2.00, *n* = 102, mean rank = 129.68, *U* = 7974.5, *z* = .405, *p* = .685, *r* = .025).

c. I feel safe from harassment or attacks on the bus/coach

In response to the statement 'I feel safe from harassment or attacks on the bus/coach' (where 1 = always and 5 = never), results showed that females (*Md* = 3.00, *n* = 102, mean rank = 156.89, *U* = 10749.5, *z* = 5.5, *p* = <.001, *r* = .34) reported feeling significantly less safe, compared to males (*Md* = 2.00, *n* = 152, mean rank = 107.78)

These results highlight that females experience safety differently when waiting for the bus and feelings of safety regarding harassment or attacks on the bus, however both genders identify feeling safe while travelling on the bus.

Train

a. I feel safe waiting for the train

In response to the statement 'I feel safe waiting for the train' (where 1 = always and 5 = never), results showed that females (*Md* = 2.00, *n* = 28, mean rank = 71.25, *U* = 1589, *z* = 2.91, *p* = .004, *r* = .27) reported feeling significantly less safe, compared to males (*Md* = 1.00, *n* = 85, mean rank = 52.31).

b. I feel safe travelling on the train

When assessing feelings of safety while travelling on the train (where 1 = always and 5 = never), there was no significant difference in the responses between males (*Md* = 2.00, *n* = 85, mean rank = 56.34) and females (*Md* = 2.00, *n* = 28, mean rank = 59.0, *U* = 1246, *z* = .47, *p* = .638, *r* = .04).

c. I feel safe from harassment or attacks on the train

In response to the statement 'I feel safe from harassment or attacks on the train' (where 1 = always and 5 = never), females (*Md* = 2.00, *n* = 28, mean rank = 73.43) reported feeling significantly less safe, compared to males (*Md* = 2.00, *n* = 85, mean rank = 51.59, *U* = 1650, *z* = 3.26, *p* = .001, *r* = .31).

These results highlight that while both genders feel safe travelling on the train and from harassment or attacks on the train, males experience stronger perceptions of safety while waiting for the train when compared to females.

Luas/tram

a. I feel safe waiting for the Luas/tram

In response to the statement 'I feel safe waiting for the Luas/tram' (where 1 = always and 5 = never), females (*Md* = 3.00, *n* = 16, mean rank = 24.06, *U* = 249, *z* = 2.25, *p* = .031, *r* = .36) reported significantly lower feelings of safety, compared to males (*Md* = 2.00, *n* = 22, mean rank = 16.18).

b. I feel safe while travelling on the Luas/tram

In response to the statement 'I feel safe while travelling on the Luas/tram' (where 1 = always and 5 = never), females (*Md* = 4.00, *n* = 16, mean rank = 23.78, *U* = 244.5, *z* = 2.13, *p* = .042, *r* = .35) reported significantly lower feelings of safety, compared to males (*Md* = 2.46, *n* = 22, mean rank = 16.39).

c. I feel safe from harassment or attacks on the Luas/tram

In response to the statement 'I feel safe from harassment or attacks on the Luas/tram' (where 1 = always and 5 = never), females Luas (*Md* = 4.00, *n* = 16, mean rank = 24.88, *U* = 262, *z* = 2.68, *p* = .01, *r* = .43) reported significantly lower feelings of safety, compared to males (*Md* = 2.00, *n* = 22, mean rank = 15.59).

Active transport

I feel safe walking

In response to the statement 'I feel safe waking' (where 1 = always and 5 = never), results showed that females felt significantly less safe walking (*Md* = 3.00, *n* = 141, mean rank = 195.55) compared to males (*Md* = 2.00, *n* = 168, mean rank = 120.97, *U* = 6127, *z* = -7.775, *p* = <.001, *r* = .44).

I feel safe cycling

In response to the statement 'I feel safe cycling' (where 1 = always and 5 = never), results showed that there was no statistically significant difference between females (*Md* = 3.00, *n* = 13, mean rank = 49.35) and males (*Md* = 3.00, *n* = 96, mean rank = 55.77, *U* = 550.5, *z* = -0.733, *p* = <.463, *r* = -.07).

Experiences of harassment or attacks on public transport and age

a. **Witnessing harassment or intimidation on Public Transport influences my decision to use public transport**

In response to the statement 'Witnessing harassment or intimidation on public transport influences my decision to use Public Transport' (where 1 = strongly agree and 5 = strongly disagree), there was a statistically significant difference between males (*Md* = 2.00, *n* = 223) and females (*Md* = 2.00, *n* = 197). Females had a significantly lower mean rank (mean rank = 182.66) than males (*U* = 16480.5, *z* = -4.68, *p* = <.001, *r* = .23). This indicates that females are less likely than males to use public transport if they witness harassment or intimidation.

b. **Experiencing harassment or intimidation on public transport influences my decision to use Public Transport**

In response to the statement 'Experiencing harassment or intimidation on public transport influences my decision to use Public Transport' (where 1 = strongly agree and 5 = strongly disagree), there was a statistically significant difference between males (*Md* = 2.00, *n* = 223) and females (*Md* = 2.00, *n* = 197). Females had a significantly lower mean rank (mean rank = 189.79) than males (mean rank = 228.79, *n* =

197, U = 17886, z = -3.43, p = <.001, r = .17). This indicates that females are less likely than men to use public transport if they experience harassment or intimidation.

These tests measured feelings of safety while waiting for and travelling on different public and active transport modes and examined experiences of harassment and intimidation on public transport and its influence on public transport use. For each statement females measured a significantly lower feeling of safety on each mode, specifically on the Luas/Tram, indicating that gender influences feelings of safety on sustainable transport. These results indicate that women's perception of safety on public and active transport influences their transport behaviour more than it does for males in this research. The next section will present the results for feelings of safety while travelling on different transport modes according to age.

9.3 Age and safety by transport mode

This section analyses age groups and feelings of safety for each transport mode. This theme developed following the analysis of the qualitative interviews and from a review of the literature where transport behaviour differs according to age, where older people's safety concerns were discussed as motivating factors for their transport behaviour. A series of Kruskal-Wallis tests were conducted to examine the relationship between age and feelings of safety when waiting for different transport modes, travelling on transport modes and the experiences of harassment or intimidation on board these modes. The following set of questions were asked under two different Likert scales; 1 = strongly agree, 2 = agree, 3 = neither agree or disagree, 4 = disagree, and 5 = strongly disagree; and a frequency scale where 1 = always, 2 = often, 3 = sometimes 4 = rarely, and 5 = never. Table 16 below outlines the results from the statistical testing conducted in SPSS for age and safety by transport mode. This section will outline these results in further detail.

Mode	**Statement**	**Group**	**N**	**Median (Md)**	**Mean rank**	**H (test statistic)**	***df***	***p*-value**
Public transport	**Witnessing harassment or intimidation on public transport**	Group 1: 18-29	60	2.00	214.73	13.90	3	.003
		Group 2: 30-44	135	2.00	233.97			

	influences my decision to use public transport	Group 3: 45-59	107	2.00	211.76			
		Group 4: 60+	118	2.00	180.35			
	Experiencing harassment or intimidation on Public Transport influences my decision to use public transport	Group 1: 18-29	60	2.00	209.36	3.04	3	.385
		Group 2: 30-44	135	2.00	209.01			
		Group 3: 45-59	107	2.00	225.79			
		Group 4: 60+	118	2.00	198.92			
Bus	**I feel safe waiting at the bus stop**	Group 1: 18-29	43	2.00	128.44	8.16	3	.043
		Group 2: 30-44	83	3.00	142.04			
		Group 3: 45-59	49	2.00	129.29			
		Group 4: 60+	79	2.00	110.60			
	I feel safe travelling on the bus/coach	Group 1: 18-29	43	2.00	140.45	11.83	3	.008
		Group 2: 30-44	83	2.20	142.88			
		Group 3: 45-59	49	2.00	121.30			
		Group 4: 60+	79	2.00	108.14			
	I **feel safe from harassment or attacks on the bus/coach**	Group 1: 18-29	43	2.00	140.76	21.81	3	<.001
		Group 2: 30-44	83	2.00	137.65			
		Group 3: 45-59	49	2.00	147.13			

		Group 4: 60+	79	2.00	97.44			
Train	**I feel safe waiting for the train**	Group 1: 18-29	18	2.00	68.14	16.17	3	.001
		Group 2: 30-44	33	2.00	67.48			
		Group 3: 45-59	26	1.61	57.31			
		Group 4: 60+	36	1.00	41.60			
	I feel safe travelling on the train	Group 1: 18-29	18	2.00	60.36	.533	3	.912
		Group 2: 30-44	33	2.00	54.85			
		Group 3: 45-59	26	2.00	57.35			
		Group 4: 60+	36	2.00	57.04			
	I **feel safe from harassment or attacks on the train**	Group 1: 18-29	18	2.00	72.92	32.44	3	<.001
		Group 2: 30-44	33	2.00	65.14			
		Group 3: 45-59	26	2.00	68.65			
		Group 4: 60+	36	1.00	33.17			
Luas/tram	**I feel safe waiting for the Luas/tram**	Group 1: 18-29	7	2.00	19.36	12.87	2	.002
		Group 2: 30-44	21	3.00	22.45			
		Group 3: 45-59	8	1.00	7.38			
	I feel safe travelling on the Luas/tram	Group 1: 18-29	7	3.00	17.79	8.99	2	.011
		Group 2: 30-44	21	4.00	22.12			

		Group 3: 45-59	8	2.00	9.63			
	I **feel safe from harassment or attacks on the Luas/tram**	Group 1: 18-29	7	2.00	16.07	9.94	2	.007
		Group 2: 30-44	21	4.00	22.60			
		Group 3: 45-59	8	2.00	9.88			
Active transport	**I feel safe walking**	Group 1: 18-29	67	2.00	136.91	10.61	3	.014
		Group 2: 30-44	113	2.00	164.24			
		Group 3: 45-59	80	2.00	170.99			
		Group 4: 60+	72	2.00	133.94			
	I feel safe cycling	Group 1: 18-29	16	2.00	33.00	11.14	3	.011
		Group 2: 30-44	28	2.72	53.13			
		Group 3: 45-59	39	3.00	54.40			
		Group 4: 60+	30	3.00	66.33			

Table 16: Results of Kruskal-Wallis testing conducted in SPSS for age and safety by transport mode. (Highlighted results indicate significant at the p = 0.05 level).

Bus/Coach

a. I feel safe waiting at the bus stop

In response to the statement 'I feel safe waiting at the bus stop' (where 1 = always and 5 = never), there was a statistically significant difference (χ^2 (3, n = 254) = 8.16, p = .043) in responses across four age groups: Group 1 (18-29 years, n = 43); Group 2 (30-44 years, n = 83); Group 3 (45-59 years, n = 49); Group 4 (60+ years, n = 79).

Post hoc testing indicated that the 30-44 age group reported significantly lower feelings of safety (*Md* = 3.00, sample average rank = 142.04), compared to the 60+ age group (*Md* = 2.00, sample average rank = 110.60, *p* = .027).

b. I feel safe travelling on the bus/coach

In response to the statement 'I feel safe travelling on the bus/coach' (where 1 = strongly agree and 5 = strongly disagree), there was a statistically significant difference (χ^2 (3, *n* = 254) = 11.83, *p* = .008) in responses across four age groups: Group 1 (18-29 years, *n* = 43); Group 2 (30-44 years, *n* = 83); Group 3 (45-59 years, *n* = 49); Group 4 (60+ years, *n* = 79).

Post hoc testing indicated that the 30-44 age group reported significantly lower feelings of safety (*Md* = 2.20, sample average rank = 142.88), compared to the 60+ age group (*Md* = 2.00, sample average rank = 108.14, *p* = .01).

I feel safe from harassment or attacks on the bus/coach

In response to the statement 'I feel safe from harassment or attacks on the bus/coach' (where 1 = always and 5 = never), there was a statistically significant difference (χ^2 (3, n = 254) = 21.81, *p* = <.001) across four age groups: Group 1 (18-29 years, n = 43); Group 2 (30-44 years, n = 83); Group 3 (45-59 years, n = 49); Group 4 (60+ years, n = 79).

Post hoc testing indicated that the 60+ age group (*Md* = 2.00, sample average rank = 97.44) reported significantly higher feelings of safety, compared to the 18-29 age group (*Md* = 2.00, sample average rank = 140.76, *p* = .006), the 30-44 age group (sample average rank = 137.65, *p* = .001) and 45-59 age group (sample average rank = 147.13, *p* = .001).

The experience of safety on the bus/coach varies across age groups with 30-44 age group feeling less safe waiting for the bus than 60+ age group, while the 60+ feel safer from harassment or attacks on the bus/coach than younger age groups.

Train

a. I feel safe waiting for the train

A Kruskal- Wallis Test indicated a statistically significant difference (χ^2 (3, *n* = 113) = 16.17, *p* = .001) in responses to the statement 'I feel safe waiting for the train' (where 1 = always and 5 = never), across four age groups: Group 1 (18-29 years, *n* = 18); Group 2 (30-44 years, *n* = 33); Group 3 (45-59 years, *n* = 26); Group 4 (60+ years, *n* = 36).

Post hoc testing indicated that the 60+ age group (*Md* = 1.00, sample average rank = 41.60) reported significantly higher feelings of safety, compared to the 18-29 age group (*Md* = 2.00, sample average rank

= 68.14, *p* = 0.12), the 30-44 age group (*Md* = 2.00, sample average rank = 67.48, *p* = < .001), and the 45-59 age group (*Md* = 1.61, sample average rank = 57.31, *p* = .041).

b. I feel safe travelling on the train

A Kruskal- Wallis Test indicated no statistically significant difference (χ^2 (3, n = 113) = .533, *p* = .912) in responses to the statement 'I feel safe travelling on the Train' (where 1 = strongly agree and 5 = strongly disagree), across four different age groups: Group 1 (18-29 years, n = 18); Group 2 (30-44 years, n = 33); Group 3 (45-59 years, n = 26); Group 4 (60+ years, n = 36). All age groups reported that they *agree* (*Md* = 2.00) they feel safe travelling on the train.

c. I feel safe from harassment or attacks on the train

A Kruskal- Wallis Test indicated a statistically significant difference (χ^2 (3, n = 113) = 32.44, *p* = <.001) in responses to the statement 'I feel safe from harassment or attacks on the Train' (where 1 = always and 5 = never), across four age groups: Group 1 (18-29 years, n = 18); Group 2 (30-44 years, n = 33); Group 3 (45-59 years, n = 26); Group 4 (60+ years, n = 36).

Post hoc testing indicated that the 60+ age group (*Md* = 1.00, sample average rank = 33.17, *p* = .000) reported significantly higher feelings of safety, compared to the 18-29 age group (*Md* = 2.00, sample average rank = 72.92, *p* = .000), the 30-44 age group (*Md* = 2.00, sample average rank = 65.14, *p* = .000) and the 45-59 age group (*Md* = 2.00, sample average rank = 68.65, *p* = .000).

Experiences of safety on the train indicated that all age groups feel safe while waiting for, and travelling on, the train. Additionally, older age groups reported feeling safer from harassment or attacks on the train when compared to all other age groups.

Luas/Tram

As previously outlined in section 5.3, an acceptable sample size per group in a Kruskal-Wallis test is *n*≥5 samples (Ostertagova et al., 2014). As the group sample size for Luas/Tram users in the 60+ age group was <5, they were not included in these tests to ensure accuracy in reporting of the *p* values.

a. I feel safe waiting for the Luas/Tram

A Kruskal- Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 36) = 12.87, *p* = .002) in responses to the statement 'I feel safe waiting for the Luas/Tram' (where 1 = always and 5 = never), across four age groups: Group 1 (18-29 years, *n* = 7); Group 2 (30-44 years, *n* = 21); Group 3 (45-59 years, *n* = 8). Post hoc testing indicated that the 45-59 age group (*Md* = 1.00, sample average rank = 7.38) reported significantly higher feelings of safety, compared to the 30-44 age group (*Md* = 3.00, sample average rank = 22.45, *p*=.001) feeling safe waiting for the Luas/Tram.

b. I feel safe travelling on the Luas/Tram

A Kruskal- Wallis Test indicated a statistically significant difference (χ^2 (2, n = 36) = 8.99, p = .011) in responses to the statement 'I feel safe travelling on the Luas/Tram' (where 1 = strongly agree and 5 = strongly disagree), across four age groups: Group 1 (18-29 years, n = 7); Group 2 (30-44 years, n = 21); Group 3 (45-59 years, n = 8).

Post hoc testing indicated that the 45-59 age group (*Md* = 2.00, sample average rank = 9.63) reported significantly higher feelings of safety, compared to the 30-44 age (*Md* = 4.00, sample average rank = 22.12, p = .008).

c. I feel safe from harassment or attacks on the Luas/Tram

A Kruskal- Wallis Test indicated a statistically significant difference (χ^2 (2, n = 36) = 9.94, p = .007) in responses to the statement 'I feel safe from harassment or attacks on the Luas/Tram' (where 1 = always and 5 = never), across four age groups: Group 1 (18-29 years, n = 7); Group 2 (30-44 years, n = 21); Group 3 (45-59 years, n = 8).

Post hoc testing indicated that the 30-44 age group (*Md* = 4.00, sample average rank = 22.60) feel significantly less safe from harassment or attacks, compared to the 45-59 age group (*Md* = 2.00, sample average rank = 9.88, p = .006).

These results indicate that the experience of using the Luas/Tram is varied across the middle-aged groups where the 30-44 age group feel significantly less safe from harassment or attacks on the Luas/Tram compared to the 45-59 age group. Additionally, the 45-59 age group feel significantly safer waiting for and travelling on the Luas/Tram compared to the 30-44 age group.

I feel safe walking

A Kruskal- Wallis Test indicated a statistically significant difference (χ^2 (3, n = 332) = 10.61, p = .014) in responses to the statement 'I feel safe walking' (where 1 = always and 5 = never), across four age groups: Group 1 (18-29 years, n = 67); Group 2 (30-44 years, n = 113); Group 3 (45-59 years, n = 80); Group 4 (60+ years, n = 72).

Post hoc testing indicated that the 60+ age group (*Md* = 2.00, sample average rank = 133.94) feel significantly safer walking, compared to the 45-59 age group (*Md* = 2.00, sample average rank = 170.99, p = .048).

I feel safe cycling

A Kruskal- Wallis Test indicated a statistically significant difference (χ^2 (3, *n* = 114) = 11.14, *p* = .011) in responses to the statement 'I feel safe cycling' (where 1 = always and 5 = never), across four age groups: Group 1 (18-29 years, *n* = 16); Group 2 (30-44 years, *n* = 28); Group 3 (45-59 years, *n* = 39); Group 4 (60+ years, *n* = 31).

Post hoc testing indicated that the 18-29 age group feels significantly safer cycling (*Md* = 2.00, sample average rank = 33.00), compared to the 60+ age group (*Md* = 3.00, sample average rank = 66.33, *p* = .006).

Experiences of harassment or attacks on Public Transport and Age

a. Witnessing harassment or intimidation on Public Transport influences my choice to use Public Transport

A Kruskal- Wallis Test indicated a statistically significant difference (χ^2 (3, n = 420) = 13.90, *p* = .003) in responses to the statement 'Witnessing harassment or intimidation on Public Transport influences my choice to use Public Transport' (where 1 = strongly agree and 5 = strongly disagree), across four age groups: Group 1 (18-29 years, n = 60); Group 2 (30-44 years, n = 135); Group 3 (45-59 years, n = 107); Group 4 (60+ years, n = 118).

