



WORKING PAPER

ITLS-WP-26-12

**Achieving sustainable travel behaviour
change – Insights from practitioners**

By

**John D. Nelson^a, David A. Hensher^a,
Corinne Mulley^a, Thiranjaya
Kandanaarachchi^a, Edward Wei^a,
Camila Balbontin^{a,b}, Wen Liu^a**

^a

Institute of Transport and Logistics Studies (ITLS),
The University of Sydney, Australia

^b

Pontificia Universidad Católica de Chile, Chile

June 2026

ISSN 1832-570X

**INSTITUTE of TRANSPORT and
LOGISTICS STUDIES**

The Australian Key Centre in
Transport and Logistics Management

The University of Sydney

Established under the Australian Research Council's Key Centre Program.

NUMBER: Working Paper ITLS-WP-26-12

TITLE: Achieving sustainable travel behaviour change – Insights from practitioners

ABSTRACT: Sustainable travel behaviour change has garnered increasing attention in response to the pressing challenges posed by traffic congestion, greenhouse gas emissions, and the broader impacts of travel on public health and wellbeing. This paper draws on insights from a series of expert roundtable discussions involving stakeholders from government, industry organisations, and research institutions with the primary objective of gathering multidisciplinary perspectives to inform the development of an overarching conceptual framework that supports the design of context-sensitive and effective behaviour change interventions. Themes emerging from the discussions were critically reviewed and mapped to relevant behavioural constructs such as attitudes, perceived behavioural control, subjective norms, and intention. The ensuing framework synthesises theoretical foundations from established behaviour change models with real-world experiences in the transport domain, offering a structured lens through which to interpret the drivers and barriers of behavioural shifts. Key insights that emerged include the critical role of overarching policies and goals enabled through collaborative governance, the need for inclusive and user centred interventions aligned with personal and societal benefits and the need for stakeholder collaboration within and across different sectors. By presenting evidence-informed recommendations and a cohesive conceptual framework, this paper offers a foundation for advancing sustainable transport through targeted and systemic behavioural change initiatives.

KEY WORDS: *travel behaviour, sustainability, behaviour change, transport interventions*

AUTHORS: Nelson, Hensher, Mulley, Kandanaarachchi, Wei, Balbontin, Liu

ACKNOWLEDGEMENTS: This research is part of iMOVE Cooperative Research Centre (CRC) research project 3-039 titled “Behavioural Change for Sustainable Transport” with Transport and Main Roads, Queensland, ITS Australia, and The Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts. We thank Alison Scott for her assistance with the roundtable discussions. The findings reported are those of the authors and are not the positions of other partners; but approval to present these findings is appreciated.

CONTACT: INSTITUTE OF TRANSPORT AND LOGISTICS STUDIES (H04)

The Australian Key Centre in Transport and Logistics
Management

The University of Sydney NSW 2006 Australia

Telephone: +612 9114 1813

E-mail: business.itlsinfo@sydney.edu.au

Internet: <http://sydney.edu.au/business/itls>

DATE:

June 2026

1 Introduction

There is a growing focus in policy making on strategies and policies aimed at reducing emissions and encouraging lifestyles that align with more sustainable behaviour patterns. This can be evident by the increasing number of net-zero pathways introduced by various countries (Bistline, 2021). However, achieving meaningful changes in travel behaviour is a complex task that requires an understanding of the psychological, social, and policy-related factors that influence individuals' transport choices. Hence, implementing interventions targeting meaningful and long-term behaviour changes necessitates a comprehensive understanding of behavioural dynamics and a cross-sectoral approach where progress in one area supports advancements in others (Cleland et al., 2023; De-Toledo et al., 2022).

There is no shortage of literature on behaviour change in the context of sustainable transport, however, systematic evaluations the effects of behaviour change are limited (Arnott et al., 2014; Bamberg et al., 2011). Nelson et al. (2025) reviewed the key theories and approaches to behavioural change in the context of sustainable transport with the intention of providing evidence of the effectiveness of measures or interventions. Informed by the literature this paper provides insights gathered through round table discussions with stakeholders currently involved in delivering transport policies, pilots, and projects aimed at encouraging sustainable mobility. As its key contribution, the paper proposes an overarching conceptual framework of travel behaviour change, referencing well-established theories in the behaviour change literature. This encapsulates a holistic view of how different constructs, both established and new, can influence travel behaviour change in a systemic manner. The paper also provides evidence-based recommendations for policymakers and transport operators, highlighting strategies that can induce systemic change in sustainable transport practices.

The paper is structured as follows. The literature context outlines the key theories related to behaviour change and examines their relevance to travel behaviour to provide the analytical lens through which the subsequent roundtable discussions were examined. This is followed by the methodology section, which describes the design and conduct of expert roundtable discussions and the approach to qualitative analysis. The subsequent section presents the study's findings, framed within an overarching conceptual framework. The paper concludes with insights for decision-makers on designing targeted strategies for sustainable behaviour change and identifies areas for future research.

2 Literature context

There is a significant body of literature which emphasises the importance of integrating behaviour change theories into the context of travel behaviour change (BC). Andersson et al. (2018) connected Transport Demand Management (TDM) and practical applications, such as personalised travel plans (PTP) (Chatterjee, 2009), with BC theories like Diffusion of Innovations (DOI) (Rogers, 2010), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Transtheoretical Model (TTM) (Prochaska and Clemente, 1982), and Gamification (Wells et al., 2014), to encourage voluntary travel behaviour changes. De-Toledo et al. (2022), through a scientometric review of over 300 published papers on travel behaviour change research, emphasised the importance of referring to BC theories when seeking to develop policies, interventions, and tools.

Arnott et al. (2014) performed a meta-analysis using transport research databases and found evidence suggesting that interventions lacking a theoretical foundation tended to be less effective in promoting long-term behaviour change goals. Their findings highlighted that transport interventions often relied on an ad hoc mix of information dissemination and behavioural regulation techniques rather having an overarching framework. Nelson et al. (2025) in a comprehensive review of behaviour change theories and travel interventions

identified the need to integrate different interventions with an overarching objective of achieving non-marginal and sustainable outcomes. Their findings also emphasise the need for segmentation which underlies the importance of tailoring strategies to specific populations and geographic contexts to maximise their impact.

In addition to segmentation based on population and geographic contexts, socio-cultural factors further shape how individuals make travel decisions. The availability of transportation options, along with community influences, affects individual choices (Cheshmehzangi and Thomas, 2016). Developing behaviour change measures that address the unique transport needs of various localities—cities, suburbs, regional, and rural areas—is crucial for effective intervention (Zhu et al., 2020). Additionally, prior studies have shown that neighbourhood design significantly impacts travel behaviour, with evidence suggesting that land-use policies promoting mixed-use developments can reduce car dependence and increase active travel modes (Cao et al., 2007; Cervero and Kockelman, 1997). Studies have shown that localised interventions tailored to specific socio-cultural contexts can be more effective in promoting sustainable travel (De-Toledo et al., 2022). Moreover, variations in travel choices across large geographical regions such as Europe necessitate different policy approaches, as identified by Haustein and Nielsen (2016) for the European Union and further supported by Gaborieau and Pronello (2019).

