TRAVEL BEHAVIOUR CHANGE

Travel Demand Management: A literature review of travel behaviour change approaches targeting schools and workplaces

BROOKE HOPKINSON

2022

Contents

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

Travel demand management and travel behaviour change

Introduction

Travel Demand Management (TDM) has many definitions and is a term that is often used inconsistently. Generally, TDM refers to policies, strategies, and actions that aim to influence people's travel behaviour to reduce car use (specifically single occupant private vehicles) and/or to increase the use of other transport modes (Meyer, 1999). Travel Demand Management is also called Transport Demand Management and in European contexts it is often referred to as Mobility Management.

TDM encompasses a wide range of strategies that are often categorised as either 'hard' or 'soft'. Hard transport measures include engineering, legal, and economic solutions, these can range from infrastructure changes such as road widening and new cycle paths to parking and pricing changes (Pawluk De-Toledo et al., 2022). Conversely, 'soft' measures, which can also be called a travel behaviour change approach, require individual voluntary behaviour change and focus on changing attitudes, beliefs, values, and norms (Whillans et al., 2021). A travel behaviour change approach uses information dissemination, education, and training to raise awareness and encourage people to change their travel behaviour (Bamberg et al., 2011). Travel behaviour change measures include personalised travel planning, location-based travel plans for schools, workplaces and residences, mobile applications, and events (Pawluk De-Toledo et al., 2022).

Present issue

Travel behaviour change activities including travel plans have been around for several decades. Given that these are not new concepts to transport practitioners, there is possibly some concern that travel plans and other travel behaviour change initiatives might no longer be fit for purpose or effective. To investigate this concern, the behavioural sciences team was tasked with three research aims broadly within the scope of Travel Demand Management:

- Conduct a brief review of travel behaviour change and travel planning literature.
- Conduct a brief literature review on the concept of Mobility as a service (MaaS).
- Investigate evidence regarding the effectiveness of activation events for travel behaviour change outcomes.

In accordance with these aims, the report is divided into three sections:

- Travel behaviour change literature review.
- New approaches to travel behaviour change.
- Activation events for travel behaviour change

Executive Summary

In summary, evidence shows there are significant benefits of travel behaviour change programmes. The fundamental elements of travel behaviour change activities have remained the same over the past few decades, and still remain relevant. A travel plan with a coordinated strategy that is tailored to the context, strong relationship building and engagement, and a champion for the work appear to be some of the critical factors that lead to success. While the core elements remain relevant, what has changed is a greater use of technology and a larger focus on applying an equity perspective. Furthermore, this report has highlighted that the way a travel behaviour change programme is evaluated is important in determining how successful it is deemed. Mobility as a Service and gamification have been identified as concepts that present new opportunities for travel behaviour change interventions. Both are relatively new tools within the suite of travel behaviour change interventions and appear useful, however there is little empirical evidence that demonstrates their effectiveness in practice on a large scale. Additionally, the literature search yielded a lack of evidence on activation events and consequently this report was unable to provide any meaningful conclusions about the impact and effectiveness of events on travel behaviour change outcomes.

Travel behaviour change literature review

Introduction

The effectiveness of travel behaviour change activities has been queried, particularly in recent years as technological advances and societal changes has led to some questioning whether there is a new modern way to create travel behaviour change. Despite this interest there is relatively little research and published literature that empirically evaluates travel behaviour change activities.

The research aim of this section was to provide a brief review of travel behaviour change and travel planning literature. Primarily this section explores what current best practice travel behaviour change looks like (with a focus on targeting schools and workplaces) and how existing evidence can be used to inform and create more effective travel behaviour change programmes. Considerations around the evaluation of travel demand management and travel behaviour change programmes is included, as well as recommendations for updating travel plan guidelines.

Overview

The findings of this section have highlighted that research into travel behaviour change programmes generally lacks robust experimental methodology. Although the consensus from the literature is that there is benefit of travel behaviour change initiatives, there is a lack of evidence to be able to comprehensively answer what travel behaviour change activities are most effective and why, and what makes a travel behaviour change programme successful. Overall, it appears that the fundamental elements of travel behaviour change activities have remained the same over the past few decades. A travel plan with a coordinated strategy that is tailored to the context, strong relationship building and engagement between those assisting with creating the travel plan and the school/workplace, and at least one person within the school/workplace that champions the work are some of the critical factors that appear to lead to a successful travel plan. While these core elements remain relevant, what has changed is the method of delivery alongside a greater focus on applying an equity perspective to the intervention.