Post hoc testing indicated that the 60+ age group (*Md* = 2.00, sample average rank = 180.35) reported significantly stronger agreement to the statement, compared to the 30-44 age group (*Md* = 2.00, sample average rank = 233.97, *p* = .001).

b. Experiencing harassment or intimidation on Public Transport influences my choice to use Public Transport

A Kruskal- Wallis Test indicated no statistically significant difference (χ^2 (3, n = 420) = 3.04, *p* = .385) in responses to the statement 'Experiencing harassment or intimidation on Public Transport influences my choice to use Public Transport' (where 1 = strongly agree and 5 = strongly disagree), across four different age groups: Group 1 (18-29 years, n = 60); Group 2 (30-44 years, n = 135); Group 3 (45-59 years, n = 107); Group 4 (60+ years, n = 118).

All of these tests measured feelings of safety while waiting for and travelling on different public and active transport and experiences of harassment and intimidation on public transport and its influence on public transport use across four different age groups. Safety concerns were indicated on the Luas/tram for middle aged groups, while older groups indicated varying levels of safety across transport modes. The

next section will examine incentivisation to use public and active transport across different transport users.

9.4 Incentives and Primary Transport Mode

The first round of surveying identified that individuals possessed pro-environmental behavioural intention. However, this was not transforming into actual transport behaviour which has also been identified in the literature and outlined in Chapter 2. This gap in understanding what could incentivise behavioural change developed as a research theme in this survey. This section of the analysis was concerned with how different mode users responded to proposed incentives to further understand if incentives could support individuals in changing their travel behaviour. Respondents were categorised into three groups based on their dominant mode of transport: public transport, active transport and private transport. A variety of hypothetical incentives were presented to respondents where they were asked to indicate if these incentives would influence their transport behaviour towards using public and active transport modes. A series of Kruskal-Wallis tests were conducted to examine if the suggested incentives would change individuals' intention to use public transport. Each of the following statements were proposed to respondents on a Likert scale where 1 = Strongly agree, 2 = Agree, 3 = Neither agree or disagree, 4 = Disagree, and 5 = Strongly disagree. Table 17 below outlines the results from the statistical testing conducted in SPSS for primary mode used and each proposed incentive. The results highlight that individuals who already use public transport and active travel agree more strongly than private transport users that the proposed incentives would change their intention to use public transport. The following section will present the results from these tests.

Statement	**Group**	**N**	**Median (Md)**	**Mean rank**	**H**	***df***	***p*-value**
I would use public transport if fares were free at peak seasonal times	**Private transport user**	300	2.00	226.63	34.04	2	<.001
	Public transport user	54	1.00	134.54			
	Active transport user	60	2.00	177.52			
	Private transport user	300	3.00	215.20	6.53	2	.038

I would use public transport If I saw how much $C0_2$ I saved per journey	**Public transport user**	54	2.00	201.38			
	Active transport user	60	3.00	174.52			
Would the following change your intentions to use public transport: **a. Faster service**	**Private transport user**	300	2.00	224.94	27.02	2	<.001
	Public transport user	54	1.73	154.93			
	Active transport user	60	2.00	167.63			
b. Cheaper fares	**Private transport user**	300	2.00	217.15	20.67	2	<.001
	Public transport user	54	1.00	142.02			
	Active transport user	60	2.00	218.17			
c. Stops closer to your home/workplace	**Private transport user**	300	2.00	202.08	4.21	2	.122
	Public transport user	54	2.00	207.46			
	Active transport user	60	2.00	234.63			
d. Free fares	**Private transport user**	300	2.00	211.53	13.60	2	.001
	Public transport user	54	1.00	158.81			
	Active transport user	60	2.00	231.18			
e. More seats	**Private transport user**	300	2.00	212.33	8.01	2	0.18

	Public transport user	54	2.00	166.99			
	Active transport user	60	2.00	219.83			
f. Accurate real-time information	**Private transport user**	300	2.00	216.36	8.17	2	0.17
	Public transport user	54	1.00	195.96			
	Active transport user	60	1.00	173.60			
g. Live tracking map for transport modes	**Private transport user**	300	2.00	224.75	27.25	2	<.001
	Public transport user	54	1.00	172.18			
	Active transport user	60	1.00	153.05			
h. Designated quiet carriage on trains	**Private transport user**	300	2.00	202.18	3.1	2	.212
	Public transport user	54	2.00	230.90			
	Active transport user	60	2.00	213.07			

Table 17: Results of Kruskal-Wallis testing conducted in SPSS for primary transport mode used and public incentives. (Highlighted results indicate significant at the p = 0.05 level).

I would use public transport if fares were free at peak seasonal times

A Kruskal-Wallis Test indicated a statistically significant difference in responses to the statement 'I would use public transport if fares were free at peak seasonal times' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300); public transport users (*n* = 54); Active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 34.04, *p* = <.001).

Post hoc testing indicated that private transport users (*Md* = 2.00, sample average rank = 226.63, *p* = .000) are significantly less incentivised to use public transport if fares were free at peak seasonal times,

compared to public transport users (*Md* = 1.00, sample average rank = 134.54, *p* =.000) and active transport users (*Md* = 2.00, sample average rank = 177.52, *p* = .008).

I would use public transport If I saw how much CO_2 I saved per journey

A Kruskal- Wallis Test indicated a statistically significant difference in responses to the statement 'I would use public transport if I saw how much C02 I saved per journey' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300); public transport users (*n* = 54); Active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 6.53, *p* = .038).

Post hoc testing indicated that active travel users (*Md* = 3.00, sample average rank = 174.52) are significantly more incentivised to use public transport If they saw how much CO_2 I saved per journey, compared to private car users (*Md* = 3.00, sample average rank = 215.20, *p* = .035).

Would the following change your intentions to use public transport:

a. Faster service

A Kruskal- Wallis Test indicated a statistically significant difference in responses to the choice 'Faster Service' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300); public transport users (*n* = 54); Active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 27.02, *p* = <.001).

Post hoc testing indicated that private transport users (*Md* = 2.00, sample average rank = 224.94) are significantly less incentivised to use public transport if the services were faster, compared to public transport users (*Md* = 1.73, sample average rank = 154.93, *p* =.001) and active transport users (*Md* = 2.00, sample average rank = 167.63, *p* = .001).

b. Cheaper fares

A Kruskal- Wallis Test indicated a statistically significant difference in responses to the choice 'cheaper fares' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300), public transport users (*n* = 54), and active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 20.69, *p* = <.001).

Post hoc testing indicated that public transport users (*Md* = 1.00, sample average rank = 142.02) are significantly more incentivised to use public transport if the fares were cheaper, compared to private transport users (*Md* = 2.00, sample average rank = 217.15, *p* =.000) and active transport users (*Md* = 2.00, sample average rank = 218.17, *p* = .001).

c. Stops closer to your home/workplace

A Kruskal- Wallis Test indicated no statistically significant difference in responses to the choice 'stops closer to your home/workplace' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300), public transport users (*n* = 54), and active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 4.21, *p* = .122).

d. Free fares

A Kruskal- Wallis Test indicated a statistically significant difference in responses to the choice 'free fares' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300), public transport users (*n* = 54), and active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 13.60, *p* = .001). Post hoc testing indicated that public transport users (*Md* = 1.00, sample average rank = 158.81) are significantly more incentivised to use public transport if fares were free, compared to private transport users (*Md* = 2.00, sample average rank = 211.53, *p* =.004) and active transport users (*Md* = 2.00, sample average rank = 231.18, *p* = .001).

e. More seats

A Kruskal- Wallis Test indicated a statistically significant difference in responses to the choice 'more seats' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300), public transport users (*n* = 54), and active transport users (n = 60) (χ^2 (2, *n* = 414) = 8.01, p = .018). Post hoc testing indicated that public transport (*Md* = 2.00, sample average rank = 166.99). are significantly more incentivised to use public transport if there were more seats, compared to active transport users (*Md* = 2.00, sample average rank = 219.83, *p* =.041) and private transport users (*Md* = 2.00, sample average rank = 212.33, *p* = .022).

f. Accurate real-time information

A Kruskal- Wallis Test indicated a statistically significant difference in responses to the choice 'accurate real-time information' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300), public transport users (*n* = 54), and active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 8.17, p = .017).

Post hoc testing showed that active transport users (*Md* = 1.00, sample average rank = 173.60) are significantly more incentivised to use public transport if there was accurate real-time information, compared to private transport users (*Md* = 2.00, sample average rank = 216.36, *p* = .019).

g. Live tracking map for transport modes

A Kruskal- Wallis Test indicated a statistically significant difference in responses to the choice 'live tracking map for transport modes' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300), public transport users (n = 54), and active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 27.25, *p* = <.001).

Post hoc testing indicated that private transport users (*Md* = 2.00) are significantly less likely to change their intention to use sustainable transport modes if there were live tracking maps, compared to public transport users (*Md* = 1.00, *p* = .004) and active transport users (*Md* = 1.00, *p* =.000).

h. Designated quiet carriages on trains

A Kruskal- Wallis Test indicated no statistically significant difference in responses to the choice 'designated quiet carriages on trains' (where 1 = strongly agree and 5 = strongly disagree), across three groups: private transport users (*n* = 300), public transport users (*n* = 54), and active transport users (*n* = 60) (χ^2 (2, *n* = 414) = 3.10, *p* = .212).

Active transport incentives

The set of tests outlined in Table 18 were conducted on specific infrastructures that could incentivise individuals and change their intention to use active travel. Active travel users were included here to examine if individuals already using the mode were more incentivised to continue to use the mode than those individuals predominantly using public transport or private transport. All tests were answered on a 5-point Likert scale where 1 = Strongly agree and 5 = Strongly disagree.

Mode	Statement	Group	N	Median (Md)	Mean rank	H	*df*	*p*-value
Walking	**Improved infrastructure (e.g. better roads and pavings)**	**Private transport user**	300	2.00	218.22	13.666	2	.001
		Public transport user	54	2.00	201.26			
		Active transport user	60	2.00	159.51			

	Better lighting	**Private transport user**	300	2.00	211.82	2.778	2	.249
		Public transport user	54	2.00	208.28			
		Active transport user	60	2.00	185.20			
	Segregated pathways	**Private transport user**	300	2.00	210.89	10.365	2	.006
		Public transport user	54	2.00	233.32			
		Active transport user	60	2.00	167.33			
	Increased information on health benefits	**Private transport user**	300	3.00	198.31	8.901	2	.012
		Public transport user	54	3.00	247.05			
		Active transport user	60	3.00	217.85			
	Garda presence	**Private transport user**	300	2.00	200.77	3.853	2	.146
		Public transport user	54	2.00	227.74			

		Active transport user	60	3.00	222.93			
	Links up to public transport services	**Private transport user**	300	2.00	208.02	.036	2	.982
		Public transport user	54	2.00	207.32			
		Active transport user	60	2.00	205.06			
Cycling	**Improved infrastructure (e.g. better roads and pavings)**	**Private transport user**	300	2.00	215.35	5.699	2	.058
		Public transport user	54	2.00	195.48			
		Active transport user	60	2.00	179.08			
	Better lighting	**Private transport user**	300	2.00	207.35	.002	2	.999
		Public transport user	54	2.00	207.75			
		Active transport user	60	2.00	208.01			
	Designated pathways	**Private transport user**	300	2.00	219.43	11.735	2	.003

		Public transport user	54	2.00	178.65			
		Active transport user	60	2.00	173.82			
	Garda presence	**Private transport user**	300	3.00	205.56	6.310	2	.043
		Public transport user	54	3.00	240.28			
		Active transport user	60	3.00	187.69			
	One Way streets/Absence of through traffic	**Private transport user**	300	3.00	219.78	12.538	2	.002
		Public transport user	54	2.00	176.14			
		Active transport user	60	2.00	174.32			
	More bike parking and storage facilities	**Private transport user**	300	2.00	215.84	7.020	2	.030
		Public transport user	54	2.00	198.14			
		Active transport user	60	1.80	174.21			

	Increased information on health benefits	**Private transport user**	300	3.00	196.23	10.754	2	.005
		Public transport user	54	3.00	242.52			
		Active transport user	60	3.00	232.33			
	Reduced car speed limits	**Private transport user**	300	3.00	213.87	10.148	2	.006
		Public transport user	54	3.00	220.76			
		Active transport user	60	2.46	163.73			
	Links up to public transport services	**Private transport user**	300	2.00	203.13	1.590	2	.452
		Public transport user	54	2.00	219.87			
		Active transport user	60	2.00	218.20			

Table 18: Results of Kruskal-Wallis testing conducted in SPSS for primary transport mode used and active travel incentives. (Highlighted results indicate significant at the p = 0.05 level).

Walking

Improved Infrastructure (e.g. better roads and pavings)

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, n = 314) = 2, p = .001) in response to the question 'Would improved infrastructure (e.g. better roads and pavings) change your intention to

choose walking as a travel mode' (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).
Post hoc testing indicated that active transport (*Md* = 2.00, sample average rank = 158.51) are significantly more likely to change their intention to choose walking as a travel mode if the infrastructure is improved, compared to private transport users (*Md* = 2.00, sample average rank = 218.22, *p* = .001).

Better lighting

A Kruskal-Wallis Test did not indicate a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .249) in response to the question "Would better lighting change your intention to choose walking as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Segregated pathways

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .006) in response to the question "Would segregated pathways change your intention to choose walking as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).
Post hoc testing indicated that active transport users (*Md* = 2.00, sample average rank = 167.33) are significantly more likely to change their intention to choose walking as a travel mode if there was segregated pathways, compared to both public transport users (sample average rank = 233.32, *p* = .006), and private transport users (sample average rank = 210.89, *p* = .022).

Increased information on health benefits

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .012) in response to the question "Would increased information on health benefits change your intention to choose walking as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Post hoc testing indicated that private transport users (*Md* = 3.00, sample average rank = 198.31) are significantly more likely to change their intention to choose walking as a travel mode if there was increased health benefits compared to public transport users (*Md* = 3.00, sample average rank = 247.05, *p* = .004).

Garda Presence

A Kruskal-Wallis Test did not indicate a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .146) in response to the question "Would a Garda presence change your intention to choose walking as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Links up to public transport services

A Kruskal-Wallis Test did not indicate a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .982) in response to the question "Would links up to public transport services change your intention to choose walking as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Cycling

Improved infrastructure (e.g., better roads and pavings)

A Kruskal-Wallis Test did not indicate a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .058) in response to the question "Would improved infrastructure (e.g., better roads and pavings) change your intention to choose cycling as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Better lighting

A Kruskal-Wallis Test did not indicate a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .999) in response to the question "Would better lighting change your intention to choose cycling as a travel mode"

(where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Designated pathways

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .003) in response to the question "Would designated pathways change your intention to choose cycling as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60). Post hoc testing indicated that active transport users (*Md* = 2.00, sample average rank = 174.82) are significantly more likely to change their intention to choose cycling as a travel mode if there was designated pathways, compared to private transport users (*Md* = 2.00, sample average rank = 219.43, *p* = .015).

Garda presence

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .043) in response to the question "Would Garda presence change your intention to choose cycling as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60). Post hoc testing indicated that active travel users (*Md* = 3.00, samples average rank = 187.69) are significantly more likely to change their intention to choose cycling as a travel mode if there is a Garda presence, compared to private car users (*Md* = 3.00, sample average rank = 240.28, *p* = .043) .

One-Way streets/Absence of through traffic

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .002) in response to the question "Would one-way streets/absence of through traffic change your intention to choose cycling as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Post hoc testing indicated that private transport users (*Md* = 3.00, sample average rank = 219.78) are

significantly less likely to change their intention to choose cycling as a travel mode if there was one-way streets/absence of through traffic, compared to both public transport users (*Md* = 2.00, sample average rank = 176.14, *p* = .030) and active transport users (*Md* = 2.00, sample average rank = 174.32, *p* =.015).

More bike parking and storage facilities

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .030) in response to the question "Would more bike parking and storage facilities change your intention to choose cycling as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Post hoc testing indicated that active transport users (*Md* = 1.80, sample average rank = 174.21) are significantly more likely to change their intention to choose cycling as a travel mode if there was more bike parking and storage facilities, compared to private transport users (*Md* = 2.00, sample average rank = 215.84, *p* = .020).

Increased information on health benefits

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .005) in response to the question "Would increased information on health benefits change your intention to choose cycling as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

Post hoc testing indicated that private transport users (*Md* = 3.00, sample average rank = 196.23) are significantly more likely to change their intention to choose cycling as a travel mode if there was increased information on health benefits, compared to public transport users (*Md* = 3.00, sample average rank = 242.52, *p* = .019).

Reduced car speed limits

A Kruskal-Wallis Test indicated a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .006) in response to the question "Would reduced car speed limits change your intention to choose cycling as a travel mode"

(where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60). Post hoc testing indicated that active transport users (*Md* = 2.46, sample average rank = 163.73) are significantly more likely to change their intention to choose cycling as a travel mode if speed limits are reduced, compared to both public transport users (*Md* = 3.00, sample average rank = 220.76, *p* = .026), and private transport users (*Md* = 3.00, sample average rank = 213.87, *p* = .007).

Links up to public transport services

A Kruskal-Wallis Test did not indicate a statistically significant difference (χ^2 (2, *n* = 314) = 2, *p* = .452) in response to the question "Would links up to public transport services change your intention to choose cycling as a travel mode" (where 1 = strongly agree and 5 = strongly disagree), across three groups: Group 1 (private transport users, *n* = 300); Group 2 (Public transport users, *n* = 54); Group 3 (Active transport users, *n* = 60).

9.5 Conclusion

This chapter has outlined how age, gender and infrastructure serve as barriers to transport behavioural change, while incentives may not encourage private car users enough to change their travel behaviour. This section of results has identified that females experience lower levels of safety across all transport modes compared to males, which supports Irish research by Transport Infrastructure Ireland on women's experiences of transport safety (TII, 2020) and highlights that women continue to experience a lower level of safety using public and active transport. Additionally, middle aged people have indicated that they feel unsafe waiting at the bus stop and when waiting for and travelling on the Luas/tram. The results also show that providing individuals with information on how much CO_2 could be saved with every journey does not incentivise transport users to change their intention to use public transport, which shows that advertising may not be a strong enough support in changing travel behaviours. The survey data also reveals that public transport users are more incentivised by free fares than private car users, and active transport users are more incentivised than public and private transport users to choose active travel modes if infrastructural changes are introduced. These results indicate that incentives alone may not support individuals in shifting from the private car to sustainable transport modes. Instead, it may indicate that disincentive measures may be required to push a behavioural change along. The next chapter will discuss

in further detail the insights outlined in these interview results, alongside the survey results, and their impact on the development of transport in Ireland to encourage behavioural change at both urban and rural levels.

Section 5:

Discussion of Results

Chapter 10: Discussion

10.1 Introduction

Understanding how individuals experience transport is a fundamental aid in decarbonising the transport sector. This research is a relevant and timely exploration of the experiences of transport as it examines the motivations and barriers to transport behaviours in Ireland. As outlined in Chapter 1, the central aim of this research sought to assess attitudes and behaviours towards transport in a post-COVID-19 Ireland to understand how behaviour could change over time to support Ireland's climate change goals. To address this aim, the objectives of this research sought to:

1. Identify the current attitudes and behaviours towards different transport modes.
2. Explore barriers to transport behavioural change.
3. Assess how proposed incentives could support sustainable transport behavioural change.

This research is the first study to examine the impact of safety, cost, time, and government response to climate change as motivations for transport behaviour in an Irish context. It broadens our understanding about what transport users need from infrastructure to bolster their sense of safety when using public and active transport. These findings also identify that the intention – behaviour gap exists when thinking about and using public and active transport from the perspective of private car users. Through these findings, the research provides an opportunity to understand the attitudes and behaviours of individuals who use the available transport infrastructure in Ireland, alongside the perspectives of the stakeholders in the transport sector who contribute to the policy, design, development, and implementation of this infrastructure. The research expands our understanding of individual experiences of transport in Ireland and fills a research gap about the motivations and barriers that exist for users when considering transport behavioural change. The results of this research provide beneficial insights into what is needed from future transport policy and infrastructure development to support behavioural change and decrease transport emissions.