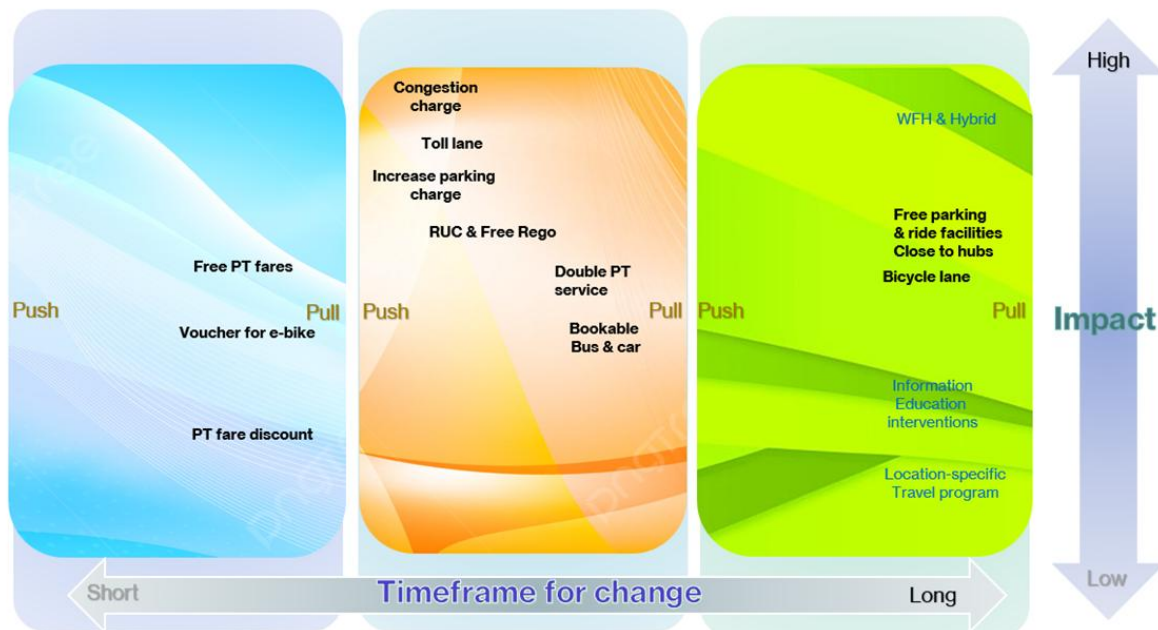


Figure 1: Classification of behaviour change interventions based on their impact and temporality - Note: Blue text = soft measures and black / bold = hard measures) (Source: modified from Nelson et al., 2025)

Figure 1 depicts a classification of behaviour interventions based on the dimensions which influence their effectiveness, namely: time frame for change (short v long), impact levels (small to high), the “push” and “pull” nature of interventions and whether they can be classified as “soft” or “hard”. As an illustration, measures such as Working from Home (WFH) would be classified as a long-term, high impact “pull” measure; providing bicycle lanes to promote active travel is a long-term, moderate to high impact “pull” measure; and parking pricing strategies are a medium term, moderate impact “push” measure. The impact of combining the role of “push” and “pull” initiatives for sustainable travel behaviour has been widely studied (see for example Hensher et al., 2026) but sometimes limited by the practical challenges of implementing such measures.

It is recognised that different traveller groups may respond differently to transport interventions and so segmentation of travellers becomes relevant. Traveller preferences can vary due to factors like attitudes, beliefs, and behaviours, rather than just demographic characteristics (Fan et al., 2023; Hunecke et al., 2008). This underscores the importance of moving beyond a "one-size-fits-all" approach and considering more tailored strategies that account for diverse motivations and barriers. Theories such as TPB (Ajzen, 1991) – discussed further in Section 4.1, DOI (Rogers, 2010) and segmentation (Anable, 2005) provide frameworks for segmenting travellers based on their attitudes toward car use and transport alternatives. Also of relevance, the socio-ecological model (SEM) underscores the subtle yet powerful influence of social and cultural perceptions. Buehler and Pucher (2021) applied the SEM to active travel and demonstrated how societal views on driving and cycling shape individual transportation decisions, while Sulikava and Brand (2021) applied the SEM to investigate what makes people walk or cycle in selected European cities.

Additionally, the stages of change model by Sunio et al. (2018) highlights the importance of addressing different stages of behaviour change for more effective policy implementation, identifying pre-decision, pre-action, action, and post-action stages. A further approach is to consider the role of stimuli triggering transport behaviour changes have also been termed as "Windows of Change" (WoC). These changes in people's lifestyle, household, work and environmental preferences provide opportunities for implementing targeted transport initiatives. Hensher et al (2026) investigate how such prior "windows of change" condition support or otherwise for a series of road pricing reform initiatives.

There has been growing interest amongst practitioners in soft transport policies due to their capacity to shape car users' choices while maintaining their sense of autonomy, as these measures encourage voluntary changes in travel behaviour rather than enforcing prohibitions. These measures work by influencing how people perceive their travel environment, helping them better understand the impacts of different transport options, and inspiring them to adopt alternatives through empowerment, information provision, and self-motivated decision-making (captured by information and education interventions in Figure 1). Fundamentally, this approach relies on tools like information sharing, communication, education, and training to raise awareness and drive behavioural shifts (Bamberg et al., 2011). Examples of such strategies include personalised travel planning (PTP) (Chatterjee, 2009); targeted travel plans for specific settings such as schools, workplaces, and neighbourhoods (De Gruyter et al., 2017; Petrunoff et al., 2016); the use of persuasive technologies like smartphone applications (Anagnostopoulou et al., 2018); community events; and promotion by influential role models (Hanna et al., 2018). Approaches like PTP, individualised travel marketing, and travel feedback programs have been widely shown to effectively motivate individuals to voluntarily reduce their reliance on cars (Bamberg and Rees, 2017).

This brief overview of literature suggests that transport interventions should focus on shifting attitudes and beliefs to encourage voluntary changes in travel behaviour, as these can underpin long-term sustainable mobility patterns. However, it is important to acknowledge that regulatory and pricing measures, such as congestion charging and parking pricing, are often among the most effective behaviour change interventions and can create supportive conditions for voluntary change. By understanding these dynamics, interventions can be designed to suit specific populations and contexts. Further, it is important to align these initiatives with overarching goals such as addressing current transportation challenges, promoting long-term behavioural change, and enhancing both environmental sustainability and social equity. However, while identifying the most effective components of behaviour change is important, there is still a lack of evidence on the success of specific interventions and challenges in implementing such strategies.

3 Methodological approach

This section outlines the methodology adopted in this study to gather perspectives and evidence from key stakeholder groups involved in policy development. It describes the design and facilitation of the roundtable discussions and details the application of a qualitative reflexive thematic analysis in interpreting the data. We acknowledge that this type of qualitative analysis depends on researchers' interpretations of transcript textual data and is therefore potentially open to bias and subjectivity (Ritchie et al., 2013). The section also explains how the emerging themes were synthesised into a conceptual framework that captures the behavioural mechanisms influencing sustainable travel choices.

3.1 Design and conduct of round table discussions

A series of roundtable discussions (RTD) was organised with the aim of gathering insights from relevant practitioner stakeholder groups, primarily based in Australia, with an interest in the field of sustainable behaviour change. The main intention of the RTDs was to engage with government, industry, research-related organisations and industry peak bodies that currently deliver policies, pilots, and projects that drive behavioural change and modal shifts toward sustainable transport and identify evidence about interventions which deliver real behaviour change. The participants were identified through publicly available information (e.g., organisational websites, reports) and professional networks of the project partners. While this purposive sampling approach was considered appropriate for targeting individuals with specialised knowledge, it is acknowledged that it may introduce some selection bias by favouring well-connected or more visible organisations. To mitigate this, the contact list was systematically reviewed to ensure representation across different sectors and organisational scales, and subsequently, divided into four groups to diminish the likelihood of bias and dominance during discussions. These comprised three homogeneous groups - Government (all tiers), Industry, and Transport Service Providers (with researchers selectively distributed across the latter two) - and one international mixed group to capture perspectives from broader contexts. Following institutional ethics approval, the potential participants in each group were approached with an invitation email, agenda and Participant Information Statement. Each RTD was professionally facilitated and ran for about 2 hours covering a predetermined set of themes (see Appendix A).

Altogether, four RTDs were conducted in late 2024 and the details of each is provided in Table 1. In addition, two online one-to-one interviews have been held with key participants unable to attend an RTD. One of the authors was involved in each of the RTDs at the start to explain the context of the project and highlight findings from the evidence review and returned at the end to gather insights for subsequent stages of the project. Each RTD was recorded, and the anonymised transcripts were used in analysis.

Table 1. Details of the Round Table Discussions¹

Round Table Discussion	Number of participants	Local / International	Composition
RTD 1	10	Local (NSW, QLD)	Peak Body/Industry
RTD 2	4	Local (NSW, SA)	Government/Researchers
RTD 3	9	Local (QLD, NSW, VIC, SA)	Transport Service Providers/Industry

¹ The RTDs took place in November and December 2024.

RTD 4	6	International (Australia, Finland, Netherlands, Norway)	Researchers/Industry/Transport service providers
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3.2 Approach to analysis

This study employed a qualitative thematic analysis to explore expert perspectives on sustainable travel behaviour and the mechanisms influencing change. Thematic analysis was selected for its flexibility and capacity to support both descriptive and interpretive levels of analysis, allowing for a nuanced understanding of complex behavioural influences. The process followed the reflexive thematic analysis framework (Braun and Clarke, 2006, 2019), enabling the development of themes through an iterative and interpretive engagement with the data. Data from the roundtable discussions were transcribed and imported into NVivo (version 15) to support systematic coding and theme development. The analysis began with open coding, where meaningful units of text were coded inductively. Codes were then grouped into initial descriptive patterns, capturing recurrent responses or concerns raised by participants. Through iterative refinement, these patterns were organised into broader themes that reflected latent meanings within the data. Divergent views that emerged during the discussions were documented in detail and treated as analytically significant rather than noise; where substantial differences arose between local and international perspectives, these were explicitly noted during the coding process and are reflected in the interpretation of findings to ensure that contextual variations were appropriately considered.

To support theory-informed interpretation, particularly drawing on the Theory of Planned Behaviour (Ajzen, 1991), themes were critically reviewed and mapped to relevant behavioural constructs such as attitudes, perceived behavioural control, subjective norms, and intention. This mapping helped validate the emerging themes and facilitated conceptual integration, bridging empirical findings with established theoretical frameworks. The analysis also examines any differences in constructs across RTDs, acknowledging the influence of the varying composition of stakeholders involved in the discussions. As a final step, a conceptual framework was developed by categorising the themes under the core constructs of TPB. This framework represents the synthesis of data-driven insights with theoretically grounded themes and constructs, illustrating the mechanisms that influence sustainable travel behaviour. It serves as both a visual and conceptual representation of how expert perspectives align with behavioural theory and provides a foundation for future intervention design and policy recommendations.

It is important to note that the insights presented below are based on the perspectives shared by roundtable participants which were triangulated with published evidence wherever possible. While some of the insights reiterate established principles in the behaviour change literature, this study aims to reflect current priorities and experiences among key stakeholders. Reported examples of impact should be interpreted as illustrative and informed by participants' experience, rather than definitive evaluations of effectiveness, and caution is warranted in generalising findings beyond the contexts represented.

4 Findings

This section presents the results of the analysis and discusses in detail the key themes that emerged from the roundtable discussions, categorising them under relevant theoretical constructs to show how they shape travel behaviour change within the given context. Figure 2 illustrates the conceptual framework developed through this process, highlighting the interrelationships between constructs and themes while providing a visual summary of the behavioural mechanisms identified through stakeholder insights. To further support the validity

of these themes, discussion also presents examples of evidenced interventions drawn from the discussions and lists relevant interventions or programs mentioned by participants. This connection between stakeholder evidence and analytical interpretation reinforces the credibility and practical relevance of the findings. This section builds a narrative around each theme, drawing on these examples to illustrate their influence in real-world policy and behavioural change initiatives.

4.1 Changing travel behaviour

Changing travel behaviour as the end goal is placed at the centre of Figure 2 as the overarching aim of this study is to understand the methods and variables that interplay in the process of influencing sustainable behaviour change. Discussions within the roundtables highlighted the importance of understanding the broader psychology behind behaviour change as essential for designing effective transport interventions. The Theory of Planned Behaviour (TPB) provides a well-established framework for understanding the psychological mechanisms underlying behaviour change (Ajzen, 1991). It posits that an individual's *intention* to perform a behaviour is shaped by three key constructs: *attitudes* (personal evaluation of the behaviour), *subjective norms* (perceived social pressure to engage in the behaviour), and *perceived behavioural control* (the perceived ease or difficulty of performing the behaviour). By analysing these constructs, TPB helps explain how personal, social, and contextual factors interact to influence travel decisions. Additional insights are drawn through application of the socio-ecological model (SEM) (Bronfenbrenner, 1986; Kilanowski, 2017) which attempts to define how behaviour is shaped by multiple levels - individual, interpersonal, institutional, community, and societal (policy/structure). We have applied the TPB framework to the themes that emerged (see Figure 2 to enable a structured examination of the factors driving sustainable travel behaviour and inform the development of targeted interventions to support long-term behavioural change.

To further support the validity of these themes, Appendix B presents concrete examples of evidence drawn from the roundtable discussions and lists relevant interventions or programs mentioned by participants, including their aims and contexts, and shows how these are linked to the identified themes. A total of 46 interventions were identified, categorised and documented (Table B1). This connection between stakeholder evidence and analytical interpretation reinforces the credibility and practical relevance of the findings. The discussion that follows build a narrative around each of the themes, drawing on these real-world examples to illustrate their influence in policy and behavioural change initiatives.