Utilising this research aim and objectives, the results, presented in Section 4, highlighted that feelings of safety, cost, and time are important factors when considering mode choice. Furthermore, these factors serve as a barrier to behavioural change, particularly for women and older people. The research identified an intention-behaviour gap, which showed that individuals held pro-environmental intentions to use sustainable transport modes, but their actual behaviour did not show this. This finding, outlined in Chapter 7, shows that while individuals intend to use sustainable modes, there are infrastructural, social and psychological barriers that prevent them from changing their behaviour.

These results have also found that the barriers to transforming the transport sector lie largely in the robust development of the infrastructure. This research finds that a strong consideration is required for how these infrastructural needs and their development differ at urban and rural levels. The interview results with stakeholders in the transport sector, presented in Chapter 8, identifies how different safety considerations are required for active travel infrastructure development at urban levels versus rural levels. This is due to the standard of the roads in rural areas, the mode sharing on roads in rural areas with larger machinery vehicles, and the entrenched perspective of rural roads being unsafe for active travel. These interviews also highlighted that while the rural public transport system is continually developing, it will not meet the needs of everyone living in rural areas due to the development of housing and settlement patterns in these areas.

The COVID-19 pandemic highlighted how hard disincentives such as travel restrictions within 2, 5 and km radii, remote working, and reduced passenger numbers on public transport were effective in forcing behavioural change and reducing transport emissions. Given that current emissions reductions targets for the transport sector are not being met (EPA, 2025), such hard disincentives will likely be necessary to support future behavioural change in this way if binding transport emissions reductions are to be achieved. Specifically, the State has committed to 50% reduction in greenhouse gas emissions for the transport sector by 2030, with commitments to shift behavioural change to support uptake of more sustainable travel modes recognised as a key component of this strategy. However, the results of this research highlight how unpopular these disincentives were, as seen in Section 7.1, where survey 1 respondents indicated that their travel behaviour reverted to their pre-pandemic behaviour soon after travel restrictions were lifted. As such, this research (survey 2) shifted to examine what role incentives might play in supporting transport behavioural change in the future, cognisant that hard disincentives to shift transport behaviour on a wider scale as witnessed during the pandemic have not been sustained long term, and transport greenhouse gas emissions have subsequently rebounded in recent years, largely driven by public transport usage.

The incentives proposed to support individuals in changing their travel behaviour, presented in Chapter 9, highlight that individuals who already use sustainable transport modes are more incentivised to continue using their sustainable travel modes than individuals using the private car switching to more sustainable modes. This is an important finding given the retention of the reduced travel fares and leap

card (travel cards) caps outlined by the NTA to encourage public transport use. These results also suggest that incentives alone do not work in encouraging private car users towards sustainable transport and may need to be paired with disincentive measures like congestion charges in urban areas to encourage individuals to change their travel modes. This use of disincentives to force behavioural change echoes back to Skinner's (1936) work on operant conditioning outlined in Chapter 2. However, the specificities of what types of disincentives could work were outside the scope of this research and therefore not evaluated in this project.

These findings were presented through two rounds of surveying with a total of 762 surveys completed, and 12 qualitative interviews with stakeholders in the transport sector (as discussed in Section 4). Through a pragmatic methodology for data collection concerned with answering the 'what' and 'why' of this research, the collection of qualitative and quantitative data has addressed the first objective set out in this thesis to identify the current attitudes and behaviours towards different transport modes. The results show how individuals perceive the private car as advantageous over sustainable transport modes due to its cost, time and safety benefits. Most survey respondents in the second survey indicated that they use a private car as their primary transport mode, outnumbering respondents using active travel and public transport as their primary transport mode by a ratio of at least 5:1 (see Section 8.4). Moreover, these private car users had lower intentions to shift to public transport than either active travel or public transport users even if incentives for taking public transport were offered. This included reducing or eliminating costs for public transport (cost), improving real-time information (time) and providing more seating on public transport (safety). Furthermore, private car users were significantly less incentivised to change their intention to use active transport when proposed infrastructural improvements were suggested when compared to public and current active transport users. These findings are reflective of a society that has yet to embrace public transport or active travel and demonstrate the challenge for policymakers in shifting transport behaviours. To further explore why individuals' behaviour is not changing, this chapter will examine the results of the data collection under the second and third research objectives outlined in Chapter 1. Research objective two explored the barriers to transport behavioural change, while research objective three assessed how proposed incentives could support transport behavioural change. This chapter will examine how these research objectives have addressed the central research aim of this research.

This chapter discusses the research themes in the context of the results and current available literature. These themes have been seen throughout the thesis to analyse the experience of transport users in Ireland and capture the perspectives from experts regarding the suitability of the current transport system in meeting the needs of users while fulfilling decarbonisation targets for the sector. The findings have developed new insight into the needs of transport users and the suggested improvements to the transport system to encourage a behavioural change to more sustainable modes of transport. These insights include the intention-behaviour gap that exists when individuals consider their transport behaviours, the influence that incentives could have on transport behaviour change, the need for robust infrastructure to support individuals transport needs and how they differ at urban and rural levels and the importance of the perception of safety when considering using sustainable transport modes. Through this examination of transport users' needs, new insights have been developed into what is required of the current transport system to support users' safety, reliability and economic concerns which can support their transport behavioural change.

10.2 Barriers to transport behavioural change

The first theme in this section focuses on the barriers and motivations to sustainable transport mode choices which is the second objective of this study. This theme initially developed as an area for further exploration following the literature review presented in Chapter 2. As evidenced from the two rounds of surveys, structural barriers for behavioural change occur at both urban and rural levels in Ireland. While these structural barriers are shared across these levels they are experienced differently. Dispersed settlement patters and planning of housing due to historical ribbon development have led to a lack of suitable transport infrastructure in rural areas, leading users to rely on their private car for journeys. Rural areas in Ireland are also experiencing forced car ownership at higher rates than urban areas (Carroll et al., 2021). The social norming of private car use in rural areas coupled with a lack of suitable infrastructure can inhibit transport behavioural change at both urban and rural levels. Results from the expert interviews, outlined in Chapter 8 highlight how individuals in rural areas do not perceive the active transport infrastructure as safe enough to use. Furthermore, as seen in the expert interview with a member of the NTA in Chapter 8, while the development of public transport infrastructure is improving in rural areas, the role of the private car cannot be fully replaced. In urban areas, perceptions of unreliability with public transport in relation to a lack of information, buses not showing up on time and infrastructure that does not meet users' needs has been outlined across Chapter 7-9 in Section 4. It is thus clear from the survey and interview data outlined in Section 4 that there is considerable complexity around the barriers to sustainable mode choice in the Irish context and how these can be resolved. The

following section examines how reliability, safety and cost can influence the behavioural choices of individuals. It also provides insight into what may be required to support a shift in these behaviours. These factors were identified initially in the literature review outlined in Chapter 2 as areas that influence individuals travel behaviour. Following two rounds of surveying of the general public and interviews/focus group with 12 individuals working in or with extensive knowledge of the transport sector it became evident that the reliability of infrastructure, both in relation to how reliable the transport services are and how suitable the current infrastructure is, the low level of safety women and older people perceive when using active and public transport, and the cost of using sustainable transport, specifically in relation to the cost of time, were core aspects that served as barriers to the uptake of sustainable transport.

10.2.1 Sustainable transport and reliability

As evidenced in the survey and interview data presented in Section 4, the reliability of transport modes influences individual's transport mode choice. The results in this study show that individuals perceive the private car as safer, cheaper and faster than public and active travel, leading them to choose the private car for their mode choice more than the sustainable transport options available to them. The results also highlighted that improvements to real time information and live tracking facilities for public transport modes and improvements to active transport infrastructure such as better lighting and designated pathways could influence private car users' mode choice. Interestingly however, in the context of incentivisation for private car users, such improvements were often perceived as more beneficial to *existing* active travel or public transport users in incentivising active and public transport uptake.

While these results may not be surprising given that nearly 70% of all journeys in Ireland are made by private car (NTA, 2023), it does create an area for development given Ireland's commitment to a 50% reduction in transport emissions by 2030. These results highlight the need to understand how the perceived reliability of sustainable transport can be developed to rival that of the private car. Perceptions of reliability can refer to the bus showing up on time, how fast the train can get an individual home, if smaller local services will connect to national services on time, and how regular the service of the Luas is. It can also refer to how reliable the infrastructure is, such as having well paved paths for walking, segregated cycling lanes, sufficient lighting and seating at different bus stops, train stations and shelters. This section of the chapter will examine how reliability influences mode choice and will examine how this can vary depending on the reliability indicator.

10.2.1.1 Time and transport mode choice

The logistical and infrastructural elements of sustainable transport can alter the perception that individuals have towards the mode, which this research has shown. This has been echoed in recent research by de Oña et al. (2021) which finds that private car users' perception of public transport reliability is influenced by the punctuality, frequency, cost and safety of the modes. The findings in this research show that individuals perceive the private car to be safer, faster and cheaper than public and active travel. These results highlight that these factors can be both barriers to sustainable transport use if these modes are considered less safe, slower and more expensive, and motivators to use sustainable transport modes if these factors are improved to rival the experience of the private car. Considering time as an indicator for service reliability, the results in this research show that individuals perceive the private car as more reliable due to its speed than public and active transport and this influences individuals travel behaviour away from sustainable transport modes and towards the private car. These findings are supported by Abdulrazzaq et al. (2020) that finds reliability indicators such as travel time significantly influences mode choice between public transport and the private car. These results show that time is an important factor for individuals when choosing their travel mode.

These outcomes, presented in Chapter 8, are often caused by actual delays on public transport modes, which has been noted by a customer experience specialist for the NTA. Recent research by Li et al. (2024) shows that when individuals are satisfied with the bus as a travel mode, they are less likely to choose the private car for their journeys. However, in an Irish context, this experience of reliability is not always positive which could explain why individuals are choosing the private car over public and active transport modes. As previously noted in Section 2.5, a 'ghost bus' is a term for a bus that is scheduled to arrive, appears on the real-time information display and then never shows up. These colloquial terms foster a narrative around the unreliability of transport modes which can influence others perception of the mode even if they have not experienced the phenomenon themselves. This further supports the idea that has been explored in research by Chowdhury et al. (2016) where others poor experience of transport modes can influence the behavioural intention of potential passengers. Improvements in the real-time information at transport stops or live tracking of the transport mode could improve perceptions of the reliability of sustainable transport modes. Interestingly, in a recent parliamentary Joint Committee on Transport, members of parliament highlighted how congestion is a large factor in the delays of public transport in Ireland (Houses of the Oireachtas, 2025), indicating that where private cars contribute to the congestion on Irish roads, public transport delays will occur. The results of this research highlight how time is an important factor in travel mode choice. This is an important finding as this research highlights

how a negative experiences of reliability and time efficiency of sustainable transport modes can shape users' perceptions of these modes. This research highlights that perception towards travel modes is a significant indicator for mode choice. Therefore, the reliability and time efficiency of sustainable transport modes needs to be reshaped, as a negative perception pushes users towards the private car over public and active transport modes. This is an important finding in an Irish urban context given the poor rail network coverage nationally and the subsequent reliance on public and private bus services to, from and within urban settings. In the context of such bus services, many bus routes encounter shared road space with other road users (e.g., private car users) for some sections of their journey, which delays journey times for all road users, including bus services. It may partially explain public intentions and behaviours around continued private car usage. Conversely, interviewees noted and evidence shows increased uptake of public transport when service levels improve. Urgently rolling out more extensive priority bus corridors would be an important step in reducing reliability concerns about the efficiency of bus services.

10.2.1.2 The hidden cost of time

The results of this research show that individuals perceive the private car as cheaper than public and active transport modes and this influences their decision to choose the private car for daily travel. This result is particularly important given the rising cost of fuel and the incentivisation to use public transport through the continuation of discounted fares implemented in 2022 (NTA, 2024; Alves et al., 2024). These results highlight that cost is not only perceived in relation to the actual cost of transport fares or fuel prices. One key factor associated with using sustainable transport modes are hidden costs. These hidden costs for public transport include the cost associated with time. Time spent waiting for the public transport mode, delays during the journey, lack of control over the route, the number of stops on the route, and the time spent walking to the mode and from the mode to get to the final destination are factors that contribute to the perceived cost of using these modes. These time-related factors can explain why some individuals in this research asserted that the financial benefits of the private car outweigh those of sustainable transport.

The experience of travel time has been examined by Department of Transport in a recently published report examining the cost of congestion in regional cities between 2022-2040. The report highlights how using sustainable transport modes can reduce the number of vehicles on the road which can reduce congestion (Department of Transport, 2025). Furthermore, the report highlights that a lack of suitable and integrated public transport infrastructure in regional cities inhibits a reduction in congestion (ibid, 2025). This higher incidence of low and single occupancy vehicles contributes to the congestion, and these

users will be a cohort to target when addressing congestion. These time-related costs will continue to exist if the supply of transport infrastructure is not developed at the same rate as the demand (ibid, 2025). These hidden costs associated with time could further explain why individuals perceive public and active travel as more costly than the private car. However, as asserted previously, perception is an important indicator for mode choice. Thus, a change in perception of how low and single occupancy vehicles contribute to congestion and delays, and the concurrent development of the sustainable transport infrastructure, could support a reduction in the time-related costs associated with using sustainable transport modes and reduce the number of low and single occupancy vehicles on the road. This is an important consideration for supporting Ireland's climate change goals as a reduction in the number of low occupancy vehicles on the road can reduce the transport emissions also.

The time costs associated with active travel include the time spent walking or cycling, time spent finding suitable bike parking or secure storage facilities, and the time spent safely storing the bike. For instance, there are currently very few free secure public bike parking facilities in most towns and cities. Dublin city has only two such facilities. Annema (2023) supports this by examining the value of time for public and active transport users. Additionally, incomplete active travel infrastructure may force individuals to take detours, longer routes and potentially travel on unsafe roads to get to their destinations. This could increase their perception that the private car is more cost-effective option, which could influence individuals to opt for the private car. This is further supported by Wismadi et al. (2025) who note that continuous, well-connected cycling infrastructure can encourage an increase in active travel. In his interview presented in Chapter 8, a member of Donegal County Council also found that incomplete active travel infrastructure could be deterring users from using these modes. This is an important finding as individuals cannot be supported in reducing their car dependency if they perceive the infrastructure as unsafe and unreliable. Furthermore, the results of survey 2, outlined in Chapter 9, highlights how all transport users indicated that improved infrastructure such as better roads and paving would change their intention to use active travel (walking and cycling) as travel modes. Thus, bolstering the perception of safety through fully built and connected infrastructure is central to users' consideration of sustainable transport modes.

This research has shown how hidden costs contribute to the perception that the private car is advantageous over sustainable transport modes. Challenging the perception that the private car provides a more efficient experience over sustainable transport requires changes to the infrastructure. These

include ensuring public transport operates reliably and can avail of efficient routes, while active travel infrastructure should fully connect users to the services they need. Furthermore, supporting individuals to shift from the private car requires a reshaping of the current perceptions of unreliability attached to sustainable transport. This will be explored further in the next section.

10.2.1.3 The reliability of infrastructure

This research examines the experience of reliability in the context of travel infrastructure. Participants reported that sustainable transport infrastructure did not adequately meet their needs, which deterred them from using public and active transport modes. Key infrastructural issues that were identified in both the surveys and interviews of this research included a lack of suitable shelters and seating at transport stops, limited seating on transport modes, unavailability of printed timetables, unsuitable paths for walking, and a lack of segregated cycling lanes. These findings align with those from Ferreira and Dias (2025) who find that the availability of seating is an important factor for public transport users' comfort. The interview results, outlined in Chapter 8, have also found that certain transport services were oversubscribed, forcing users to stand on board. Carrel et al. (2013) supports these findings, as individuals experienced overcrowding when trying to board the travel modes, leading some individuals to be left behind. This overcrowding and general over subscription of services can lead to delays in the transport journey which users can link to their perception that the private car is a more time efficient transport mode. Furthermore, the results also support findings by Tanwar and Agarwal (2024) which found that providing clear and accurate information to transport users can improve their experience and reduce uncertainty about when the transport mode will show up. As the literature review outlined in Chapter 2, the availability of information is an important motivator for transport mode choice. The results of this research have identified that users do not perceive real time information for public transport modes to be reliable enough to support them in choosing these modes. Therefore, this result regarding the reliability of transport modes is important as a lack of trust in the available information can shift users towards the private car if they perceive it to be more reliable.

To further understand how reliability functions as barriers to behavioural change, it is important to examine how the development and installation of public transport infrastructure can seem disconnected from users' actual needs. For example, Figure 10 shows an example of one of multiple recent installations of unsheltered single seats that sit approx. six metres from bus stop in the south side of Dublin city which have been branded as 'hostile', with individuals unclear on the reasoning of their placement (O'Cearbhaill, 2025).



Figure 10: Single unsheltered seat that sits approx. six metres from the bus stop. Source: (O'Cearbhaill, 2025)

This example of infrastructure being developed and installed without consultation from the individuals who will be using it serves as a lesson that can result in a widening of the gap between what users' need from transport infrastructure and what they are being offered. This disconnect between the development of the infrastructure and what the actual users need from the infrastructure can push individuals away from transport modes they cannot see themselves using, which can strengthen the culture of private car use, which has been outlined in Section 2.5.2 previously. The interviews with COPE Galway presented in Chapter 8, further outlines this point where the reliability of public transport and its infrastructure is an integral consideration for older people choosing these modes. This lack of consultation with users directly interacting with this infrastructure could disincentivise individuals from choosing sustainable transport modes if they perceive it as unreliable in meeting their transport needs. Increasing the perception and experience of reliability of these sustainable transport modes requires effective consideration and consultation with the individuals using these services and infrastructure.

When considering the reliability of active transport infrastructure in this research, results from survey 2, outlined in Chapter 9, indicate that a number of different infrastructures could change individuals' intention to choose active travel as a travel mode. The results in Chapter 9 outline how individuals already using active travel modes are significantly more likely to intend to use these modes if the infrastructure is improved. This finding is important as it indicates that improving infrastructure is an important incentive to keep active travel users using these modes, particularly when they are already using the most sustainable transport modes. Given that existing active transport users recognise the need for improved infrastructure such as designated cycle lanes and secure bike storage, it may be challenging to encourage private transport users that active travel is both a reliable and safe transport option. This has been echoed previously by Chowdhury et al. (2016) regarding users poor experience of transport modes and how this can influence potential passengers behavioural intention. Enhancing the infrastructure could incentivise active transport users to continue walking and cycling and the results from survey 2 support this. These infrastructures include improved roads and paving, better lighting, secure bike parking facilities, and designated cycle lanes and paths for people walking.

Furthermore, the interview results, detailed in Chapter 8, indicate that active transport infrastructure is not at a suitable level, both in terms of accessibility and safety, across both rural and urbans areas in Ireland. However, a member of Dáil Éireann indicated that when active transport infrastructure was implemented, users of these modes increased. These findings support research from Panter et al. (2016) that note when the new active transport infrastructure is introduced, there was an increase in commuting using these modes, particularly cycling. The results of this research highlight how the introduction and development of active transport infrastructure is essential to enable individuals to have viable alternatives to the private car.

This section outlined how the perception of reliability influences transport mode choice for individuals in this research. Improvements to the transport system must be targeted depending on the mode, the group of users and the location of the transport system, which has been echoed in research by as Redman et al. (2013). This is especially pertinent in the context of Ireland, given the differing transport needs at urban and rural levels, the more limited availability of suitable public and active transport infrastructure in rural areas than in urban areas, and the consideration for the role of the private car in supporting individual's transport needs in lower density areas. This has been noted in research by Carroll et al. (2021) where they find that demand responsive transport services, outlined in the Rural Transport Plan such as door-to-door

services and community cars, may be needed in rural areas due to a lack of political will or sufficient travel demand to provide high-capacity transport options. However, this research finds that cost and time are important determinants of reliability. Without improvements to these factors, individuals' perceptions and subsequent mode choices will struggle to shift.

This section has examined the reliability of public and active transport through the lens of cost and time and how these factors are important determinants in influencing individuals' mode choice. Chapter 2 has outlined how safety operates as an important indicator of travel mode choice, particularly how this experience can differ for older people and for women. The safety concerns that can exist for older people when using sustainable transport include fears of tripping, concerns with getting on and off of the transport modes on their own and concerns around harassment and attacks (Henry and Baffoe, 2024; Musselwhite, 2021; Ravensbergen et al., 2021). This research provides beneficial insight into older people's experience of safety as it relates to harassment or attacks and how safety is experienced across different transport modes. Safety is also an important determinant of mode choice for women (Dubey et al., 2025; Hörcher and Tirachini, 2021; Ouali et al., 2020, TII, 2020). The literature review identified how women experience transport differently due to fears around physical and social vulnerability to crime, the time of day travelling and accessibility (Dubey et al., 2025; Pourhashem et al, 2022; Stark and Meschik, 2018). These varied experiences of safety required further exploration to understand how safety is perceived across transport modes and how this influences transport behaviour. The next section will examine how safety is an influencing factor in mode choice which can vary depending on age, gender and at urban and rural levels.

10.2.2 Safety

This research found that safety plays a significant role in motivating transport behaviour. Safety was examined through individuals experience of harassment or attacks and whether they felt safe travelling and waiting for different transport modes. Individuals reported how their experience of safety influences their decision to use public and active transport modes. In both rounds of surveying and the qualitative interviews, safety was found to influence transport mode choice. The results in survey 1 show how perceptions of safety can influence behavioural intention and pro-environmental behaviour. In survey 2, safety was examined to take account of specific socio-demographic factors that can dictate public perceptions and uptake of different transport modes which were outlined in Chapter 2. The results show how factors such as age and gender can influence feelings of safety on sustainable transport modes. Finally, the qualitative interviews highlight that the level of safety across current sustainable transport

infrastructure is not suitable enough to ensure individuals feel safe when using these modes. These experiences of safety differed for public and active transport and the infrastructural needs to improve feelings of safety also differ for these modes. This research shows that feelings of safety for these sustainable modes will differ depending on the mode itself and socio-demographic factors such as age and gender.

The literature review in Chapter 2 detailed how perceived behavioural control refers to how individuals perceive the ease of performing a behaviour, which can influence their actual behaviour (Ajzen, 1991). The literature also highlighted how perceived behavioural control is an important indicator in influencing transport behaviour for car use and the uptake of sustainable transport modes (Nogueira et al., 2023; Semenescu and Gavreliuc, 2021; Semenescu and Gavreliuc, 2019; Cristea and Gheorghiu, 2016; Ambak et al., 2016). As such, safety was used to measure perceived behaviour control in this study in relation to public and active travel. Survey 1 results indicate that individuals perceive private cars as safer than public and active travel, which reduces their behavioural intention to use sustainable transport. Their pro-environmental behaviour also declines when they perceive private cars as safer than public and active transport. These findings are consistent with research from Bandyopadhyaya and Bandyopadhyaya (2022) which identifies that safety is a motivating factor for mode choice post-COVID-19. Furthermore, the findings of this research show that there is a perception that the private car offers a safer experience to sustainable modes of transport as it relates to personal security and the availability of safety infrastructure such as lighting and security presence, which is consistent with findings from Xia et al. (2017). This perception of safety can influence both behavioural intention and actual behaviour, highlighting infrastructural gaps related to sustainable transport. Moreover, in rural areas, a lack of robust safety infrastructure can reduce active travel. Without improvements to these infrastructures, the perception that sustainable transport is less safe than the private car is unlikely to change. Recent research by the NTA shows that over one third of transport users over the age of 16 do not feel safe on public transport in Ireland (NTA, 2025). Therefore, it is crucial that improvements to infrastructure are targeted, relevant to the mode and considerate of the safety needs outlined in the findings. These improvements could support a mode switch from the private car to sustainable transport modes. This section will therefore examine safety through gender, age, urban and rural experiences of safety and the perception of safety for different transport modes. As Chapter 2 has identified, transport safety concerns are experienced differently for older people, women, and at urban and rural levels. Therefore, these socio-demographic aspects were identified as important areas for further exploration in this research.

10.2.2.1 Gender and safety

This study has identified how women's experience of safety on public and active transport differs from men, a finding which has been echoed in the existing literature (Hörcher and Tirachini, 2021; Ouali et al., 2020; TII, 2020). The influence of gender on the perception of safety can vary depending on factors such as the transport mode, the time of day, past experiences and the availability of robust safety infrastructure such as lighting and reporting facilities. This section examines how gender and the gendered experience of safety can influence mode choice and the factors that could be introduced to enhance the perception of safety on sustainable transport modes.

Women in this research reported feeling less safe than men when waiting for and travelling on sustainable transport modes (including by bus/coach, Luas/tram, train, walking). Specifically, survey 2 examined the experience of safety as it relates to harassment or intimidation and the role of safety infrastructure in bolstering the perception of safety when using sustainable transport modes. Personal safety concerns can be related to fear of harassment, intimidation or attacks when using sustainable transport modes. However, the statistics available on reported crimes are often lower than the lived experience due to the non-reporting of these experiences (Agrawal et al., 2025; Gekoski et al., 2017; Loukaitou-Sideris, 2014). Underreporting of crimes can occur for a number of reasons, which include fears that the report will not be taken seriously, unclear processes on how to report crimes, and the lack of available services to report the crimes (Hooker et al., 2024). The absence of comprehensive data on these lived experiences can make it challenging to provide infrastructure that effectively addresses women's safety needs.

This research found that reporting facilities, a visible security presence and improved lighting are examples of key infrastructures that could enhance women's perceptions of safety when using sustainable transport modes. This finding supports Gardner et al. (2017) and Hamilton and Jenkins (2000) who also identify improving reporting facilities as necessary to support women's perception of safety when using sustainable transport modes. Given that women in this research have identified that reporting facilities could enhance their feelings of safety when using sustainable transport modes, current reporting infrastructure may not be adequately visible or functional to meet the safety needs of women. The results of this research also highlight the importance of improved lighting which could increase feelings of safety when waiting for public transport, walking, and cycling. While Gardner et al. (2017) found that lighting has a limited impact on women's perception of safety, recent research by Dubey et al. (2025) and Noor and Iamtrakul (2024) supports this research's findings that improved lighting infrastructure can increase

feelings of safety for women using sustainable transport. These results highlight the role gender plays in mode choice and speaks to the broader societal discourse on the gendered experience of safety. This echoes findings from Hamilton and Jenkins (2000) who note that women and men feel and experience public transport differently, which informs their travel behaviour.

This research contributes further insight into women's experiences and perceptions of safety, which sheds a light on how these factors influence their transport behaviour. While research by TII (2020) has offered an insight into the experience of travel for women which has been discussed previously in Chapter 2, there remains a lack of comprehensive studies on women's experiences of transport in Ireland. The findings of this research expand the limited understanding of women's experience of transport in Ireland and provides viable solutions to bolstering their perception of safety and to support them in considering sustainable transport modes. The following section will examine how age can influence the perception of safety when considering sustainable transport modes.

10.2.2.2 Age and safety

The results in this study showed that older people (60+) experience transport differently compared to other ages groups. Sustainable transport modes, and in particular public transport, can facilitate older people in living independent lives by attending appointments, going shopping and avoiding social isolation (Shresta et al., 2016). Nine out of ten adults aged over 50 years travel primarily by car (as a passenger or driver) in Ireland (Donoghue et al., 2017) which highlights an urgent need to provide older people with sustainable mobility options that can meet their travel needs as they age. The results of the second survey showed that older people (60+) had a largely positive experience of public transport modes, which is an interesting result given their higher car dependency (Donoghue et al., 2017). Older people indicated that they feel safe waiting for and travelling on the bus. One of the possible explanations for older people experiencing a significantly higher sense of safety on the bus may be due to their familiarity with the route and the driver. Research by Loukaitou-Sideris et al. (2019) showed that the bus was a popular mode choice for older people due to their familiarity with the bus and their ability to ask the bus driver questions.

Concerns around stepping on and off the bus at bus stops has been noted as an additional mobility challenge that older people experience when using public transport in research by Ravensbergen et al. (2021). Public transport is an integral part of older people's mobility and their sense of freedom (Shresta et al., 2016). The results of this research support this and further identify that older people are an important target group given their high car dependency (Donoghue et al., 2017) and require support in

using sustainable mobility options. This is particularly important in rural areas where robust changes to the transport system must occur. These changes should include bus stops that provide lighting, shelter and seating, accessible bus timetables, and age-friendly training for staff to accommodate older people's mobility needs, such as providing sufficient time to get on the bus and sit down before the bus moves. These changes could support older people in perceiving the bus as a viable mode for daily travel. As noted in the previous section, lighting is an important infrastructural improvement in enhancing female transport users' perceptions of safety, thus highlighting the dual benefit of providing safety infrastructure that can benefit multiple groups of transport users.

Older people reported that witnessing harassment or intimidation does influence their decision to use public transport more than other groups. However, older people reported feeling significantly safer on the bus than other age groups. Most research about older people's use of the bus is centred around their physical safety concerns regarding tripping, getting a seat before the bus moves off or flagging down the bus (Musselwhite, 2021; Ravensbergen et al., 2021). However, the results in this study suggest a different picture, where older people feel safer on the bus. While limited research exists on why older people perceive the bus as safe there are several factors that could explain this. Older people's familiarity with their bus route, bus driver, fellow passengers or the time of day travelling and how this is also experienced on rural services may explain why older people perceive the bus as a safe transport mode. This is supported by Green et al. (2014) whose research notes that the bus provides older people with a sense of community and the ability to feel safe socialising with strangers. In a rural context, Hagan, (2020) notes that older people appreciated the assistance of bus drivers from the community transport service assisting them with tasks like carrying their bags to their door. The introduction of more door-to-door services and demand-responsive services could help older people feel safer using public transport modes as the assistance provided on these services could be more flexible and provide more familiarity to the users.

Interviewees from COPE Galway highlighted that when considering walking as a travel mode, older people were more likely to have safety concerns around uneven pavements and the risk of trips or falls. This research highlights how the experience of urban transport infrastructure poses a barrier to the active travel of older people, which has been echoed in recent studies on barriers to sustainable transport for older people (Patil et al., 2024; Musselwhite, 2021). Providing smooth and wide pavements free of trip hazards could improve older people's perceived safety of walking as a transport mode. These results are significant in developing an understanding of the active travel mobility needs for older people.

The findings of this study show that the perception of safety must be improved for public transport modes to support older peoples continued use and enhance their capacity to live independently. This is critical given the Irish government's commitment to supporting older people to age well at home (Department of Health, 2024) and research showing that one in five adults aged 75 years and older living in rural areas experience a lack of suitable public transport which impacts their lifestyle (Donoghue et al., 2017). Thus, improvements must be made to the current infrastructure to provide continued support for older people in feeling safe on these modes. This research highlights how providing safety infrastructure such as lighting, shelter and seating at stops, and smooth pavements can support older people in feeling safer, which could in turn support them in using these modes.

10.2.2.3 Rural experiences of active travel and safety

The interview results in particular highlighted that the availability of suitable active travel infrastructure at urban and rural levels creates a different experience of using active travel modes. Interviewees highlighted that rural roads do not feel safe enough to cycle on due to a lack of space when sharing the road with drivers. The results also identified that where active travel infrastructure is built in rural areas, it is often not built or integrated fully with other sustainable transport infrastructure. This disincentivises individuals from using it. As noted previously and outlined in Chapter 8, a member of Donegal County Council noted that when building active travel infrastructure in rural areas that it is important to build the infrastructure completely so that users are able to get from A to B. This may encourage individuals to consider using these travel modes if they know they can complete their full journey on this fully built infrastructure.

Given the government's ambition to have sustainable journeys account for 50% of all journeys by 2030 (Government of Ireland, 2023), the results of this research highlight that these targets will remain ambitious if infrastructure is not developed to be safe, suitable and fully built for use. The Sustainable Mobility Index for Rural Towns in Ireland's Western Region (2024) notes that for services such as shops, GPs and pharmacies the average travel distance is seven times longer in rural areas. The report further notes that investments such as better cycling and walking infrastructure can make towns more liveable and sustainable (p.52). The development of active transport infrastructure in rural areas should consider the spatial context, such as the lower density and higher dispersion of the population, to tailor services to users while also addressing the distinct safety concerns that these settings present. These demand-responsive services could include door-to-door collection or the ability to book a service in advance to be

collected at a location that suits the user. While these services are slowly being introduced by the NTA, an increase in service ability is needed to meet the needs of rural users and provide an alternative to the private car. This has been supported by Ma et al. (2017) who find that campaigns for promoting the safety of infrastructure should be tailored to the specific focus area. Providing targeted infrastructures, such as the demand-responsive infrastructure mentioned previously, that addresses the unique needs of the users is an important consideration in encouraging individuals to change their travel behaviour and increase sustainable transport uptake.

If active transport users must share the road space with vehicles ranging from private cars to lorries and tractors, the development of this infrastructure should account for rural land use, rural housing development and population distribution. Walking and cycle lanes physically separated by barriers may be required to enhance feelings of safety. This is supported by TII's National Roads – Active Travel Planning report (2021) which highlights the importance of physical barriers for improving the perception of safety for active transport users. Incorporating these considerations into the design of active transport infrastructure could further support rural transport users in adopting sustainable transport modes. However, these considerations should be location-specific given the differing road sizes available in rural areas that are still shared with larger vehicles such as farm machinery that can take up more space on these roads. This has been highlighted in a recent news report where road users, including cyclists, have raised concerns over the safety of new cycling infrastructure which was introduced on a road that no longer had a hard shoulder, posing safety concerns for all users (Walsh, 2025). If individuals are to consider using active transport, the development of active transport infrastructure on existing roads must consider the current road users, their needs and the safety implications of reducing this road space to encourage active transport.

This section has examined how the perception of safety is an important influence on transport behaviour and mode choice. Motivating transport users requires more than just infrastructure; it requires mindset shifts and moving the social norm away from the private car as the primary mode for travel. To encourage an attitude and behaviour shift, the safety needs of users must be considered in the context of their space. Providing transport infrastructure that is not fully built, that continues to coexist with vehicles on unsuitably developed roads, and that does not address the spatial context of users' needs, will continue to discourage users from considering sustainable travel modes. Encouraging a mode shift away from the private car requires targeted infrastructure that consider the spatial context, gender and age amongst other factors. Infrastructural developments such as lighting, segregated paths and bike lanes and smooth,

trip-free paths and reporting infrastructures can support individuals to feel safer when using public and active transport. This shift in perception could positively influence individuals in the uptake of sustainable transport.

The next section will examine how the gap between behavioural intention and pro-environmental behaviour exists due to psycho-social factors such as habitual and effortful behaviour and how this gap may be closed. In examining the barriers to transport behavioural change, this research was interested in identifying if an attitude-behaviour gap existed among transport users in this research to understand if individuals attitudes towards government response to climate change influences their travel behaviour. While no attitude-behaviour gap was observed in the results of this thesis, this may be attributed to the approach taken in measuring attitudes. As outlined in Section 4.11, the use of the TPB to assess attitudes towards government responses to crises such as climate change has not been extensively explored. As such, this research offers a novel examination of the role of government responses to crises, such as COVID-19 and climate change, in influencing behavioural intentions and behaviours. The approach taken in this research, using a TPB+ framework as outlined in Chapter 4, may explain why no attitude-behaviour gap was present. However, this research has identified that a gap exists between intention and pro-environmental behaviour, specifically where private car use is considered. The results of this research show that individuals intend to change their behaviour but fail to see this through into pro-environmental behaviour. The results from both quantitative surveys and qualitative interviews highlight the need for transport infrastructure development to meet the varying needs of users at urban and rural levels. The next section will explore how the psycho-social variables of the habitual nature of private car use, the effortful nature of behavioural change and the imbalanced weight of moral intentions versus actions can further explain this intention-behaviour gap. This section will also identify how these variables, coupled with ineffective transport infrastructure, may continue to widen the gap between behavioural intention and pro-environmental behaviour.

10.2.3 Habitual car use

This section examines how habitual private car use can influence travel behaviour and how individuals could be supported to change their travel behaviour by structural changes to the transport system. The survey results, outlined in Section 3, shows that individuals in this research intend to use sustainable transport modes more than the private car. However, they perceive the private car as safer, faster and cheaper than sustainable transport and this influences their travel behaviour. These results could be due to the habitual nature of private car use and the lack of suitable sustainable transport alternatives.

The habitual nature of private car use can explain in part why individuals in this research intend to use sustainable transport but ultimately are not motivated enough to do so. Research by Xia et al. (2017) supports the understanding that the habitual nature of private car use can impact individuals' ability to change their travel behaviour. This habitual use of the private car, where individuals continue to use the private car out of a habit formed over time, may be caused by a number of circumstances. These include the location and the availability of alternative transport modes, social norming of private car use, the convenience and control of using the private car and the time associated with using sustainable transport modes. Factors such as time have been discussed in relation to the reliability of transport modes in Section 10.2.1 previously. These factors can influence the decision to use the private car for travel. These structural barriers to sustainable travel are supported by Carroll et al. (2021), particularly where alternative modes of transport are not available to users in rural areas leading to forced car ownership. Where structural barriers such as a lack of alternative transport options exists, private car use can increase and become habitual.

The habitual use of the private car can exacerbate the gap between behavioural intention and pro-environmental behaviour, a gap which has been identified in users' behaviour in this research. More precisely, as Chapter 7 shows, while individuals in this study show positive intentions to use active and public transport more than the private car, this is not shown in their actual transport behaviour. This has been supported by Møller and Thøgersen (2008) where they find that the habitual use of the private car can pose a barrier to transforming behavioural intentions into pro-environmental behaviour. The results in this research highlight that while individuals hold behavioural intentions to use sustainable transport, this does not influence their transport behaviour enough to use sustainable transport. To further understand this, De Vos et al. (2022) notes that the influence of behavioural intention on behaviour can be negated by habit, where the strength of the habit (having been performed regularly, if found to be satisfactory) can weaken the influence of intention on behaviour (p.212). The highlighted section in Figure 11 from De Vos et al. (2022) shows how habit can create an enclosed cycle with the travel mode choice. Working within this framework and considering the context of the research results, finding effective methods to change private car behaviour before it becomes habitual is complex.