1. Attitudes

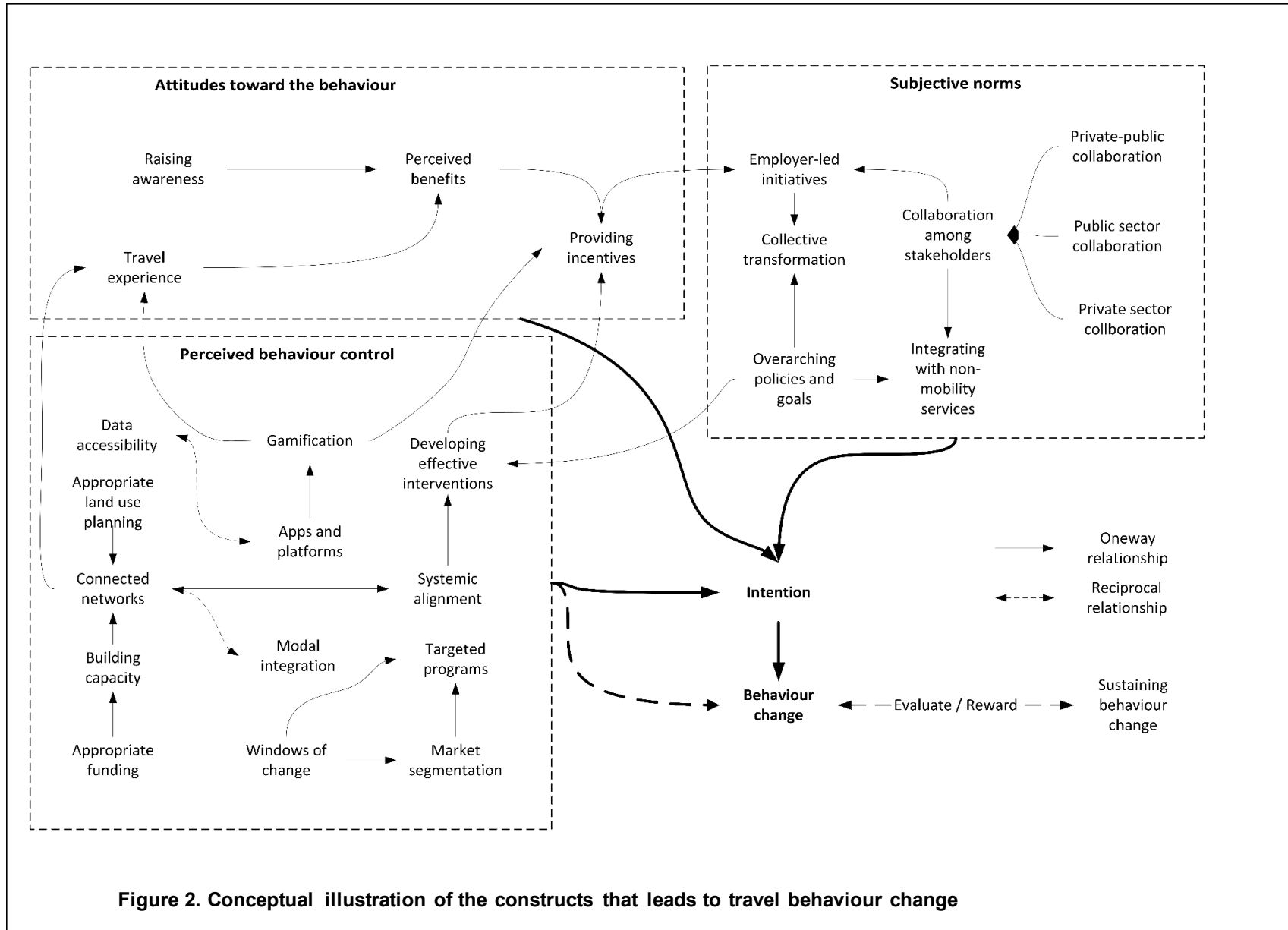
Attitudes shape an individual's perception of behaviour, influencing their willingness to adopt it. The themes such as travel experience, raising awareness, perceived benefits, and providing incentives deemed to have an influence on how the users perceive travel behaviour were grouped under the attitude construct of the TPB.

A positive travel experience is widely recognised as fundamental to enabling voluntary behaviour change. Insights from all RTDs confirmed that sustainable transport interventions are more effective when travel is perceived as enjoyable, efficient, satisfying, and safe. Without such qualities, individuals are less likely to adopt or maintain new behaviours. Supporting research on habit formation (Kwasnicka et al., 2016) reinforces this view, highlighting that behaviours aligned with personal goals and positive reinforcement are more likely to persist. Safe and segregated infrastructure, such as cycle lanes and walking paths, as well as supportive technologies like Mobility as a Service (MaaS) platforms and trip planners, contribute to enhancing the user experience. The B-Line high-quality bus branded network in the Northern Sydney Beaches and provision of segregated cycling infrastructure in

London, UK are some examples of enhanced travel experience resulting in improved patronage² .

“Yes, it might take you longer to ride a bike, and it will certainly take you longer to ride a bike if you then choose to go on a route which is a bit longer than the street route, because it takes you next to a nice waterway or something like that. But there's lots of evidence that shows that people will do that.” - RTD 1

² In the first five years of operation the B-Line reduced car usage by 5 per cent, improved journey times by 6 per cent and grew ridership by 20 per cent (NSW Bus Industry Taskforce, 2024).



Awareness campaigns can shape the attitudes of people by informing both the public and policymakers about the perceived benefits and feasibility of sustainable mobility options. These campaigns can enhance perceptions of accessibility and reliability, often through digital platforms and targeted messaging. The popularity of apps can be used effectively in achieving this task and can improve the information available to the public about the available alternatives, thus improving the connectivity across networks. Tailored messaging can help different user groups see sustainable travel as accessible and convenient, which may encourage broader uptake. Successful examples include initiatives like the 10,000 steps program in Queensland (Queensland Government, 2025), prescription bike schemes in UK (BBC, 2019), and workplace cycling programs in Melbourne (Bicycle Network, 2025). These interventions demonstrated that increasing awareness contributes significantly to uptake by reshaping public understanding and highlighting co-benefits such as health, convenience, and urban liveability.

“...but it actually heightened people's awareness of what fixed bus services were available in the area, as well as other public transport and that they would use it to go from one mode to another.” – RTD 3

Providing incentives has consistently proven important in encouraging behavioural change, particularly when these incentives offer direct, immediate benefits. While health and environmental concerns play a role, financial incentives, convenience, and time savings are often more persuasive. Other incentives, like priority access to services, loyalty programs, or gamified rewards, can further reinforce positive behaviour. Beyond individuals, incentives can also be targeted at organisations that support behaviour change, such as employers, hospitality, entertainment venues, and retailers. Examples include fringe benefits tax (FBT) deductions for companies offering sustainable travel options, partnerships with event venues to provide discounted public transport, or retailer-based reward schemes linked to sustainable travel choices. This aligns with the propositions of the SEM, which suggests that interventions operating across multiple levels, such as individual, interpersonal, and societal, are more effective than those focused on a single level. Notable examples include Queensland's 50-cent fares and e-bike subsidies introduced in countries such as the United States, France, Norway, and Portugal.

“...they did a \$1 million purchase incentive that got used up in about, I think it was about 10 days, eight days, and so they released a second million dollars to get more people riding bikes, based on international examples, about 60% of those users are non-traditional riders...” – RTD 2

2. Subjective Norms (Social pressure & influence)

Social expectations and influences play a central role in shaping individual behaviour, as recognised by both the TPB and the SEM. Interventions that encourage cross-sector collaboration and initiatives led by different organisations such as employers, help foster shared values and reinforce social norms that favour sustainable transport behaviours. Overarching policies and goals play a key role in this space by ensuring alignment at all levels and instilling a sense of direction among stakeholders involved in the travel behaviour change landscape. Hence, these aspects are grouped under the subjective norm construct of the TPB.