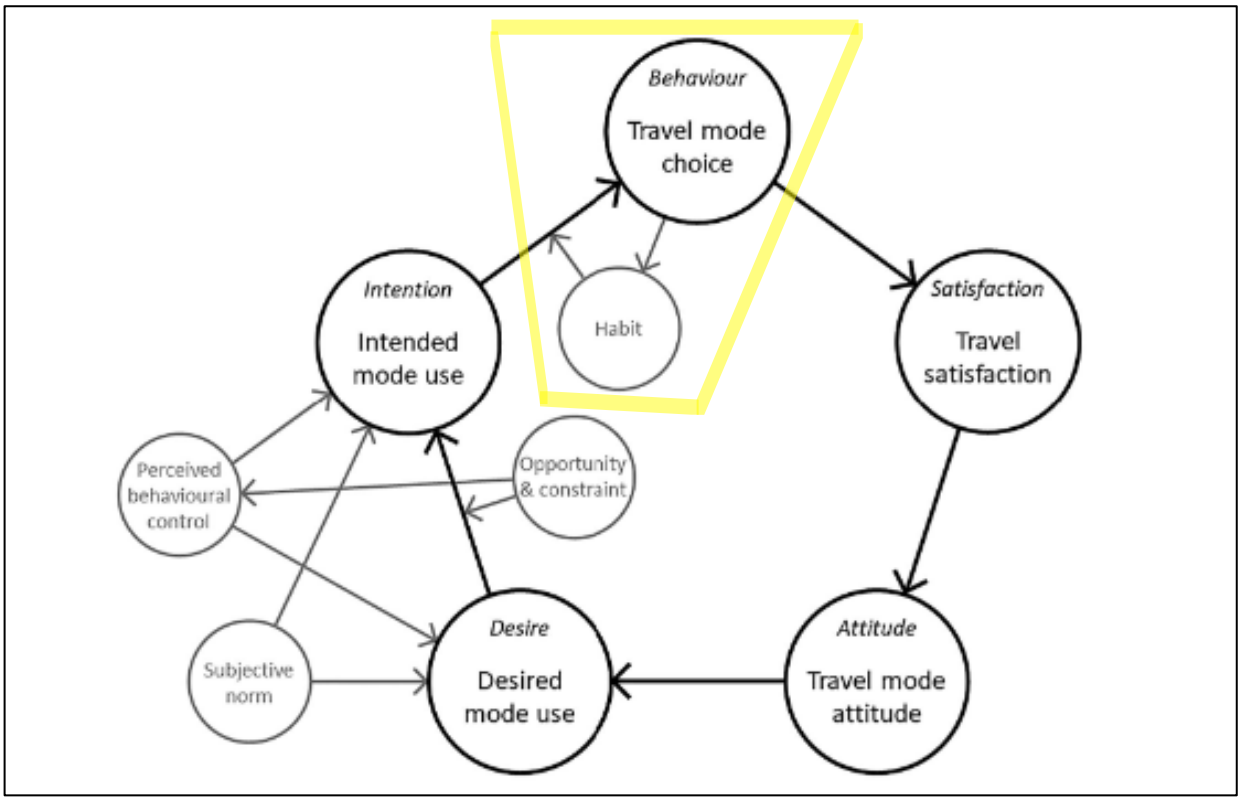


Figure 11: The Travel Mode Choice Cycle (De Vos et al., 2022). (*Highlighted section researchers own)

While solutions could include providing more information about the benefits of sustainable transport modes to users (Malhado et al., 2014), research has highlighted that providing information about environmental impacts of using the private car alone may not actually influence travel behaviour (Tertoolen et al., 1998). Robust solutions to break the habitual cycle of private car use are complex. The results of this research also identify that these solutions should consider where users are located as urban and rural needs differ due to transport availability, which has been expressed in the expert interview results in Chapter 8. This understanding has been supported by Carroll et al. (2021) examination of forced car ownership in rural areas. Where urban user's habitual private car use may be altered by infrastructural changes such as shorter waiting times or increased capacity on public transport services, rural users may require increased frequency of services or stops that are closer to their homes. The ability to provide these services to users in rural settings may be hamstrung by the workforce available to fulfil the infrastructural needs to develop the services, as noted by interviewees in this research outlined in Chapter 8. Furthermore, political will to support public and active transport development in rural areas may be fraught, which has been highlighted in the results of this research and echoed in research by Carroll et al. (2021).

Solutions to support sustainable transport use and decrease the habitual use of the private car are complex. As outlined in Chapter 2, the historical ribbon development of housing has led to low population density in rural areas and settlement patterns that are more dispersed than urban areas. Delivering transport infrastructure in such circumstances can be more challenging. Breaking the cycle of private car dependency requires context-specific solutions for rural areas which consider the varying needs of these rural communities (Kirjavainen and Suopajärvi, 2025). These solutions should also consider the influence that social norms can have on environmental behaviour (Keizer and Schultz, 2018). Reframing the social norm to make private car use less desirable while promoting sustainable transport modes through targeted campaigns and improved public transport and active travel infrastructure could influence a shift away from this social norm.

Developments to the transport system to encourage users in choosing sustainable transport modes has been aided by the introduction and development of services in rural areas. The Connecting Ireland Rural Mobility Plan has introduced new services such as Local Links and demand-responsive transport options in rural areas, which has seen ridership increase on these services by 165% compared to 2019 (NTA, 2025). The increased frequency and reliability of these services could support users in choosing these modes and reduced the dependence on the private car for travel. Linking these smaller rural services to larger national services was highlighted by interviewees in this research as a key consideration for enhancing the perception of reliability among users also. Ensuring that these services connect up to national services and have a frequency and reliability that users can depend on could increase sustainable transport use and reduce the reliance and dependency on the private car.

Furthermore, the implementation of recommendations from the All-Island Strategic Rail Review could provide more sustainable transport mode choices to users. Iarnród Éireann have outlined that priority projects have already been identified under this review and improvements to the current rail system are underway (Iarnród Éireann, 2025). However, it is important to highlight that many regions nationally lack rail services, including large parts of the north-west that have been underserved in terms of public transport for decades. Donegal does not have any rail projects outlined or planned under this review. Therefore, further developments to other public bus and active transport systems should be prioritised in these regions to support users who will not have direct access to rail as a transport mode choice under current policies.

This section has outlined how social, infrastructural and habitual factors influence sustainable mode choice. This research reveals that while individuals express intentions to use active and public transport more than the private car, they fail to see this through to behaviour. The habitual use of the private car is related to a lack of suitable alternative public and active transport options, which has, in part, been enabled by the historical ribbon development of housing discussed in Chapter 2. Furthermore, when private car use becomes a social norm, the habitual nature of car use is reinforced, making it harder for individuals to choose sustainable modes of transport. As Chapter 2 has noted, perceived behavioural control, which dictates the ease individuals feel over doing a behaviour, plays an important role in shaping travel intentions and behaviour. If individuals perceive the private car as more advantageous, this behaviour can become habitual, and changing this habit can be perceived as requiring considerable effort. Transforming behaviour is therefore a complex challenge that requires policy interventions aimed at improving sustainable transport infrastructure, making it more convenient, safe and cost effective.

This research emphasises that the habitual nature of private car use should be considered when developing interventions to increase sustainable transport use. By addressing the social, infrastructural and habitual factors outlined in this research, improvements can be designed to support transport behavioural change. Given that this research has identified a gap between intention and behaviour, the next section will examine how the effort required to change this habitual travel behaviour may discourage private car users from switching modes.

10.2.3.1 The effort of changing behaviour

This research has identified that the perception of sustainable transport needs to be altered to provide an experience that can rival the perception of the car. This has been echoed in research by Steg (2007), that notes the attractiveness of the private car must be reduced alongside increasing the attractiveness of other transport modes to enable a reduction in private car use. The habitual use and social norming of the private car outlined in the previous section can explain the gap between the intentions individuals have expressed in this research and their actual behaviour. This section will further expand the understanding of what influences mode choice and why individuals may not realise their behavioural intention into pro-environmental behaviour.

Individuals in this research have highlighted that they would like to use sustainable transport modes, but they are not transforming this into behaviour. While infrastructural and social influences on mode choice have been discussed, further exploration of psycho-social influences may explain why individuals do not

transform their intentions into behaviours. To understand why intention does not materialise into behaviour, we can explore the perception that shifting modes from the private car to sustainable modes requires effort from the user. Changing transport behaviour, synchronising timetables to switch between modes and checking real-time information when using sustainable transport modes may be perceived as requiring effort, and the convenience of using the car without the same planning stands in opposition to the effort of changing behaviour. The perceived effort of switching to sustainable modes may be related to the travel time required for sustainable travel, comfort and convenience of the private car, or the effort of preparedness to use sustainable transport modes. This has been echoed in research by Kent (2015), where they noted that the effort required to be prepared with cycling gear or having to carry more items if using active or public transport in comparison to the private car can disincentivise users to switch to these sustainable modes.

Within this intention-behaviour gap, individuals may perceive changing their behaviour as effortful and may not alter their travel behaviour due to this perception. To further understand why individuals may rationalise this inaction, individuals may perceive that the intention to change their behaviour is a sufficient enough action itself. By intending to change their behaviour, individuals may feel absolved from having to see this through to actual behavioural change. Monin and Merritt (2012) support this understanding, where they note that individuals who perceive their intention to act in a moral way is a sufficient action and this can reduce their feelings of having to commit the intention to actual behaviour. In the context of understanding why this gap exists between intention and behaviour in this research, individuals may perceive that intending to use sustainable transport modes is a sufficient climate action and may rationalise this when not transforming these intentions into behaviours. It is evident that these moral inconsistencies outlined in Monin and Merritt (2012) echo what Festinger (1957) exemplifies as dissonance. Where a change of behaviour may be perceived as painful or involving loss, dissatisfying, or the individual is incapable of making the change due to, for example, a lack of readily available transport infrastructure, then a dissonance can further this gap between the intention and behaviour.

While it is important to note that these psycho-social variables can influence the intention behaviour gap, it does not provide a complete explanation for this lack of behavioural change in this research. As discussed in Section 10.2.1 of this chapter and expressed by individuals in both rounds of surveying and interviews outlined in the results Chapters 7-9 of this study, a robust transformation of the transport system, where transport infrastructure is safe, convenient and cost effective is central to the mode choice

of individuals. Reiterating the findings of Carroll et al. (2021), transport behavioural change must include political will and infrastructural development to encourage individuals away from the private car as their primary mode choice. Providing demand-responsive options such as last mile transport, and alternatives such as community cars schemes and park and ride infrastructure can encourage this behavioural shift, while still acknowledging the role of the private car in facilitating the mobility needs of individuals, which has been expressed by interview participants in this research. Such developments to the transport infrastructure could aid the wider acceptance of alternative transport options.

The next section will examine how incentives could encourage sustainable transport behaviour, and how these incentives, when considered alongside potential disincentive measures, could reduce private car use.

10.3 How incentives can support sustainable transport behavioural change

The final research objective of this thesis sought to assess if the proposed incentives outlined in Chapter 9 could support transport behavioural change and examine how these could be supported by disincentive measures. As evidenced by individuals return to pre-COVID-19 travel behaviours outlined in Section 7.1, the disincentive to travel introduced during the pandemic proved highly unpopular. As such, this research examines the role of incentives to support transport behavioural change, while acknowledging the need for harder disincentive measures to shift travel behaviour long-term. This section of the chapter will examine how incentive and disincentive measures can vary across public, active and private transport modes. Individuals in this research have highlighted how different measures such as free fares and tax relief could change their travel behaviour. While these results highlight that incentivisation measures could work to encourage some users to change their travel behaviour, more is needed to support private car users towards sustainable transport, and this may not be achieved through financial incentives alone. The previous sections of this discussion chapter have highlighted how improving infrastructure is integral to supporting transport behavioural change. This section will further this point by highlighting how incentivisation can be beneficial in supporting behavioural change. This section will also examine how these incentive measures could be considered alongside potential disincentives for the private car, while also increasing the development of infrastructure to further support the transport needs of users at urban and rural level.

10.3.1 Combining incentives and disincentives to encourage behaviour change

The findings of this research show that incentives for increasing sustainable transport use were significantly more enticing to individuals already using these modes (e.g. public and active transport users

indicating that incentives could encourage them to use sustainable transport modes more) than for private car users. Proposed incentives ranged from cheaper fares at peak times, free fares, accurate real time information, more seats on public transport modes, and improved paths and cycle lanes. While private car users generally agree that these incentives could change their transport decisions, the results were not significant when compared to individuals already using sustainable transport modes. Indeed, as Section 10.1 noted, private car users had lower intentions to shift to sustainable transport than either active travel or public transport users even where enhanced incentives for taking these transport modes were proposed. These incentives included reducing or eliminating costs for public transport (cost), improving real-time information (time), providing more seating on public transport, and designated pathways and cycle lanes (safety). These results are consistent with recent research by Carroll et al. (2021), which also found that interventions related to time and cost incentivise users who are already using sustainable modes, rather than enticing those who use the private car towards these sustainable modes. Importantly, these results highlight that incentivisation is insufficient in encouraging significant behavioural change, particularly for private car users. This challenge highlights the complexity of reducing transport emissions as the proposed incentives fail to encourage an important target population of private car users. In response to this, this research returns to B. F. Skinner's work on operant conditioning outlined in Chapter 2 and proposes that a combination of disincentive measures, such as penalising the use of the private car by making it less convenient and more expensive, coupled with targeted incentive measures for sustainable transport modes that focus on safety, time and convenience, could support more sustained transport behavioural change.

These findings suggest that these 'carrot' incentive measures are not enticing private car users as much as existing sustainable transport users. To further understand these results, we can look toward the complex requirements for reducing the dependence on the private car and encouraging a transition towards sustainable transport use. The discussion chapter of this thesis has referred to the expressed need for a robust development of sustainable transport infrastructure that can bolster the perception of sustainable transport modes as safe, convenient and cost effective. The challenges of developing the transport system in such a way will vary at urban and rural levels as the needs of individuals varies in these regions also.

Hierarchies for individuals' psycho-social needs have been utilised in research ranging from Maslow's (1943) hierarchy of individual needs to Musselwhite and Haddad's (2018) hierarchy of older people's

travel needs. Mouratidis (2025) outlines a hierarchy of strategies for reducing dependence on the private car in their recent study which focus on planning and infrastructure development, this can be viewed in Figure 12 below. They note that the order of the strategies is not directly correlated to how effective they are and that the lower the strategy is on the hierarchy, the more fundamental it is. They support the understanding in Carroll et al. (2021) that by combining the strategies, a carrot and stick approach can develop. With this hierarchy in mind, a pathway for transport development at an urban level could benefit from the shift from dependency on the private car to increased sustainable transport use. However, Mouratidis (2025) note that the placement of these strategies is a fundamental prerequisite for higher placed strategies and focuses this hierarchy at urban transitions in cities with higher densities, while acknowledging that some of these strategies could be used for lower density areas. This research expands these existing strategies to consider how they might be applied to lower density rural areas. This expansion demonstrates how such a framework could be used to support the transition to more sustainable transport modes both in urban and rural settings. Given this consideration, Figure 13 has been developed for this research and expands Mouratidis (2025) hierarchy. This new development frames the strategies for reducing car dependency at rural levels in the context of this study's findings to include strategies to address both infrastructural and psycho-social needs to support sustainable transport uptake.

Raising awareness is a fundamental step in Mouratidis (2025) hierarchy for reducing car dependency. Providing transport users with more information about the benefits of sustainable transport modes has been supported by Malhado et al., (2014). However, Tertoolen et al. (1998) has found that providing information about environmental impacts of using the private car may not be sufficient in reducing this travel behaviour. A member of the NTA noted in their interview that the government leads on the broader behavioural change messaging for transport and this has been witnessed in the 'Your Journey Counts' behavioural change campaign. Promoting compact city policies is essential in higher density urban areas to support a shift from single and low occupancy vehicles to higher occupancy and sustainable transport modes. The National Economic and Social Council (NESC) 2025 report on compact growth in Ireland outlines the benefits of compact development on sustainable mode choice. Compact city policies that consider the development of active and public transport infrastructure could support a shift away from the private car and towards these sustainable modes.

In Mouratidis (2025), shared and virtual mobility are at the top of the hierarchy and should exist as fundamental strategies for reducing car dependency in both urban and rural areas. Improving the availability of suitable shared mobilities such as increased public transport services can provide alternative transport options for private car users and influence their car dependency. Furthermore, the COVID-19 pandemic provided an opportunity for individuals to utilise virtual mobility by working from home and attending meetings online. Under new legislation introduced by the Irish government in 2024, employees now have a legal right to request remote working (Citizens Information, 2025) which can support individuals in using virtual mobility. However, organisations are starting to mandate in-office attendance following the COVID-19 pandemic (Murphy, 2025). While the right to request remote working is a positive step towards virtual mobilities, it does not guarantee that the employer will accept the request after a fair review. To further support a reduction in car dependence through virtual mobility options, the government could enshrine the legal right of employees to work from home for a minimum number of days per week where the role allows for remote working. This could support a reduction in car dependency and target commuters who are travelling for work given that the CSO (2023) have outlined that travelling to work by car accounts for the most common mode of transport at 63%, while only 9% of people travel by public transport and 12% travel by bike or walk.

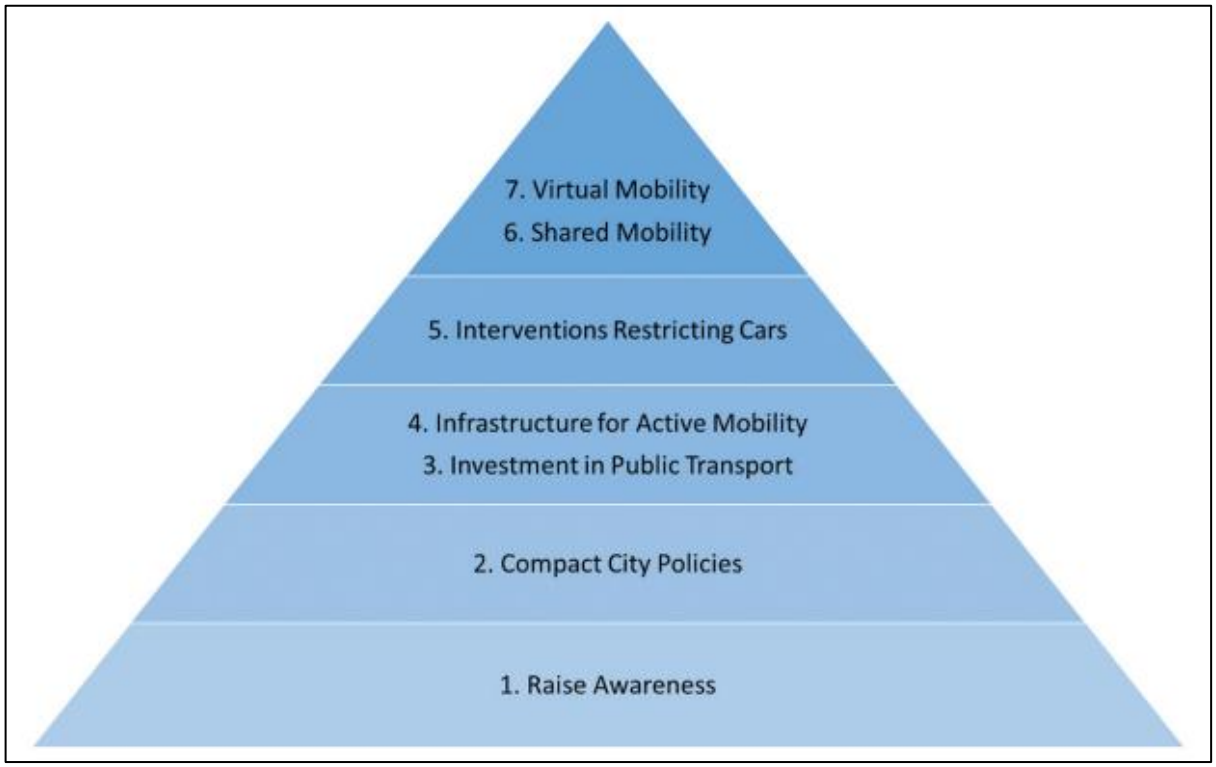


Figure 12: Hierarchy of strategies for reducing car dependence from Mouratidis (2025).

In contrast, the reduction of rural car dependency should focus on the first four strategies in the hierarchy and consider densification and a land use mix (Mouratidis, 2025). Achieving a reduction in car dependency in rural areas is complex and Morgan et al. (2023) found that it may be unclear to determine if car dependency can decrease without densification of an area. The results of this study highlighted that the car cannot be fully replaced in rural areas of Ireland, and this consideration must be included when developing transport policies for car reduction going forward. With this consideration in mind, the hierarchy of strategies for reducing rural car dependence adopts some of the strategies outlined in Mouratidis (2025) and reorders the hierarchy based on the results of this research.

This research has found that without the available sustainable transport infrastructure, individuals in rural areas are limited in their transport choices which can lead to their reliance on the private car for journeys. This has been supported by Carroll et al. (2021) regarding the rural hotspots for forced car ownership in Ireland. Given this understanding, the hierarchy for reducing rural car dependence has identified that the development of public transport infrastructure that builds integrated sustainable transport networks (i.e. active travel and public transport networks) could support the reduction in car dependency in rural areas that have densities of population that can support its use. These necessary developments to rural sustainable transport should occur alongside the development of the roads in these regions to support the safe coexistence of public, active and private transport, a consideration which was noted during the interview portion of this research from multiple experts across public, private and charity organisations in the transport sector.

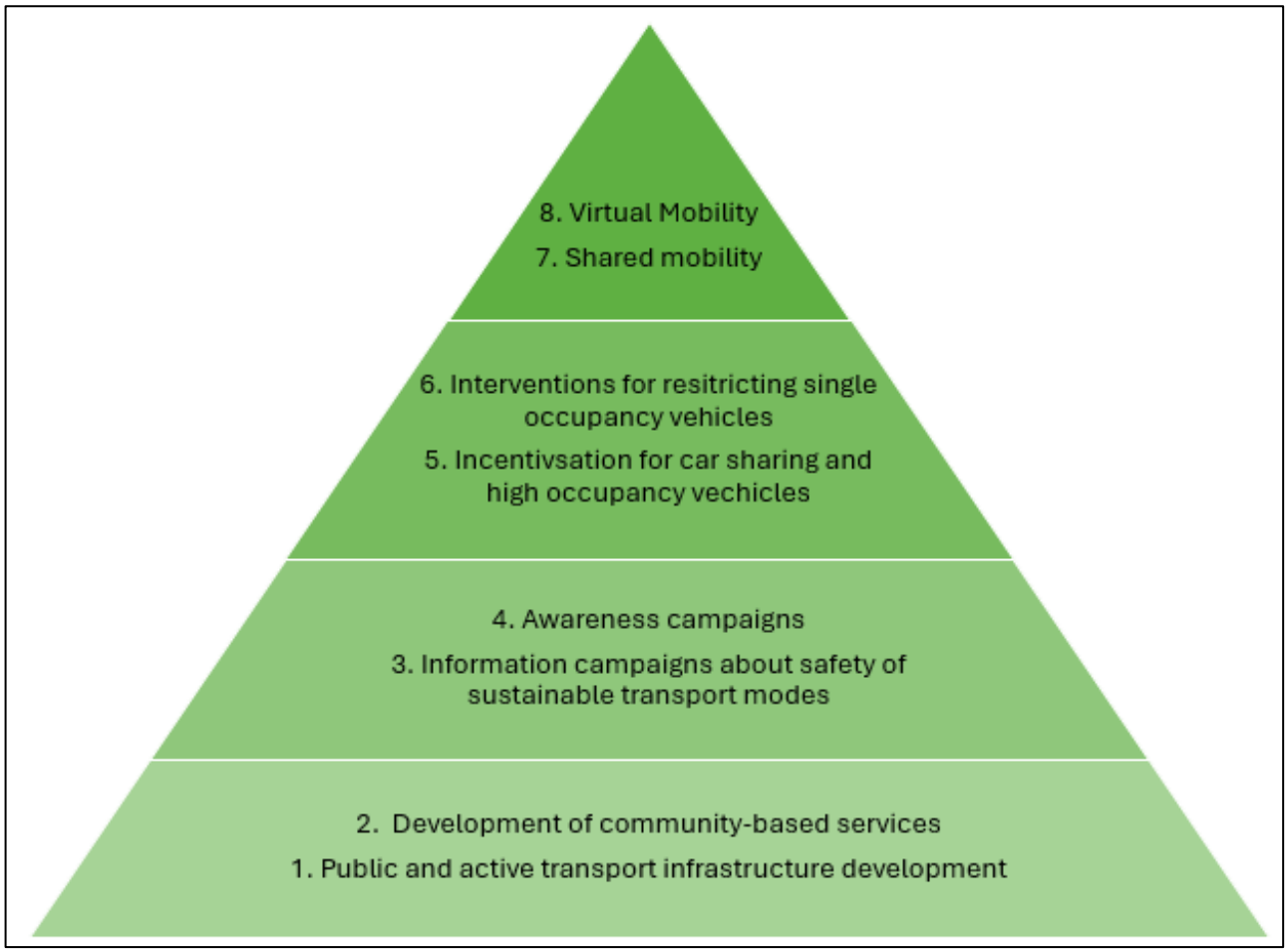


Figure 13: Hierarchy of strategies for reducing rural car dependence.

The order of the hierarchy of strategies for reducing rural car dependence is created in line with the results from this research and acknowledges the demand for rural transport development to support this. The results of this research highlight that sustainable rural transport options are not developing at a rate that can meet the needs of individuals. There are visible indicators of successful uptake of sustainable transport in Ireland when these services are developed and provided in rural areas. This has been witnessed by the Connecting Ireland Rural Mobility Plan which is an initiative run by the NTA since 2022 and funded by the Department of Transport. This plan aims to improve and develop public transport in rural areas to enhance the connectivity and mobility in these areas (NTA, 2024). The introduction of this plan has seen ridership increase by 165% compared to 2019, nearly 8 million journeys on these services last year alone with 1.8 million of these journeys associated with the role out of services in phase three of the plan (NTA, 2025). These metrics highlight the desire for sustainable transport options in rural areas and the growing demand for increased services across rural communities. The development of these infrastructures is integral to supporting a decline in rural car dependency and ensuring individuals are not limited to the private car for their mobility needs.

Communicating these advancements in current services and the introduction of new routes is important for raising awareness among users. The results of this research highlight that wastage messaging occurs when new services are introduced and individuals receiving updates about these are not in the catchment of service availability. Raising awareness for new services and providing information about how to access these services is an important factor for individuals when considering their mobility options which Ma et al. (2017) have supported in their research. As one interviewee from the NTA highlighted, these advertising campaigns can be costly, therefore it is important that messaging is reaching the individuals who can and do have access to the new services being introduced. Furthermore, the perception of safety should be considered when advertising new services as the results of this study highlight that safety is a motivating factor for transport mode choice. Campaigns that outline the safety considerations integrated into new active travel infrastructure could support a shift in public perception about the safety of using sustainable transport modes. This has been supported by Ma et al. (2017) where they note that campaigns around safety and sustainable transport should be targeted to the specificities of the region. These campaigns could support a shift in the perception of safety and encourage an increase in users choosing sustainable transport modes.

The results of this research highlight that incentives to encourage a behavioural change to sustainable transport are less significant for private car users than existing active or public transport users. Given the high dependency on the private car in rural areas of Ireland (NTA, 2023), carrot and stick measures for alleviating the dependency on the car in Mouratidis (2025) hierarchy are also important in a rural context. Incentivised 'carrot' measures, where individuals are set to gain something through behavioural change such as free public transport fares, may be more effective when coupled with disincentive 'stick' measures, where individuals are set to lose something such as no parking zones or urban congestion charges for using their cars at certain times or in certain locations. This has been supported by Xiao et al. (2022) where they find that a combination of carrot-and-stick measures may be more effective than just using carrot or stick measures. In rural areas, incentivisation for car sharing and high occupancy vehicles coupled with road development that considers adequate space for active transport could encourage a decline in single occupancy vehicle use. However, this should occur in consideration with the spatial context of the road users, particularly in rural areas where road space is shared with larger heavy goods vehicles e.g., haulage and agricultural machinery.

As outlined above in Mouratidis (2025), shared and virtual mobilities are also important strategies for reducing car dependency and are also placed at the top of the rural hierarchy to support individuals in being able to work from home. To support virtual mobilities solutions include the consideration for enshrining the right to a minimum number of remote working days into law where the role allows. Furthermore, the improvements in shared mobilities in rural areas such as increased rollout and subsequent uptake of Local Link services provided by the NTA under the Connecting Ireland Rural Mobility Plan is evidence of the demand for these services. The continued expansion and development of these shared mobilities and the introduction of more demand-responsive solutions such as door-to-door collection services in rural areas could support a reduction in car dependency.

This section has outlined the results from this research which show how incentives and disincentive measures could be paired together to provide greater support in reducing car dependency in urban and rural areas and support an increase in the uptake of sustainable transport modes. This section has presented an extension of Mouratidis (2025) hierarchy in the context of the Irish transport sector and the associated barriers to behavioural change identified in this study. This research shows that incentive measures such as reduced transport fares do not entice private car users as significantly as individuals already using sustainable transport modes. Therefore, disincentives could be paired with incentives to encourage a mode shift. While these measures are important considerations for motivating transport behavioural change, the availability of suitable transport infrastructure to support these behavioural changes is also essential.

10.4 Limitations

There were limitations to this research that should be considered for future research. This research struggled to access a larger cohort of people aged 75 and over. As outlined in Section 3 of the methodology, accessing older age groups can be hard due to access to the internet, computer literacy and concerns over scams. While survey 2 did receive respondents over the age of 75, unfortunately no respondents were over the age of 75 in survey 1. Although this research did utilise a focus group with COPE Galway to fill this gap and made concerted efforts to include more organisations that work with older people, future research should seek to examine older people's relationship with public and active transport in greater detail so that future results can be generalised to older populations and infrastructure can be designed to affectively support their needs. This could be done through focus groups with older people to capture a wider range of perspectives on their transport use and to subvert the technological barriers that these age groups might face when research is conducted using online surveys.

A spatial examination of the survey data in the context of the Eircode information collected from participants was not in the remit of this research which serves as a limitation to this study. While the qualitative results outlined in Chapter 8 contextualise the spatial context of transport use in urban and rural areas, future research could utilise the quantitative data gathered in this study to further examine the experiences of transport users at urban and rural levels and contrast this with the qualitative findings presented in Chapter 8.

This research has provided valuable insights into women's experience of safety on public transport and recommended safety infrastructure that could support the perception of safety across sustainable transport modes. However, while safety was examined in this research in relation to harassment or intimidation and broader feelings of safety across each transport mode, future research could benefit from examining women's experiences of safety in greater detail to understand if these safety concerns are based on experiential factors or wider social norming of behaviours relating to harassment or attacks on these modes. Further research could complement the findings in this study to deepen the understanding of the complex nature of safety and identify further infrastructural interventions to bolster the perception of safety on transport for women.

10.5 Recommendations

This research has created new insights into what shapes individuals' attitudes and behaviours towards transport. It has focused on how individuals use transport and why they make these decisions. In exploring these aspects of transport behaviour this research has found that individuals' transport behaviour is influence by their perception of safety, which is particularly relevant for women and older people in their choice of transport mode. This research has also identified how cost and time influence travel behaviour. The hidden cost of time can influence travel behaviour if individuals perceive sustainable modes as requiring more of their time due to delays, lack of control and the routes taken. Furthermore, the habitual nature of private car use and the effort that is required to change this behaviour is a barrier that can prevent individuals from changing their mode choice. To further support individuals in changing their travel behaviour, this research has found that incentives are not enough and could be paired with disincentive measures for greater effectiveness. By examining these factors that influence transport behaviour, an opportunity arises in utilising the results of this research to support future policy, research and development of transport infrastructure to meet individuals transport needs and reframe the entrenched perception that the private car is more advantageous than sustainable transport. The

following recommendations utilise the insights garnered from the two rounds of quantitative surveys conducted with the Irish public and the insights from 12 participants, which included one focus group, from 8 stakeholders/organisations during qualitative interviews conducted with stakeholders in the Irish transport sector.

10.5.1 Recommendations for infrastructure

The following recommendations for developments to transport infrastructure include:

1. Lighting infrastructure should be considered as a key infrastructure for supporting the perception of safety amongst transport users, particularly women and older people, and be prioritised for improvement and further development.
2. Incentives such as reduced or free fares for high occupancy vehicle use such as public transport modes could be coupled with road development that considers adequate space for active transport users while reducing the space for single occupancy vehicles.
3. Age friendly training for staff, even and smooth pathways, and shelters when waiting at transport stops are important infrastructure for supporting older people in using sustainable transport and should be considered for future implementation. These developments to the transport system could support a behavioural change for older people that encourages them to choose sustainable travel and supports their ability to live independently in both urban and rural areas.

10.5.2 Recommendations for policy

The following recommendations for future transport policy include:

1. Future development of public and active transport should involve targeted consultation with users directly affected by the infrastructure, with consideration for the differing needs of vulnerable users and urban and rural needs. This could help ensure that future transport infrastructure meets users' needs and supports their uptake of sustainable transport.
2. Safety campaigns should emphasise the enhanced safety of active transport modes, particularly in regions where new infrastructure has been built fully and has prioritised these safety concerns. Rural campaigns should be utilised to highlight these safety considerations and outline how these safety concerns were considered particularly around sharing road space with larger vehicles.
3. Campaigns around safety and gender should highlight improvements to safety infrastructure such as lighting and reporting facilities when these improvements have been introduced.

4. A greater understanding of the gendered experience of transport can inform future infrastructure design that considers gendered safety needs, which could enhance the perception of safety for women when using sustainable transport modes.

10.5.3 Recommendations for future research

The following recommendations for future areas of research include:

1. Further research is recommended to gain a deeper understanding of how time-related costs can negatively influence sustainable mode choice. A deeper exploration of the impact of hidden temporal costs associated with sustainable transport modes could provide a greater understanding of how to shift perceptions and support a behavioural change away from the private car and towards an increase in active and public transport.
2. There is ample room for further research into how habitual car use impacts sustainable transport mode choice. In the Irish context this is particularly important, given historical and current spatial patterns of settlement.
3. Future studies examining the active transport needs of older people should investigate the perception of safety when considering walking as a mobility choice to build on the findings related to safety concerns presented in this research.
4. Further research and understanding of the lived experiences of women's transport behaviour is necessary to build on the important insights presented in this research which can support women's experience of safety on sustainable transport modes.
5. Further exploration in an Irish context into the psycho-social variables presented in this research is needed for robust assertions regarding their influence on pro-environmental behaviour.
6. Further research is required to examine how the incentive and disincentive measures presented in this research could support behavioural change in both urban and rural areas and encourage an uptake in sustainable transport modes
7. Further research is required to build on the experiences that inform feelings of safety when using public and active transport presented in this research. Moreover, future research should seek to uncover the multi-layered understanding of safety in the context of personal safety and the role that infrastructure can play in bolstering these perceptions of safety for sustainable transport modes.

10.6 Conclusion

This research has examined how individuals perceive private, public and active transport modes, and how these perceptions inform their travel mode choice. By exploring the impact of government response to climate change, safety, cost and time, this study is one of the first to examine these motivating factors for transport mode choice in an Irish context. This research shows that reducing car dependency and increasing the uptake of sustainable transport modes is complex. This chapter has outlined how perceptions of safety vary across age, gender and transport mode. Furthermore, this chapter has highlighted how habitual car use, and the effort of changing behaviour widens the gap between behavioural intention and behaviour change. This chapter has also identified how incentivisation, coupled with disincentives, could support transport behavioural change. This includes improvements to the transport infrastructure that consider the varying needs at both urban and rural levels.

This research highlights the importance of addressing the complex motivations and barriers to sustainable transport uptake in Ireland. Encouraging sustainable transport use over the private car requires the development of physical transport infrastructure alongside a reshaping of the social norms associated with private car use. The hierarchy of strategies for reducing car dependency in higher density urban areas proposed by Mouratidis (2025), alongside the hierarchy for reducing rural car dependency proposed in this research, both outline the importance of shared and virtual mobilities in achieving a reduction in car dependency and an increase in sustainable transport use. The limitations that arose from this research indicated areas for further research to include examining women's experience of safety in more details and further research of older people's experience of transport. Recommendations arising from these research findings include infrastructure development such as lighting and shelters, policy recommendations such as development of infrastructure that considers the users' needs, information campaigns with a focus on safety, and considerations for how the gendered experience of transport could influence future design and development. The varying experiences of transport across age, gender and spatial contexts highlights the number of factors that must be considered when developing future transport policy. These insights broaden the understanding of travel behaviour in Ireland and offer a strong foundation for informing future transport policies.

Chapter 11: Concluding Remarks

This research was conducted to examine what the attitudes and behaviours of individuals are towards transport and what this means for Ireland's climate change goals. This research developed due to the understanding that Ireland's commitment to a 50% reduction in transport emissions by 2030 will not be achieved. Given that the IPCC has indicated that behavioural change is a fundamental aid in reducing emissions, examining why these targets will not be achieved in the context of behavioural change was a useful starting point for this research.

The literature review set out to examine how attitudes and behaviours are formed, what can influence transport related behaviour and what are the barriers to behavioural change. In examining how transport behaviours operate, Ajzen (1991) *A Theory of Planned Behaviour* served as a fundamental framework in explaining how attitudes, subjective norms and perceived behavioural control influence behavioural intention and how this behavioural intention influences transport behaviour. This review highlighted that behavioural change through incentive and disincentive measures could influence transport behaviour. However, there is a lack of research in an Irish context exploring how disincentive measures could operate and what these disincentives could look like for transport users. An examination of the barriers to sustainable transport use highlighted how safety was a motivating factor for mode choice, particularly among women and older people. This review highlighted that women experience sustainable transport differently to men in relation to safety and that their requirements for increased perception of safety differ from men also. Furthermore, older people experience safety concerns when using sustainable transport specifically around the suitability of the safety infrastructure such as lighting, smooth paths and the amenability of the driver to their needs when boarding and deboarding the transport modes. Time was also identified as a barrier to sustainable transport uptake in the literature review. This exploration of time when using sustainable transport modes highlighted that there was a hidden cost associated with delays, lack of control over the route and the time spent on the transport mode, which disincentives individuals in choosing sustainable transport modes over the private car. The final barrier to the uptake of sustainable transport identified in the literature related to the habitual nature of private car use where individuals formed a habit of using the private car for travel, which feeds into the social norming of the private car for travel also. This experience, when coupled with the ribbon development of housing across Ireland which has forced areas out of sustainable transport access, has led to a reliance on the private car, posing a direct barrier to the uptake of sustainable transport.

The insights garnered from the literature review have influenced the development of the central aim and objectives of the research. This research aim sought to understand the current state of attitudes and behaviours towards transport in Ireland and their implications on reducing transport emissions. To address this central aim, the objectives of this research sought to assess the current attitudes and behaviours towards transport modes, to understand what barriers to transport behavioural change exist, and how incentives might support individuals in their uptake of sustainable transport. To achieve this research aim and objectives, a pragmatic approach to data collection was utilised to examine the 'what' and the 'why' of this aim and objectives. Through a pragmatic approach to data collection, a mixed-method methodology was identified as the most suitable approach for collecting the data. In utilising this pragmatic approach, quantitative online surveys and qualitative interviews were identified as the most suitable data collection methodology.

The first round of online surveying was conducted with the general public aged over 18 to examine their current attitudes and behaviours towards travel in Ireland and these results were presented in Section 4, Chapter 7. Preliminary analysis of Survey 1 highlighted that while COVID-19 changed how often individuals were travelling to the workplace post-pandemic, it did not fundamentally shift how individuals travel. Survey respondents reported using the same travel modes post-pandemic and travelling the same distances. These results indicated that while COVID-19 travel restrictions influenced travel behaviour during the pandemic, travel behaviour reverted back to pre-pandemic behaviour when these restrictions were eased and ultimately lifted post-COVID-19. Following the analysis of these results, it was evident that individual's behaviour was influenced by their perceived control over performing the behaviour which was measured through the cost, time and safety of the modes. These results highlighted that individuals perceived the private car as advantageous over sustainable transport modes and this did not increase their pro-environmental behaviour. Furthermore, the intention of individuals to choose sustainable modes over the private car did not influence their actual travel behaviour. The insights from the first round of surveying highlighted how the private car presents a barrier to the uptake of sustainable transport modes.