Consistent, overarching policies provide a stable framework for long-term change by reducing silo-based interventions and promoting integrated approaches (van Wee et al., 2023). Designing interventions that address the societal level through appropriate policies and initiatives capable of transforming communities and institutions is a core principle within the SEM. Policies supporting sustainable transport choices, such as low-emission zones, active travel infrastructure, and public transport investment are crucial, but must be coupled with

decisive action and political will to avoid delays that hinder progress. Consistency across national, regional, and local levels ensures alignment, while adaptability to technological advances and evidence-based policymaking enhances effectiveness. Collaboration between public and private sectors is also essential to ensure interventions serve the interests of all stakeholders while prioritising long-term sustainability. Appropriate, sustained funding is vital to build capacity and support behaviour change initiatives (Vickerman, 2024). Financial investment should align with overarching goals and be justified through clear evidence of economic, social, and environmental benefits. Innovative funding mechanisms such as public-private partnerships, grants, and revenue reinvestment models can help sustain long-term initiatives. Addressing current misalignments, particularly the underinvestment in active travel, is critical to achieving meaningful and lasting outcomes.

“And that's really sort of through a vision led approach. So, we have to get away from calculating, you know, transport model says no. To get away from that, we have to have a vision, go for it, and then make it work. And this was through South Bank [Brisbane], South Bank cooperation. We just had sort of political courage to do that. And that's actually what we need from a higher political level.” – RTD 4

Collaboration across stakeholders strengthens subjective norms by creating a unified, system-wide approach to behavioural change. Effective collaboration includes public-private partnerships, intra-industry cooperation, and alignment across government sectors. Such partnerships leverage complementary capabilities and resources, as seen in initiatives by employers to integrate sustainable transport into workplace benefits, and through coordination with non-transport sectors such as entertainment, healthcare, and hospitality (Hensher and Nelson, 2025; Kandanaarachchi et al., 2025). These arrangements promote multimodal integration and expand the visibility of sustainable options.

“I think partnering with stakeholders, finding the best stakeholders, and again, connecting and building on what said, finding the right partners to, especially to change the culture and identify the people that can help us, because we also don't have so much funding.”- RTD 4

Employers are particularly well positioned to directly influence travel behaviour by implementing workplace initiatives that reward sustainable choices. Strategies include subsidised public transport, investment in active travel infrastructure, and partnerships with MaaS platforms to provide bundled, flexible commuting options. Work-from-home policies and flexible hours further support reduced dependency on private vehicles, while fringe benefit tax (FBT) incentives offer an additional financial rationale for businesses and employees to shift behaviour (Hensher et al., 2022). The effectiveness of inducing behaviour change through interventions at the institutional and community levels is also well supported by the propositions of the SEM.

“...they made a conscious business decision that staff would not be driving to work. They ran a series of their own buses. They incentivized through cash, bike riding and active transport. And every single staff member going to that new office had to design a new travel plan.”- RTD 3

Ultimately, the potential for collective transformation underpins the significance of subjective norms. While individual changes may seem incremental, their aggregation can lead to substantial system-wide impacts. Acknowledging the challenges faced by communities during the behaviour change process is essential, as transitions to sustainable mobility can initially feel inconvenient or unfamiliar. Addressing these uncertainties openly helps build trust and acceptance within a given community, although it is important to acknowledge that one size does not fit all. Hence, community-led initiatives, such as participatory planning and local engagement programs, help foster a sense of shared responsibility and social cohesion, thereby improving trust. Aligning personal and collective goals, such as reducing congestion

or improving air quality, builds a supportive cultural context in which sustainable behaviours are more likely to be adopted and maintained.

3. Perceived behavioural control (ease/difficulty of behaviour)

The ability to adopt a behaviour is influenced by external conditions that either enable or constrain action. It emerged that data accessibility, apps and platforms, building capacity, connected networks, modal integration, gamification, developing effective interventions, identifying windows of change, market segmentation, targeted programs and systemic alignment all contribute to facilitating behaviour change. Hence, these enablers are grouped under the perceived behaviour control construct.

Building capacity within both physical infrastructure and institutional expertise is crucial for facilitating behavioural shifts. High-quality, safe, and well-connected infrastructure, including bike-friendly public transport, secure end-of-trip facilities, and pedestrian-prioritised station designs is key to enabling seamless transitions between active, shared, and public transport options. Securing investment from both public and private sectors is necessary to support these developments and foster a conducive environment for behaviour change. Integrated land use and transport planning also play a foundational role by ensuring that services and key amenities are co-located with transport hubs, reducing travel distances and reliance on private vehicles. Examples such as the E-Hub project in New Zealand highlight how land-use strategies can promote public and active transport options through higher-density, mixed-use development. It is also important to consider the upskilling of the decision makers and employees who are involved in different layers of transport service delivery to ensure the efficient use of the improved networks.

“I’m shaped by things I’ve been involved behaviour changes happened when people have been provided with a physical ability to do that, that is most observably when new infrastructure is built.” – RTD 1

Creating a strong network effect is crucial in encouraging behavioural shifts and a well-planned system that integrates different modes of transport enables greater convenience and efficiency, making sustainable options more attractive. International systems such as Tokyo’s Metropolitan Transit System and Zurich’s public transport demonstrate the value of network connectivity and first- and last-mile infrastructure in supporting public transport use. Digital integration further enhances multi-modal journeys by providing real-time information, journey planning, and ticketing in one interface.

“We just had this amazing new Metro Open [Sydney], but you know, if people don’t know how to get there or, or use it, that becomes very challenging. So, you need support to make the end-to-end journey. You know, every journey that anyone makes has a walking component, even in a car, you know, certainly at your destination may only be a short trip, but it’s that end-to-end journey piece.” – RTD 2

Land-use planning strategies, including service co-location near public transport nodes, are essential for reducing car dependency and embedding public transport within broader service ecosystems. Further, systemic alignment across policies, funding, infrastructure, and governance is essential to support effective and sustainable behaviour change interventions. Applying structured frameworks such as avoid-shift-improve (TUMI, 2019) and adopting systems thinking approaches can strengthen alignment between policy, research, and implementation. Bridging the current disconnect between research insights and policy execution is key to enabling scalable, evidence-based interventions that promote sustainable urban mobility.

“We tended to look at transport as the silo, the silo that we focus on as an industry. But I keep telling my crew and also our clients, don't forget why. Transport doesn't exist for its own reasons. Transport exists because people need to go places, and it's a why. The why might be education, the why might be a job, it might be hospital, it might be social.” – RTD 4

Effective interventions require a balanced mix of 'hard' infrastructure and policy measures alongside 'soft' strategies like incentives, awareness campaigns, and personalised travel planning. Integrating these approaches can amplify behaviour change impacts, as demonstrated by initiatives like Vienna's €365 annual public transport pass. After introducing the €365 annual pass in 2012, public transport ridership increased by over 30% within five years, with the number of annual pass holders rising from ~400,000 in 2012 to over 800,000 by 2019. This incentive-led approach helped public transport's mode share grow to around 38%, surpassing car use in the city (Hahn et al., 2024). Interventions should align with broader urban and transport planning strategies to ensure consistency and long-term effect (Arnott et al., 2014; Cheng et al., 2024; Cleland et al., 2023). Key moments of disruption, also termed as “Windows of Change (WoC)”, such as moving house, changes in household composition (for example, having children), starting a new job, or experiencing significant policy or infrastructure changes, create opportunities to shift travel behaviours (Hensher et al., 2025). Targeted programs timed around these WoC can influence long-term habits by offering appealing, sustainable alternatives when individuals are most receptive to change, given their circumstances.