This first round of surveying presented an opportunity to further examine what the barriers to transport behavioural change are through interviews with 12 participants in the transport sector. These stakeholders were from organisations ranging from government officials to charities representing older

people and organisations advocating for rural transport users. Continuing in the pragmatic approach to data collection outlined previously, these 12 in-depth semi-structured qualitative interviews were used to examine how stakeholders in the transport sector viewed the current state of transport and transport behaviour. Following a pragmatic approach to the transcription and analysis of the qualitative interviews, key themes around barriers to sustainable transport behavioural change developed in the transcripts. These themes highlighted how the development and implementation transport infrastructure served as a barrier to transport behavioural change. Furthermore, what is required to support transport users at a rural level, and how gender and age influence the experience of safety on sustainable transport modes developed as key barriers to behavioural change also. These results were presented in Section 4, Chapter 8. Following the analysis of both the first round of quantitative surveys and qualitative interviews, a final round of online surveying was conducted with the general public aged 18 and over to further understand how infrastructure, personal safety and incentives could bridge the gap between intention and behaviour and support individuals in choosing sustainable transport modes. The results from this round of surveying highlighted how infrastructure does not support women and older people in feeling safe when using sustainable transport. Furthermore, incentivisation is not an effective strategy for encouraging private car users towards sustainable transport modes. These results were presented in Section 4, Chapter 9.

The results from both rounds of surveying and the Interviews with 12 stakeholders contribute valuable insights which highlight how safety must be enhanced through effective infrastructure, which includes improved lighting, seating and shelters at stops, security presence on board and clear and accessible reporting facilities that are visible across all sustainable transport modes. These recommendations for safe infrastructure are a necessary enhancement in supporting women and older people in choosing sustainable transport modes. Furthermore, incentivisation is not enough for private car users. This research recommends that disincentives may be required alongside incentives to push private car users towards sustainable transport modes, which has been driven by the ineffectiveness of incentives alone outlined in the results of survey 2 in Chapter 9. Future research could further examine how specific disincentives could operate to support a reduction in private car use.

Finally, this research acknowledges that current transport infrastructure is not being developed and implemented at a rate that can support behavioural change for individuals in rural areas. This research acknowledges that ribbon development has led to a scattered development of housing in rural areas that creates a challenge for providing suitable sustainable transport infrastructure to all users. Given the

challenges that have been outlined in this research in relation to the provision of sustainable transport in rural areas, this research acknowledges that the private car remains an important form of transport to support mobility in rural areas. However, the current demand-responsive transport being rolled out is not meeting the current demand for sustainable transport in rural areas that already have a high reliance on the private car and should be addressed to support individuals in these areas in their shift away from the private car. These barriers and potential supports to behavioural change present an opportunity in transforming the transport sector and support a reduction in transport emissions through collective behavioural change.

This research provides an important and original insight into the current transport attitudes and behaviours of individuals in Ireland, and the perspectives of stakeholders in the transport sector regarding what is required to support behavioural change. This research has focused on examining the current attitudes and behaviours towards transport in Ireland, offering an insight into how and why individuals choose their travel modes. By examining the barriers to transport behavioural change, this research provides worthwhile contributions in highlighting the current state of transport behaviour in Ireland and what is required to support individuals in shifting from the private car to more sustainable modes. In conclusion, this research provides necessary, original contributions into the current state of transport in Ireland by bridging the gap between users' behaviour and stakeholders' perspectives. By detailing the 'what' of current transport behaviour, 'why' of key barriers such as safety and habit, and the 'how' which identify future pathways through infrastructure developments, this research provides evidence-based recommendations for transforming the transport sector through long-term behavioural change to meet Ireland's climate change goals.

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Appendices

Appendix A: Survey 1 plain language statement

Dear Participant,

I am a researcher from Dublin City University (DCU) conducting research to gather your experiences regarding COVID-19 and transport before and during the pandemic. In particular I am interested in how you use space i.e. how and why you travel. I am interested in how you use space at home, at work and in public.

Your Role

You have been asked to participate in this research as you have been identified as someone who has important knowledge to offer based on your experience of the COVID-19 pandemic. If you choose to participate you will be asked a variety of question about your experience of using transport before COVID-19, travel restrictions, transport access and your views on climate change measures. Your participation will improve industry and government understanding of travel restrictions, transport infrastructure and climate change measures in Ireland. Your participation will inform future publications about COVID-19, travel restrictions and climate change.

Survey Process

The survey will last approx. 15 mins.

Confidentiality and Anonymity

Your identity will remain anonymous when attributing survey responses in this research and future publications.

The questions asked will relate to your experience of the pandemic, specifically how you use transport, why you travel and your views on climate change. The questions will not be personal in nature. You will be

asked to provide the first 3 digits of your Eircode. This information will be used to map responses to the questions and to identify any spatial trends in responses. Providing the first 3 digits of your Eircode will not make you identifiable. You will not receive any reimbursement from taking part as a volunteer in this research.

Your participation will be confidential however, I must inform you that in certain limited circumstances I cannot guarantee confidentiality, such as where mandatory reporting applies or if a Freedom of Information request or court order requires our cooperation. If you tell me that you or another person is at risk of harm, I may have to report this to the relevant authority and cannot guarantee confidentiality or anonymity in these situations.

Data Protection

All data gathered will be stored safely following DCU's data handling policy in compliance GDPR. The data will be used for this PhD research and will be disposed of when the research is complete. If you would like to be contacted with the results of this research, you can provide your email address at the end of the survey. If at any point you change your mind during the survey, you can withdraw from the survey process without submitting the survey. You can also request for your data to be removed.

This research has received ethical approval from the DCU Ethics panel, if you require any further details on this, the ethics reference number for this survey is DCU-FHSS-2022-024. If you have any questions please do not hesitate to contact Erica using the contact details below.

Thank you for your time and willingness to participate.

Kind regards,

The research team

If you have any queries or would like more information, please contact one of our research team:

Erica Fox: erica.fox29@mail.dcu.ie

Dr Trish Morgan: trish.morgan@dcu.ie

Dr Darren Clarke: darren.p.clarke@dcu.ie

Address: DCU St. Patricks Campus, SPD D328

Appendix B: Survey 1 consent form

I confirm that I am 18 years of age or older and live in the Republic of Ireland *

- Yes, I am 18 years of age or older and live in the Republic of Ireland
- No, I am not 18 years of age or older **OR** I do not live in the Republic of Ireland

I have read the information sheet attached and I consent to participating in this research *

- Yes, I consent to this
- No, I do not consent to this

Appendix C: Survey 1 questionnaire

Travel Habits

1. **BEFORE COVID-19, please indicate which of the following most accurately represented your commuting behaviour.**
    - I never went to office/college and worked/studied at home
    - I went to office college/college/workplace 1-2 days per week
    - I went to office college/college/workplace 3-4 days per week
    - I went to office college/college/workplace 5 or more days per week
    - I lost my job and I was not commuting/Not studying
    - I was retired/unemployed/homemaker

After COVID-19, please indicate which of the following most accurately represents your commuting behaviour.

- I never go to office/college and work/study at home
- I go to office college/college/workplace 1-2 days per week
- I go to office college/college/workplace 3-4 days per week
- I go to office college/college/workplace 5 or more days per week
- I lost my job and I am not commuting/Not studying
- I am retired/unemployed/homemaker

2. **Consider your experience working from home and please indicate the extent to which you agree or disagree with each of the following statements.**

BEFORE COVID-19, I was an experienced home worker.

- Strongly agree
- Agree
- Neutral/Don’t know
- Disagree
- Strongly disagree
- Non applicable

BEFORE COVID-19, in my organisation it was already

- Strongly agree
- Agree
- Neutral/Don’t know
- Disagree
- Strongly disagree
- Non applicable

After COVID-19, In the future I would like to work from home more often.

- Strongly agree
- Agree
- Neutral/Don’t know
- Disagree
- Strongly disagree
- Non applicable

After COVID-19, In the future I expect to work from home more often.

- Strongly agree
- Agree
- Neutral/Don’t know
- Disagree
- Strongly disagree
- Non applicable

Mobility

3. **Please indicate the extent to which you agree or disagree with the following statement. have good access to public transport where I live.**
    - Strongly agree
    - Agree
    - Neutral/Don't know
    - Disagree
    - Strongly disagree
4. **BEFORE COVID-19, please indicate the main reason that influenced your daily travel.**
    - Work
    - Studying
    - Social activities
    - Recreational/Sports activities
    - Shopping
    - Other

Please indicate the main reason influencing your daily travel now.

- Work
- Studying
- Social activities
- Recreational/Sports activities
- Shopping
- Other

5. **BEFORE COVID-19, please indicate the approximate total distance travelled for the main reason influencing your daily travel identified in question 4. (Total distance refers to the return journey).**
    - 0-5 Kilometres
    - 6-10 Kilometres
    - 11-15 Kilometres
    - 16-20 Kilometres
    - 21-30 Kilometres
    - 31-50 Kilometres
    - More than 50 Kilometres

Please indicate the approximate total distance travelled for the main reason influencing your daily travel now.

- 0-5 Kilometres
- 6-10 Kilometres
- 11-15 Kilometres
- 16-20 Kilometres
- 21-30 Kilometres
- 31-50 Kilometres
- More than 50 Kilometres

6. **BEFORE COVID-19, please indicate the primary mode of transport you took for daily travel.**
    - On foot
    - Bicycle
    - Non-motorised scooter or E-scooter
    - Bus, minibus, or coach
    - Train or luas
    - Motorcycle or scooter
    - Driving a car
    - Passenger in a car

Please indicate the primary mode of transport you take for daily travel now.

- On foot
- Bicycle
- Non-motorised scooter or E-scooter
- Bus, minibus, or coach
- Train or luas
- Motorcycle or scooter
- Driving a car
- Passenger in a car

7. **Please briefly outline your primary reasons for using the main mode of transport you currently use:**

    [insert answer]

    _____

8. **How long does your current journey to work, school or college usually take? (Write in numerical minutes e.g. 35, 45. Please answer Non applicable if you do not work, go to school or college)**

    [insert answer]

    _____

9. **BEFORE COVID-19, please indicate which factors affected your primary mode of transport for daily travel by ranking them from Essential priority to Not a priority.**
    - Travel time saving
    - Cost
    - Cleanliness
    - Comfort
    - Safety and security
    - Climate change
    - Health reasons

10. **BEFORE COVID-19, please indicate the extent to which you agreed or disagreed with each of the following statements. Note: Active travel refers to walking, cycling, non-motorised scooting.**

Private car usage was safer than active travel.

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage was more comfortable than active travel

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage was faster than active travel

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage was cheaper than active travel

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage made an individual more environmentally friendly compared with active travel

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage was safer than public transport

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage was more comfortable than public transport

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage saved time over public transport

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage saved money over public transport

- Strongly agree

- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car usage increased an individual's social status compared with public transport

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I preferred using a private car to active travel

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I preferred using public transport to active travel

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I preferred using a private car to public transport

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

11. **BEFORE COVID-19, please indicate your attitude to using the following forms of transport by ranking them from Very positive to Very negative**
    Walking
    Bicycle
    Non-motorised scooter or E-scooter
    Bus, minibus, or coach
    Train or tram
    Motorcycle or scooter
    Car
    Ferry
    Aeroplane

Restrictions

12. **Please indicate your attitude to the following statements regarding COVID-19.**

The Irish government cares about COVID-19.

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

The Irish government have handled COVID-19 well.

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

The Irish government's communication about COVID-19 has been clear

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I have trusted the Irish government's advice since the outbreak of the COVID-19 pandemic until now

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I trusted the Irish government's advice during the first lockdown in March 2020

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I trusted the Irish government's advice during the second lockdown in October 2020

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I trusted the Irish government's advice during the third lockdown in December 2020

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I trusted the Irish government's advice about preventative measures to COVID-19 (social distancing, personal hygiene and mask wearing)

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I complied with travel restrictions during COVID-19

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Reducing the spread of COVID-19 is my responsibility

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Environment

13. How important is tackling the issue of climate change to you?

- Very important
- Important
- Moderately important
- Slightly important
- Not important

14. Please indicate your attitude to the following statements regarding methods of travel.

Flying makes an individual more environmentally friendly.

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Active travel makes an individual more environmentally friendly

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Private car use makes an individual more environmentally friendly

- Strongly agree
- Agree
- Neutral/Don't know

- Disagree
- Strongly disagree

Public transport makes an individual more environmentally friendly

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

15. Please indicate your attitude to the following statements regarding climate change and the government.

The Irish government cares about climate change.

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

The Irish government is handling the climate crisis well

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

The Irish government's communication about climate change is clear

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I would comply with restrictions to help combat climate change

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I would fly less to reduce travel emissions

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

I would drive less to reduce travel emissions

- Strongly agree
- Agree

- Neutral/Don't know
- Disagree
- Strongly disagree

I would use public transport more to reduce travel emissions

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

Reducing travel emissions are my responsibility

- Strongly agree
- Agree
- Neutral/Don't know
- Disagree
- Strongly disagree

16. Have you taken any actions in your own life to address climate change?

- Yes
- No

If you answered yes to question 16, please briefly outline the actions you have taken to address climate change in your own life.

[insert answer]

_____

17. Which of the following actions related to travel and transport have you taken in your own life to address climate change? (please select all options that apply)

- Purchased an electric or hybrid car
- Purchased a more efficient petrol or diesel car
- Reduced the use of your personal car
- Use public transport more than private car for journeys
- Use active travel more than private car for journeys
- Use active travel more than public transport
- Take fewer flights
- Holiday in Ireland more
- None of the above
- Other

18. What is the main type of fuel used by cars/vans in your household? (please select all options that apply to your household)

- Diesel
- Petrol
- Hybrid
- Electric
- N/A

19. Is public transport financially accessible to you?

- Yes

- No

20. Would you use public transport more if it was cheaper?
- Yes
- No

21. Which of the following shared transport methods do you use? (tick all that apply)
- Local link
- Bus or coach
- Car sharing e.g. GoCar
- Train (including Luas, DART, commuter, and inter-city train)
- Cycling lanes
- Bike rental (including Dublin Bikes and Coca-Cola Zero Bikes in Cork, Limerick, and Galway)
- Other

22. Which of the following shared transport methods would you use if it was more easily accessible to you? (tick all that apply)
- Local link
- Bus or coach
- Car sharing e.g. GoCar
- Train (including Luas, DART, commuter, and inter-city train)
- Cycling lanes
- Bike rental (including Dublin Bikes and Coca-Cola Zero Bikes in Cork, Limerick, and Galway)
- Other

23. Please briefly outline how you think public transport could be improved in your area.
[insert answer]

_____

24. The government have stated that by 2030 they will increase the number of sustainable journeys by 500,000 a day. Will you travel more sustainably to help achieve this? (Note: Sustainable journey refers to walking, cycling and public transport journeys)
- Yes
- No
- Maybe

If no, please state why:

[insert answer]

_____

25. The government have proposed to increase the fleet of electric vehicles in Ireland to 945,000 by 2030. Do you intend to purchase an electric vehicle in the next 5 years?
- Yes
- No
- Maybe

If no, please state why:

[insert answer]

Socio-demographics

Gender:

- Male
- Female
- Non binary
- Gender fluid
- Prefer not to say
- Other

Age:

- 18-29
- 30-44
- 45-59
- 60-74
- 75+

What is your nationality?

[insert answer]

What are the first 3 digits of your Eircode/Postcode

[insert answer]

What is your current employment status:

- Working for payment or profit
- Looking for first regular job
- Unemployed
- Student or pupil
- Looking after home/family
- Retired from employment
- Unable to work due to permanent illness

Which of the following options best describes your personal income last year? (Tick one)

- €0
- €1-9,999
- €10,000-24,999
- €25,000-49,999
- €50,000-74,999
- €75,000-99,999
- €100,000 or more
- Prefer not to answer

What is the highest educational or professional level qualification you have obtained? (please tick one)

- Intermediate/Junior Certificate
- Leaving Certificate

- Vocational Qualifications
- Bachelor degree or equivalent
- Masters/PhD or equivalent
- No formal qualifications
- Other

Do you have any of the following long-lasting conditions or difficulties?

- Blindness or a serious vision impairment
- Deafness or a serious hearing impairment
- A difficulty with basic physical activities such as walking, climbing stairs, reaching, lifting or carrying
- An intellectual disability
- A difficulty with learning, remembering, or concentration
- A psychological or emotional condition
- A difficulty with pain, breathing, or any other chronic illness or condition
- None of the above
- Other

If you answered yes to the above question, do you have any difficulty doing the following?

- Dressing, bathing, or getting around inside the home unaccompanied
- Going outside the home alone e.g. to the shop or to visit the doctor
- Working at a job or business or attending school or college
- Participating in other activities e.g. using transport

How many children under 16 live in your household? (please tick one)

- 1
- 2
- 3
- 4 or more
- None

I would like to contact you in the future to examine your attitudes and behaviours related to the environment, transport, and consumption of space after COVID-19. Please tick this box if you are willing to participate in a future study.

- Yes
- No

If you answered yes to the above, please fill in your details to create a unique identifier for future surveys. Providing this information allows us to match up your survey responses in the future while protecting your anonymity

Unique Identifier

- Your mother's initials
- Your day and month of birth
- The last 2 digits of your mobile number

Appendix D: Survey 2 plain language statement

Dear Participant,

I am a researcher from Dublin City University (DCU) conducting research to gather your experiences of transport and travel in Ireland.

Your Role

You have been asked to participate in this research as you have been identified as someone who has important knowledge to offer based on your experience of transport in Ireland. If you choose to participate you will be asked a variety of questions about your experience of using transport, transport access and your views on climate change measures. Your participation will improve industry and government understanding of transport infrastructure and climate change measures in Ireland. Your participation will inform future publications about transport and climate change.

Survey Process

The survey will last approx. 10 mins.

Confidentiality and Anonymity

Your identity will remain anonymous when attributing survey responses in this research and future publications.

The questions asked will relate to your experience of transport, your views on climate change and the Irish government. The questions will not be personal in nature. You will be asked to provide the first 3 digits of your Eircode. This information will be used to map responses to the questions and to identify any spatial trends in responses. Providing the first 3 digits of your Eircode will not make you identifiable. You will not receive any reimbursement for taking part as a volunteer in this research.

Your participation will be confidential. However, I must inform you that in certain limited circumstances I cannot guarantee confidentiality, such as where mandatory reporting applies or if a Freedom of

Information request or court order requires our cooperation. If you tell me that you or another person is at risk of harm, I may have to report this to the relevant authority and cannot guarantee confidentiality or anonymity in these situations.

Data Protection

All data gathered will be stored safely following DCU's data handling policy in compliance with GDPR. The data will be used for this PhD research and will be disposed of when the research is complete. If you would like to be contacted with the results of this research, you can provide your email address at the end of the survey. If at any point you change your mind during the survey, you can withdraw from the survey process without submitting the survey. You can also request for your data to be removed.

This research has received ethical approval from the DCU Ethics panel, if you require any further details on this, the ethics reference number for this survey is DCU-FHSS-2022-024. If you have any questions please do not hesitate to contact Erica using the contact details below.

Thank you for your time and willingness to participate.

Kind regards,

The research team.