“You rarely get studies, you know, to a level of a peer reviewed study that looks at combining an integrated intervention. So, if you're adding in a bike lane and running a communications campaign to encourage people to use that bike lane.” - RTD 3

Further, recognising the diversity in travel needs and motivations is essential for tailoring interventions. Market segmentation allows policymakers to categorise individuals based on demographics, travel habits, or behavioural drivers (Anable, 2005). Personalised Travel Planning (PTP) builds on this by offering tailored advice and incentives to promote sustainable travel choices (Bamberg and Rees, 2017). Employers also play a significant role in shaping commuting patterns through travel plans and workplace incentives. Targeted programs developed in alignment with these principles offer bespoke, context-specific solutions that promote sustainable mobility, such as employer-led schemes, public transport incentives, active travel improvements, and community-based first- and last-mile services. These initiatives should be integrated with broader urban policies and involve key stakeholders to deliver clear, tangible benefits.

“there's been lots of stuff said tonight that really taps into the habit research, especially those you know, opportunities, the times when you can change people's behaviours, when they have a disruption in their general day to day, if they've moved somewhere, that's an opportunity where you can create a new habit.”- RTD 4

Data accessibility emerged as a fundamental enabler for behaviour change interventions, underpinning initiatives such as gamification, mobility apps, and open data frameworks. Case examples like ODIN PASS in Queensland (Chen et al., 2026) and 'Walk my Street' in Australia demonstrate the importance of reliable, accessible travel data for designing, implementing, and evaluating behaviour change programs. Government involvement is essential to support policy frameworks that enable open data sharing while safeguarding privacy (Kandanaarachchi et al., 2024; Mahajan et al., 2021). Digital platforms offer integrated journey planning, ticketing, and real-time service updates, promoting sustainable travel by enhancing convenience, transparency, and awareness through features like reward-based gamification. Leveraging data through apps and platforms using sources like travel surveys, smart cards, and GPS tracking provides insights into mobility trends and barriers to sustainable travel by enabling assessment of the status quo and evaluating interventions.

“I guess that's the other thing when we talk about, you know, patronage uplift or, or mode shift, you know, it's hard to have the baseline to know what we're measuring against. And so, yeah, I guess it's coming back to that, that data thing.” – RTD 2

Gamification emerged as a theme that is gaining traction in promoting sustainable transport behaviours. It leverages data and digital platforms to create engaging, interactive experiences that encourage users to make more sustainable choices (Wells et al., 2014). Programs such as the Queensland "10,000 Steps" initiative, Melbourne's "Ride to School" "Prescription Bikes" in the UK and "We Ride" (across Australia) exemplify the effectiveness of this method. These interventions incorporate elements like step tracking, points, badges, and leaderboards to enhance motivation. Transport apps can reward users for choosing public transport or active travel, with incentives ranging from travel discounts to health-related benefits (Arriagada et al., 2025). As gamification taps into users' intrinsic motivations and fosters a sense of community, it has been shown to be effective in both initiating and sustaining positive behavioural shifts (Yen et al., 2019). However, its effectiveness in supporting long-term behaviour change remains largely exploratory, particularly in the context of promoting sustainable travel behaviours (Bassanelli et al., 2025).

4. Intention (Commitment to Behaviour Change)

A strong commitment to behaviour change requires the alignment of attitudes toward the behaviour change, subjective norms and perceived behaviour control. These elements collectively support the formation of intention within the TPB framework, by shaping attitudes, subjective norms, and perceived behavioural control in ways that encourage sustainable transport behaviours.

Measuring the success of behaviour change interventions is crucial to refining strategies and securing ongoing support. Key performance indicators such as modal shift towards sustainable modes, reductions in car use, and increases in public transport ridership provide measurable evidence of impact. Combining continuous feedback, data-driven analysis, and qualitative insights ensures a comprehensive understanding of behavioural dynamics. A scientific, evidence-based approach using natural experiments and human-centred evaluation supports iterative improvements and strengthens the case for sustained investment.

“I'd broadly say that approach is now about using behavioural science principles to identify what's driving and motivating behaviour and then developing tools to disrupt those behaviours and to encourage them to shift towards whatever the desired behaviours we are trying to achieve.” – RTD 2

Workplace travel schemes, such as subsidised public transport, carpooling benefits, or flexible working arrangements, contribute to shifting daily habits by aligning individual and organisational incentives. Sustaining behaviour change requires a continuation of the positive reinforcement mechanisms that initially drive adoption. Beyond financial rewards, long-term engagement can be supported through social recognition programs and integration of gamification with social networks to build community and friendly competition (Brög et al., 2009; Yen et al., 2023). These mechanisms help reinforce new behaviours and make them habitual.

“...if you consider it needs to be fun, efficient or satisfying. So, if you don't hit one of those, and you're trying to get people to change their behaviour, and they're not enjoying it, feeling like it's satisfying, and helping them achieve a person or it's more efficient for them, then they're not going to stick with it.” – RTD 1

4.2 Implications of these findings

The discussion from the round tables implies that sustainable transport initiatives need to consider multiple layers, addressing personal motivations, social influences, community infrastructure, and supportive policies to create an enabling environment for behaviour change. It is important to note that the attempts to bring about behaviour change should be directed, ensuring systemic alignment driven by an overarching vision and desired outcomes set at the top level. The idea of systemic alignment (van Geet et al., 2021) emphasises the development of effective interventions considering the alignment of policies, structures, processes, and stakeholders to create coherence and efficiency.

An important emergent theme was the opportunities provided by taking advantage of the windows of change such as major lifestyle changes, transport related changes etc. with a carefully designed set of dedicated programs aimed at achieving the desired mobility patterns that reduces car kilometres and emissions and promotes active and public transport use. Further, a positive travel experience is deemed to be critical for sustaining behaviour change. If a journey is enjoyable, convenient, and meets personal and collective goals whether through time savings, cost efficiency, or improved well-being people are more likely to adopt and sustain travel behaviours. It is important to note these motivations can also change depending on individual circumstances, such as having a family, and these concerns need to be addressed when developing personalised travel plans. Apps and platforms, gamification and connected networks are some other themes that appear to enhance the travel experience and thereby induce behaviour change.

The achievement of sustainable transport outcomes requires overarching policies and goals that clearly define the desired behavioural and societal changes. Given the complexity of transport interventions, policy frameworks should establish measurable goals, ensuring that interventions align with broader sustainability objectives. A well-defined policy direction enables coherence across initiatives, guiding stakeholders in designing, implementing, and refining strategies based on evidence and evolving needs.