If you have any queries or would like more information, please contact one of our research team:

Erica Fox: erica.fox29@mail.dcu.ie

Dr Trish Morgan: trish.morgan@dcu.ie

Dr Darren Clarke: darren.p.clarke@dcu.ie

Appendix E: Survey 2 consent form

I confirm that I am above 18 years of age and have lived in the Republic of Ireland since December 2019. *

- ○ Yes, I am above 18 years of age and have lived in Ireland since December 2019
- ○ No, I am not above 18 years of age or have not lived in Ireland since December 2019

I have read the information sheet attached and I consent to participating in this research *

- ○ Yes, I consent to this
- ○ No, I do not consent to this

Appendix F: Survey 2 questionnaire

Responsibility

Please indicate your attitude to the following statements about transport related greenhouse gas emissions:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I feel responsible for my greenhouse gas emissions that contribute to climate change					
I feel responsible for my greenhouse gas emissions caused by transport					

Who do you think should be responsible for reducing greenhouse gas emissions caused by transport? (Please order the responses from who you feel should be most to least responsible. Click on the answers and move them to reorder them

- Individuals (drivers and commuters)- Individual choices, such as using public transportation, carpooling, and choosing low-emission vehicles, can significantly impact transport emissions.
- National Government - Policymaking, setting emission standards, and investing in sustainable infrastructure are crucial government responsibilities.
- Local Government - Local authorities can implement policies and infrastructure projects that reduce emissions, such as bike lanes and pedestrian-friendly streets.
- Transport Companies - Companies that provide transportation services, including public transport and logistics firms, should adopt sustainable practices and technologies.
- Car Manufacturers - These companies should be responsible for producing fuel-efficient and zero-emission vehicles.
- Corporations (large businesses and industries) - Businesses can reduce emissions by optimising logistics, using cleaner transportation options, and encouraging employees to adopt sustainable commuting practices.
- European Union - As a supranational entity, the EU can set broader regulatory frameworks and emission targets that member states, including Ireland, must follow.
- Non-Governmental Organisations - NGOs can advocate for policy changes, raise awareness, and support initiatives aimed at reducing transport emissions.
- General Public - Collective public action and societal shifts towards sustainable behaviours can drive significant reductions in transport emissions.

Behaviours

The following section will ask you about the transport modes you use and the transport modes you have access to.

Please select all of the travel modes you use:

- Walking
- Cycling
- Scooting (incl. E-Scooter)

- Carpooling
- Private car
- Public Transport

Please select the travel mode you use the most for daily travel:

- Walking
- Cycling
- Scooting (incl. E-Scooter)
- Carpooling
- Private car
- Bus/Coach
- Luas/Tram
- Train
- Other

Please indicate your response to the following statements about your Travel Behaviour:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I use Public Transport as a transport mode for environmental reasons					
I Carpool as a transport mode for environmental reasons					
I use a Scooter or E-Scooter as a transport mode for environmental reasons					
I use walking as a transport mode for environmental reasons					
I cycle as a transport mode for environmental reasons					

I use sustainable modes of transport to reduce my transport related greenhouse gas emissions					

Do you use any of the following Public Transport modes? (Please select all that apply)

- a. Bus/Coach
- b. Local Link
- c. Train
- d. Luas/Tram
- e. None of the above
- Other

Which Public Transport modes are easily accessible to you from your home? (Please select all that apply)

- a. Bus/Coach
- b. Local Link
- c. Train
- d. Luas/Tram
- e. None of the above
- Other

Do you use any of the following Active Travel modes? (Please select all that apply)

- Walking
- Cycling
- Scooting (incl. E-Scooter)
- None of the above

Reliability

The following section will ask you about your attitudes towards the Public Transport modes you have access to and the Active Travel modes you use.

Please state your attitude to the following statements about the Bus/Coach:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
The Bus/Coach is always on time					

The Bus/Coach is convenient to get to from my house					
Bus/Coach fares are affordable					
Travelling by Bus/Coach is faster than the car					
I feel safe travelling by Bus/Coach					
I trust the Bus/Coach real-time information					
I am satisfied with the number of stops on the Bus/Coach					
The Bus/Coach is always crowded					

Please state your attitude to the following statements about the Local Link:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
The Local Link is always on time					
The Local Link is convenient to get to from my house					
The Local Link is affordable					
Travelling by Local Link is faster than the car					
I feel safe travelling on the Local Link					
I am satisfied with the number of stops on the Local Link					

The Local Link is always crowded					

Please state your attitude to the following statements about the Train:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
The Train is always on time					
The Train is convenient to get to from my house					
The Train is affordable					
Travelling by Train is faster than the car					
I feel comfortable travelling on the Train					
I feel safe travelling on the Train					
I am satisfied with the number of stops on the Train					
The Train is always crowded					

Please state your attitude to the following statements about the Luas/Tram:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
The Luas/Tram is always on time					
The Luas/Tram is convenient to get to from my house					
The Luas/Tram is affordable					
I am satisfied with the number of stops on the Luas/Tram					
The Luas/Tram is always comfortable					

I feel safe travelling on the Luas/Tram					
The Luas/Tram is always crowded					
The Luas/Tram is faster than the car					

Please state your attitude to the following statements about Walking as a travel mode:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Walking is faster than travelling by car					
Walking is faster than travelling by public transport					

	Always	Often	Sometimes	Rarely	Never
I feel safe walking					

Please state your attitude to the following statements about Cycling as a travel mode:

	Always	Often	Sometimes	Rarely	Never
Cycling is faster than travelling by car					
Cycling is faster than travelling by public transport					
I feel safe cycling					

Please state your attitude to the following statements about Scooting (incl. e-scooting) as a travel mode:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Travelling by scooter (inc. e-scooter) is faster than the car					

Travelling by scooter (inc. e-scooter) is faster than public transport					

	Always	Often	Sometimes	Rarely	Never
I feel safe travelling by scooter (incl. e-scooter)					

<u>Transport Intentions</u>

The following section will ask you about your transport and travel related intentions.

Would the following change your intentions to use public transport:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Faster service					
Cheaper fares					
Stops closer to your home/workplace					
Free fares					
More stops along the route					
More standing space					
More seats					
Accurate real-time information					
Live tracking map for transport modes					
Designated quiet carriages on trains					
Faster service					
Cheaper fares					
Stops closer to your home/workplace					
Free fares					
More stops along the route					
More standing space					

More seats					
Accurate real-time information					
Live tracking map for transport modes					
Designated quiet carriages on trains					

Would the following change your intentions to use walking as a travel mode:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Improved infrastructure (e.g. better roads and pavings)					
Better lighting					
Segregated pathways					
Increased information on health benefits					
Garda presence					
Links up to public transport services					

Would the following change your intentions to use cycling as a travel mode:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Improved infrastructure (e.g. better roads and pavings)					
Better lighting					
Designated pathways					
Garda presence					
One Way streets/Absence					

of through traffic					
More bike parking and storage facilities					
Increased information on health benefits					
Reduced car speed limits					
Links up to public transport services					

Please indicate your response to the following statements on intentions for transport and travel:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I intend to use Public Transport more than the Private Car for environmental reasons					
I intend to Carpool more than driving a single occupancy Private Car for environmental reasons					
I intend to start walking as a transport mode more for environmental reasons					
I intend to start cycling more as a transport mode for environmental reasons					
I intend to start scooting (incl. e-scooting) more as a transport mode for environmental reasons					

I intend to use sustainable modes of transport more to reduce my transport related greenhouse gas emissions					

Safety

The following section will ask your attitudes towards your feelings of safety on Public Transport and Active Travel.

Please indicate your attitude to the following statements on safety:

	Always	Often	Sometimes	Rarely	Never
I feel unsafe on public transport					
I feel safe waiting at the bus stop					
I feel safe waiting for the train					
I feel safe waiting for the Luas/Tram					
I feel safe in a car					
I feel safe from harassment or attacks on the bus/coach					
I feel safe from harassment or attacks on the train					
I feel safe from harassment or attacks on the luas/tram					

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

Witnessing harassment or intimidation on public transport influences my choice to use public transport					
Experiencing harassment or intimidation on public transport influences my choice to use public transport					

When do you feel safe on the following modes of transport:

	Morning (6am-12pm)	Mid-day (12pm-5pm)	Evening (5pm-8pm)	Nighttime (8pm-12am)	Early Morning (12am-6am)	None of these times
Public Transport						
Walking						
Cycling						
Scooting (incl. e-scooter)						
Driving a car						

Please indicate your attitude to the following statements about Public Transport:

	Always	Often	Sometimes	Rarely	Never
I feel safe travelling alone at night on public transport					

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
My gender influences my feelings of safety on public transport					

Please indicate if any of the following would make you feel safer on public transport: (Please select all that apply):

- Park and Ride infrastructure
- Better lighting
- Visible security presence
- Reporting facilities for anti-social behaviour
- Reporting facilities for feeling unsafe on-board
- None of the above
- Other

Please indicate if any of the following would make you feel safer walking: (Please select all that apply):

- Better lighting
- Designated walking routes
- Improved paths
- Longer time for pedestrian traffic signal crossings
- None of the above
- Other

Please indicate if any of the following would make you feel safer cycling: (Please select all that apply):

- Better lighting
- Segregated pathways
- Improved paths
- Earlier start than cars at traffic junctions
- More dedicated traffic light signals for cyclists
- More bike parking and storage facilities
- None of the above
- Other

Please indicate if any of the following would make you feel safer scooting (incl. e-scooting): (Please select all that apply):

- Better lighting
- Segregated pathways
- Improved paths
- Earlier start times than cars at traffic junctions
- More dedicated traffic light signals for scooters
- None of the above
- Other

<u>School Transport</u>

The following section will ask you about school-related travel if you have any children under 18 in your household

Do you have any children under 18 living in your household?

- Yes
- No

If yes, how do your children get to and from school?

- Walking

- Cycling
- Scooting (incl. E-Scooter)
- Passenger in my car
- Passenger in another car (carpooling)
- School bus
- Train
- Luas
- Public bus
- Local Link
- Other

How many car journeys a week do you make bringing your children to and from school?

[Insert text]

_____

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I would feel safe letting my child travel to and from school with a walking bus (a group of school children walking to and from school together led by an adult)					
I would feel safe letting my child travel to and from school with a cycling bus (a group of school children cycling to and from school together led by an adult)					

<u>Incentives</u>

The following section will ask you about your attitudes towards proposed transport and travel related incentives.

Please indicate your attitude to the following statements about Active Travel: Cycling, Scooting (incl. e-scooting) and Walking:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I would cycle/scoot/walk to work if I was paid per km travelled					
I would cycle/scoot more if there were community bikes and scooters (incl. e-scooters) in my area					
I would cycle/scoot if I was provided with a free safety gear set (e.g. helmets, hi-vis jackets)					
I would walk more for journeys if I received a tax credit for walking shoes					

Please indicate your attitude to the following statements about Public Transport:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I would use public transport instead of the car if I saw how much CO2 I saved with every journey					
I would use public transport if I earned rewards (e.g. free cinema tickets, money off shopping vouchers) for the number of journeys taken					
I would use public transport if fares were free at peak seasonal times (e.g. school holidays, bank holidays etc)					

Please indicate your attitude to the following statements about the Private Car:

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I would use alternative fuels in my car such as hydrotreated vegetable oil if it was cheaper than diesel/petrol					
I would use sustainable modes of transport over my car if I could take out month to month car insurance					

Socio-demographics

Gender:

- Male
- Female
- Non binary
- Gender fluid
- Prefer not to say
- Other

Age:

- 18-29
- 30-44
- 45-59
- 60-74
- 75+

What is your nationality?

[insert answer]

_____

What are the first 3 digits of your Eircode/Postcode

[insert answer]

_____

What is your current employment status:

- Working for payment or profit
- Looking for first regular job
- Unemployed
- Student or pupil
- Looking after home/family

- Retired from employment
- Unable to work due to permanent illness

Which of the following options best describes your personal income last year? (Tick one)

- €0
- €1-9,999
- €10,000-24,999
- €25,000-49,999
- €50,000-74,999
- €75,000-99,999
- €100,000 or more
- Prefer not to answer

What is the highest educational or professional level qualification you have obtained? (please tick one)

- Intermediate/Junior Certificate
- Leaving Certificate
- Vocational Qualifications
- Bachelor degree or equivalent
- Masters/PhD or equivalent
- No formal qualifications
- Other

Do you have any of the following long-lasting conditions or difficulties?

- Blindness or a serious vision impairment
- Deafness or a serious hearing impairment
- A difficulty with basic physical activities such as walking, climbing stairs, reaching, lifting or carrying
- An intellectual disability
- A difficulty with learning, remembering, or concentration
- A psychological or emotional condition
- A difficulty with pain, breathing, or any other chronic illness or condition
- None of the above
- Other

If you answered yes to the above question, do you have any difficulty doing the following?

- Dressing, bathing, or getting around inside the home unaccompanied
- Going outside the home alone e.g. to the shop or to visit the doctor
- Working at a job or business or attending school or college
- Participating in other activities e.g. using transport

A similar survey was available for completion in 2021. If you completed the survey in 2021, then please choose Yes, otherwise Choose No?

- Yes
- No

Please fill out the unique identifier you created in the 2021 survey. Providing this information allows us to match up your survey responses while protecting your anonymity.

Unique Identifier

- Your mother's initials
- Your day and month of birth

- The last 2 digits of your mobile number

Appendix G: Interview plain language statement

Project: Environment, Transport, Travel Habits and COVID-19

Information Sheet

Dear Participant,

I am a researcher from Dublin City University (DCU) conducting interviews to gather your expert insight regarding COVID-19 and transport before during and after the pandemic. In particular, I am interested in the attitudes and behaviours that influence transport and travel in Ireland and how these can influence climate change emissions.

Your Role

You have been asked to participate in this research as you have been identified as someone who has important knowledge to offer based on your experience of the COVID-19 pandemic. If you choose to participate you will be asked a variety of question about your experience of transport and its governance before COVID-19, travel restrictions, transport access and your views on climate change measures. Your participation will improve industry and government understanding of travel restrictions, transport infrastructure and climate change measures in Ireland. Your participation will inform future publications about COVID-19, travel restrictions and climate change.

Interview Process

The interview will be semi-structured. This will entail a semi-structure of questioning that will reside in the themes of attitudes and behaviours towards transport, transport policy and climate change in Ireland. The interview may be recorded and transcribed alongside note taking. The interview will last approx. 30 minutes. If more information or clarification is required, a follow-up interview, Zoom or phone call may be arranged. These follow up communications will be brief. You will be allowed to view the notes, transcriptions and any material generated from your interviews.

Confidentiality and Anonymity

Your identity will not remain anonymous when attributing quotes in this research and future publications. If you require anonymity, please select this option in the consent form attached.
The questions asked will relate to your professional evaluation of the pandemic, changes in the use of transport and travel and how these changes may impact climate change. The question will not be personal in nature. You will not receive any reimbursement from taking part as a volunteer in this research.

Data Protection

All data gathered will be stored safely following DCU's data handling policy in compliance GDPR. The data will be used for this PhD research and will be disposed of when the research is complete. If you would like to be contacted with the results of this research, you can provide your email address to Erica before the interview begins. If at any point you change your mind, you can withdraw from the interview process and request for your data to be removed.

If you have any questions, please do not hesitate to contact Erica using the contact details below.

This research has received ethical approval from the DCU Ethics panel, if you require any further details on this, the ethics reference number for this project is DCU-FHSS-2022-024.

Please read and sign the consent sheet attached after reading this sheet. We thank you for your time and willingness to participate.

Kind regards,

Erica Fox: erica.fox29@mail.dcu.ie

Dr Trish Morgan: trish.morgan@dcu.ie

Dr Darren Clarke: darren.p.clarke@dcu.ie

Address: DCU St. Patricks Campus, SPD D328

Appendix H: Interview consent form

Project: Environment, Transport, Travel Habits and COVID-19

Consent Form

You have been invited to take part in research that gathers your experiences regarding COVID-19 and transport before and during the pandemic. Please tick a box for your response to each of the questions below.

I have read through the information sheet provided	Yes ☐	No ☐
I have had enough time to consider participating in this research.	Yes ☐	No ☐
I have had the opportunity to ask questions about this research	Yes ☐	No ☐
I am aware that I can withdraw from the research at any time without explanation	Yes ☐	No ☐
I consent to the recording, transcribing and note taking of the interview	Yes ☐	No ☐

I consent to the interview being used for research purposes and publications	Yes ☐	No ☐
I understand that the researcher will protect my right to anonymity	Yes ☐	No ☐

Preference for anonymity (please tick one):

Full anonymity: you prefer your identity not to be revealed in my final thesis and subsequent publication	
Partial anonymity: you are referred to by your first name, the initial of your surname, and organisation e.g., 'Lara P., The Climate Organisation'	
Partial personal anonymity: you are referred to by your organisation e.g., 'Member of The Climate Organisation'.	
Full credit: you prefer to be credited with your full name and organisation.	

By signing this consent form you are agreeing to the terms outlined above and consent to participate in this research.

Participant Name (Print) Signature Date

_____ _____ _____

Researcher Name (Print) Signature Date

_____ _____ _____

Appendix I: Interview guide

Interview Guide

Introductions – Can you please introduce yourself and your role?

Theme 1: Attitudes and Behaviours

Q1. Where do attitudes to transport stand currently in rural Ireland?

Q2. Do attitude-behaviour gaps exist with transport users?

Q3. What do you believe are the attitudinal gaps when switching from private modes of transport towards public and active modes of travel?

Q4. In a similar way, what do you think the behavioural gaps are?

Q5. In your opinion, is there an attitudinal or behavioural entrenchment in policy that is hindering its development in a pro-environmental way? OR Do you think there are barriers to behaviour change in the attitudes of certain decision makers

Theme 2: Communication about service enhancements and safety

Q6. Do you believe that an information deficit surrounding public and private modes of transport influences it's use across Ireland?

Q7. What is the perception of safety like across transport modes?

Q8. How can safety be communicated for different transport modes?

Q9. What do you believe is required to make public and active modes of transport attractive to women?

Theme 3: The role of government

Q10. How is the government encouraging behavioural change and how is this enacted through your role/organisation?

Q11. What are the lessons that you believe we can take from COVID-19, regarding how the collective action was enacted to combat the spread of the virus, and apply these to the climate crisis?

Q12. Policy often refers to the need for efficiency in transport development. Do you believe it's worthwhile to talk about efficiency when capacity, particularly in rural areas, should come first?

Q13. How can the government facilitate attitude change in rural Ireland if funding is supplied for infrastructure?

Q14. How is the government aiming to alter public trust in active travel and public transport infrastructure to ensure this modal shift can take place?

Appendix J: Ethical approval letter

Faculty of Humanities & Social Sciences
DUBLIN CITY UNIVERSITY

12 May 2022

CONFIRMATION OF RESEARCH ETHICS APPROVAL FOR A PROJECT

Application Reference: **DCU-FHSS-2022-024**

Project Title: **Climate change after COVID-19: Challenges and opportunities to transform the Irish transport sector**

Project contact(s): **erica.fox29@mail.dcu.ie**

Let this letter certify that the proposed project identified above has been reviewed by the *Humanities & Social Sciences Faculty Research Ethics Committee* (F-REC) and has been approved as a low-risk project. The application was found to that comply with university requirements and best practices for research ethics, and with GDPR guidelines and requirements where personal data is processed in the project.

A copy of the application, including appended documents related to participant consent, is archived under the reference above. Queries about this project's approval may be directed to the F-REC Chair.

Sincerely,

Dr Dónal Mulligan
donal.mulligan@dcu.ie

Chair, Faculty Research Ethics Committee
Faculty of Humanities & Social Sciences
Dublin City University

Dámh na nDaonnachtaí agus na nEolaíochtaí Sóisialta
Ollscoil Chathair Bhaile Átha Cliath

Appendix K: Recruitment email to stakeholders

Dear X,

I hope this email finds you well. I am a PhD student in DCU and I'm researching the impacts of COVID-19 on attitudes and behaviours towards transport in Ireland.

I am currently recruiting participants for short 20 minute interviews on their experience of transport in Ireland. I am eager to capture a wide range of experiences from a variety of communities and I would greatly appreciate a perspective from X organisation. These interviews will take place online or in-person and I will be asking a representative from your organisation to speak on the experience of people who access your services in relation to their experience of transport in Ireland.

Please let me know if a member of your organisation would be willing to participate and if you have any questions let me know.

Best wishes,
Erica Fox

PhD Student | School of History and Geography | Dublin City University