Continuous evaluation and adaptation are essential to assess effectiveness, address unintended consequences, and refine interventions to achieve long-term impact. Decision-makers require clear, quantifiable evidence to justify investments and hence, demonstrating measurable impacts, such as reduced congestion or increased public transport use enhances credibility, securing financial support for sustainable behaviour change interventions. A scientific approach to behaviour change was emphasised by participants in the RTDs. This involves understanding the base case, defining clear objectives, and systematically measuring progress. This requires leveraging natural experiments to assess real-world impacts while controlling for confounding factors to improve attribution and clarity. Alongside quantitative analysis, qualitative insights play a crucial role in understanding perceptions and experiences. Even if immediate behaviour change is not observed, interventions can plant a seed for future change, creating conditions that may influence decisions over time. A robust evaluation framework combining both data-driven analysis and human-centred perspectives ensures a more comprehensive understanding of transport behaviour dynamics. Future research should focus on developing holistic evaluation mechanisms that capture both direct and indirect effects, ensuring sustained progress towards sustainable mobility.

It is also important to note some of the differences observed across the RTDs are primarily due to stakeholder composition. It is always the case that more participants from a wider stakeholder classification could have been undertaken, and these are the normal limitations of such an approach. In RTDs with a majority of private sector stakeholders, greater emphasis was placed on aligning funding with government-defined outcomes in specific jurisdictions. Conversely, RTDs comprising public sector representatives and researchers focused more on justifying funding based on the broader economic, social, and environmental impact.

Participants highlighted the importance of using scientific approaches to evaluate the holistic effects of interventions. While there was general consensus on the value of interventions that promote voluntary behaviour change, private sector practitioners favoured a user-centred approach, whereas public sector participants emphasised the broader societal impact. Notably, the integration of mobility with non-mobility service providers (such as employers and retailers) emerged predominantly in international RTDs, likely due to greater exposure to such solutions in global contexts compared to the local setting.

5 Conclusion

This paper has examined the complex and multifaceted nature of travel behaviour change in the context of sustainable transport, drawing on established behavioural theories and qualitative insights from expert roundtable discussions (RTDs). By aligning empirical findings with constructs such as attitudes, subjective norms, perceived behavioural control and intention based on the Theory of Planned Behaviour supported by insights from the socio-ecological model (SEM), a conceptual framework was developed to illustrate how these elements interact in practice (Figure 2). This framework incorporates both established and new constructs and demonstrates how these factors influence and reinforce one another in driving travel behaviour change. Key themes such as systemic alignment, overarching policies and goals, travel experience, windows of change, and integration with non-mobility services demonstrated the importance of targeting interventions not only at the individual level but also across social, organisational and policy layers. The findings underscore the need for a clear overarching vision and well-defined outcomes that are co-developed with stakeholders across the transport ecosystem. Sustainable transport interventions should aim to facilitate voluntary, informed and autonomy-preserving behaviour change, supported by consistent policies and effective funding strategies. Importantly, the RTDs highlighted nuanced perspectives across stakeholder groups, particularly in how the value of funding and evaluation is framed. The recognition of voluntary behaviour change, positive travel experiences and strategic timing of interventions emerged as critical levers in influencing sustainable mobility patterns respecting individuals' capacity for self-determination and choice. This study contributes to bridging the gap between theory and practice by contextualising behaviour change within real-world policy and project delivery settings. Future research should build on these findings by quantifying their relevance in diverse contexts through user surveys and developing robust evaluation mechanisms that capture both direct and indirect impacts of intervention.

Acknowledgements

This research is part of iMOVE Cooperative Research Centre (CRC) research project 3-039 titled "Behavioural Change for Sustainable Transport" with Transport and Main Roads, Queensland, ITS Australia, and The Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts. We thank Alison Scott for her assistance with the roundtable discussions. The findings reported are those of the authors and are not the positions of other partners; but approval to present these findings is appreciated.

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Appendix A - Outline Agenda for the Roundtable Discussions

- Briefing about the project and its scope (Objectives; high level findings from literature review)
- Brief introductions from the participants in terms of their relevant expertise and their opinion of the project in one sentence
- Gathering evidence of existing experience/capacity from participants for delivering sustainable transport interventions which result in real behaviour change (including discussion of what constitutes a successful outcome)
- Strategies for capacity building in delivering sustainable travel behaviour change (upskilling, leadership, budgets etc.)
- Briefing on preparation for a planned Australia-wide online survey of the factors that influence sustainable travel choices and to obtain feedback on new transport initiatives with a modal focus, designed to give people improved accessibility by sustainable modes.

Appendix B – Examples of Sustainable transport interventions with emerged themes

Table B1. Relationship of the themes derived to the evidence presented related to sustainable transport interventions

	Intervention category	Program / Intervention name / Description	Aim	Location	Relation to themes in Figure 2
1	Public transport	Back on Track - 50 Cent Fares	Increasing public transport patronage	Brisbane, QLD	raising awareness, providing incentives, data accessibility, public sector collaboration, sustaining behaviour change, appropriate funding
2	Active transport	Citylink connected, segregated cycleways	Increasing use of bikes	Brisbane, QLD	data accessibility, building capacity, raising awareness, apps and platforms, travel experience, appropriate funding, market segmentation, connected networks
3	Active transport	Walk My Street	Improving door to door walking experience	Brisbane, QLD	data accessibility, raising awareness, apps and platforms, travel experience, building capacity, market segmentation, connected networks, targeted programs, collective transformation
4	Active transport	New Green Bridge	Encouraging cycling by providing a safer route for cyclists	Brisbane, QLD	building capacity, appropriate funding, travel experience, connected networks, developing effective interventions
5	Active transport	Ride and Scoot to School	Increasing active travel	Sunshine Coast, QLD	providing incentives, windows of change, gamification, appropriate funding, raising awareness, private-public collaboration, market segmentation, targeted programs, sustaining behaviour change
6	Active transport	10,000 Steps	Increasing walking using infrastructure / environments	Rockhampton, QLD	travel experience, building capacity, raising awareness, collective transformation, sustaining behaviour change, apps and platforms, providing incentives, gamification, public sector collaboration, appropriate funding, collaboration among stakeholders, overarching policies and goals
7	Active transport	Queensland Walking Strategy	Encouraging walking by increasing footpaths & safe road crossings across 30 councils & 100 locations	QLD	raising awareness, apps and platforms, travel experience, building capacity, market segmentation, collective transformation, collaboration among stakeholders, systemic alignment, developing effective interventions

	Intervention category	Program / Intervention name / Description	Aim	Location	Relation to themes in Figure 2
8	Active transport	WeRide	Championing cycling	QLD	gamification, collective transformation, providing incentives, sustaining behaviour change
9	Active transport	Purchase Incentives for new E-bikes	Increasing cycling to commute to work or school via \$1 million purchase incentive	QLD & Tasmania	providing incentives, windows of change, developing effective interventions
10	Public transport	Public Transport Optimisation Program	Optimising public transport - before considering MaaS-through, e.g., fare reduction to reduce emissions.	WA	overarching policies and goals, connected networks, providing incentives, modal integration, collaboration among the stakeholders, building capacity, developing effective interventions
11	Active transport	Safe, Active Streets	Encouraging AT by trying to make the door-to-door journey as pleasant as possible	WA	raising awareness, travel experience, targeted programs, collective transformation
12	Public transport	Behavioural Insights Project	Encouraging shopping centre staff to commute via PT	WA	employer-led initiatives, targeted programs, market segmentation, providing incentives, sustaining behaviour change
13	Public transport	Two-Zoned Fare Cap	Encouraging use of PT for longer trips by setting low maximum fare price (\$5)	WA	providing incentives, developing effective interventions, targeted programs
14	Public transport	Smart Rider	Increasing use of PT	WA	apps and platforms, providing incentives, raising awareness, travel experience
15	Discourage car use	Perth Parking Management Act	Discouraging car use by increasing parking fees	Perth, WA	appropriate land use planning, developing effective interventions, overarching policies and goals, public sector collaboration
16	Public transport	On-Demand Bus Service	Decreasing car use by providing shared (flexible) bus service	Mount Barker, SA	connected networks, market segmentation, apps and platforms, modal integration, travel experience
17	Public transport	Frequent Bus Service to CBD	Encouraging use of PT by providing a frequent	Adelaide, SA	connected networks, building capacity, collective transformation, modal integration, travel experience

	Intervention category	Program / Intervention name / Description	Aim	Location	Relation to themes in Figure 2
			service from the Adelaide Hills to the Adelaide CBD.		
18	Public transport	B-Line Bus Improvement	Increasing use of public transport	Northern Beaches, Sydney	providing incentives, building capacity, connected networks, developing effective interventions, appropriate funding, overarching policies and goals, travel experience, raising awareness
19	Modal integration	ODIN PASS	Encouraging mode switching via Skedgo app	Canberra, Perth, Darwin, Queensland & UK	apps and platforms, modal integration, data accessibility, sustaining behaviour change, appropriate funding, collaboration among the stakeholders, public sector collaboration
20	Active transport	55 KM bike network	Increasing active travel	Wagga Wagga, NSW	connected networks, building capacity, appropriate funding, travel experience
21	Public transport	Community Led Initiative (Infrastructure Victoria report)	Providing a bus service from Dandenong to Chadstone	Dandenong, VIC	connected networks, collective transformation
22	Active transport	Cycle to Work Scheme	Increasing bike use by opening new lane	St. Kilda Rd. Melbourne	building capacity, raising awareness, connected networks
23	Active transport	Ride to School	Increasing cycling and decreasing car use	Melbourne	windows of change, raising awareness, gamification, travel experience, targeted programs, market segmentation
24	Active transport	Equitable Commute Program	Enabling those in low socio-economic areas to cycle to work or school	Melbourne	Market segmentation, providing incentives, windows of change, targeted programs, overarching policies and goals
25	Active transport	E-Hub Project, NZ University	Enabling use of AT by providing e-scooters, e-bikes, safe biking facilities and micro-mobility racks	New Zealand	building capacity, travel experience, raising awareness, appropriate land-use planning, developing effective interventions
27	Active transport	Cycle to Work Scheme	Increasing cycling to work	UK	collaborating with other stakeholders, creating awareness, market segmentation, targeted programs, windows of change
28	Active transport	CO ₂ Savings Data on Commuting to Work by Bicycle	Providing employers with CO ₂ savings data for ESG reporting	UK	sustaining behaviour change, providing incentives, collaborating among stakeholders, overarching policies and goals, private-public collaboration, systemic alignment, apps and platforms, data

	Intervention category	Program / Intervention name / Description	Aim	Location	Relation to themes in Figure 2
					accessibility, private-public collaboration
29	Active transport	Messaging Nudging to use Prescription Bikes	Encouraging increased use of bikes via tech platform messaging through a GP referral service	UK	apps and platforms, raising awareness, data accessibility, gamification, integrating non-mobility services, targeted programs
30	Discourage car use	Mobility Vouchers from hospitals	Reducing use of hospital transportation services	England	collaboration among the stakeholders, integrating non-mobility services, windows of change, providing incentives
31	Active transport	Segregated Cycle Infrastructure	Facilitating safer cycling by improving infrastructure	London, England	building capacity, appropriate funding, travel experience, public sector collaboration
32	Active transport/Public Transport	Council cycling and PT project providing bikes to low socio-economic areas	Enabling use of AT to access PT	Essex, England	modal integration, systemic alignment, providing incentives, connected networks, targeted programs, public sector collaboration, overarching policies and goals
33	Discourage car use	Mobility Vouchers from car insurance companies	Reducing use of courtesy cars when car being repaired	Finland	apps and platforms, providing incentives, collaboration among the stakeholders, private sector collaboration, integrating non-mobility services
34	Discourage car use	Private investment	Enabling those who've got rid of their car/avoided buying one to travel sustainably using apps	Helsinki, Finland	apps and platforms, sustaining behaviour change, providing incentives, overarching policies and goals, appropriate funding
35	Discourage car use	Validating Mobility	Discouraging car use by replacing validating parking at large shopping malls with validating mobility	Finland	modal integration, integrating non-mobility services, apps and platforms, developing effective interventions, systemic alignment, appropriate land-use planning
36	Active transport	Free bicycle leasing	Increasing bike riding	Netherlands	providing incentives, sustaining behaviour change, overarching policies and goals, collaboration among the stakeholders
37	Discourage car use	Limited car parking spaces in new housing	Discouraging car ownership	Netherlands	systemic alignment, appropriate land-use planning, overarching policies and goals, providing incentives, public-private collaboration, developing effective

	Intervention category	Program / Intervention name / Description	Aim	Location	Relation to themes in Figure 2
		developments			interventions, collective transformation, systemic alignment
38	Active transport	Replace road space with AT infrastructure & green space	Increasing active transport	Netherlands	building capacity, developing effective interventions, appropriate land-use planning, overarching policies and goals, travel experience
39	Active transport	E-Bike Share Schemes	Addressing the last mile issue through train company owning share e-bikes & providing free to ticket holders	Netherlands	connected networks, providing incentives, apps and platforms, systemic alignment, modal integration
40	Public transport	Smart Ticketing Schemes	Increasing use of PT	Norway	apps and platforms, developing effective interventions, providing incentives, travel experience
41	Discourage car use	Road toll scheme	Decreasing use of cars	Norway	developing effective interventions, building capacity, public sector collaboration, providing incentives
42	Discourage car use	Reducing highway lanes into CBD; compulsory parking charges; restricting parking spaces; & buy-back car schemes	Limiting car use in CBD	Oslo	developing effective interventions, building capacity, involvement of public sector, overarching policies and goals
43	Active transport	Free Use of E-scooters	Encouraging people to use e-scooters rather than cars.	Multiple countries overseas	providing incentives, raising awareness
44	Active transport	Mobility Plan with new apartments sold by developers	Replacing on-site parking with easy (and transferable) access to multiple transport modes	Paris	collaboration among stakeholders, modal integration, service integration, connected networks, integrating with non-mobility services, developing effective interventions
45	Active transport	Cycle to Work Scheme FBT on E-Bikes	Encouraging use of e-bikes	Belgium	collaboration among stakeholders, developing effective interventions, providing incentives
46	Active transport	Mobility Options from landlords	Unlocking different modes of	Tokyo	collaboration among stakeholders, developing effective

	Intervention category	Program / Intervention name / Description	Aim	Location	Relation to themes in Figure 2
			transportation for tenants		interventions, integrating with non-mobility services