Summary of findings

The key findings from the review of travel behaviour change literature are summarised below:

- Overall, the research provides **an evidence base justifying the use of and investment in travel behaviour change programmes.**
- **Integrating travel demand management (TDM) into overall planning** and policy appears to be more successful compared to implementing TDM as a separate programme that is added following the planning stage.
- **Tailored** travel behaviour change interventions are more successful than interventions that take a 'one-size-fits-all' approach. The travel plan and related content should be **tailored to the workplace/school, location and transport context.** There is some evidence that **localised** approaches are more effective than national campaigns.
- **A coordinated strategy** between central, regional, and local governments is important to ensure that plans do not contradict each other, and so that resources can be used efficiently. Having staff dedicated to overseeing the TDM strategy at national, regional, and local levels contributes to success.
- Research found that when analysed by the psychological variable targeted, the most effective travel behaviour change interventions were those that targeted **social, cultural, and moral norms** (i.e., the perceived prevailing attitudes, behaviours, or moral standards in a given context), followed by **knowledge and awareness** (i.e., information, familiarity and understanding), and then **capability and self-efficacy** (i.e., the subjective belief that one will succeed in a particular situation).
- Travel planning commonly uses the "six E's" as an organising framework. The six E's have been updated to **remove 'enforcement' and include 'equity' and 'engagement'** forming a framework that

is comprised of: **engagement, equity, engineering, encouragement, education, and evaluation.** Each of these six components should be considered when creating a travel plan.

- The way that a TDM programme is **evaluated** has an impact on the perceived value of the programme. Conventional methods of evaluation (e.g., reduction in vehicle kilometres travelled or mode share) can underestimate or overlook many benefits (e.g., staff wellbeing, safety, health). Both quantitative and qualitative data should be included in the evaluation. Poor evaluations of travel plans can result in travel plans appearing ineffective and being discontinued.
- Frequent in-person **relationship building** with the school/workplace is seen as critical to success, rather than creating a lengthy documented paper plan.
- **Stakeholder and industry engagement and collaboration** are important success factors. Involving schools/communities/workplaces in identifying the problem and the best solution(s) for their context helps to create commitment that is likely to improve the outcomes.
- The **perception of an issue** is important, as the activities included in a travel behaviour change programme depend on the way the travel issue is defined. For example, the less problematic an issue (e.g., physical activity, injury prevention) is perceived as, then the more limited in options and impact the intervention.
- Workplace travel plans should be seen as a **business management tool** that becomes embedded as an important part of workplace operations. If the travel plans are seen to have broad value, then the travel plan work is likely to continue to be resourced and sustained.
- For workplace travel plans, **at least one person with a strong interest and ability to coordinate and support the implementation of a travel plan** is needed. Having one person as **a champion is effective** but can be a vulnerability if this person does not continue the work. To mitigate this vulnerability **a network of people** that support the workplace travel plan is likely to contribute to a travel plan that is successful.
- For school travel plans, **student-led groups that meet frequently** are vital tools for engagement and the success of a travel plan.
- Travel plans should include **a package of measures rather than a single action**. Information or pricing initiatives alone are not enough to change travel behaviour. Likewise, marketing should not be used alone, and should only be used when services are operating effectively. It is counterproductive to promote a service that is likely to provide a negative experience.
- **Workplace relocations should be considered as an opportunity to influence behaviour**. The process of creating a travel plan and involving employees should **begin prior to the relocation** and continue after the move has occurred.
- **The travel planning process should be simplified**. The documentation provided should be **concise, written in user-friendly, natural, and guilt-free language**. The plan should **be customer focused with clear metrics and actions that can be tracked**. Travel surveys should be relatively short and conducted digitally.
- The travel plan should not be made unnecessarily difficult or overwhelming. This could mean focusing **small achievable activities that build up over time**.
- An **understanding of the target audience** is vital (research is required for this). The **research needs to be meaningful and used to inform the travel plan.**
- **An equity lens should be applied when designing a travel plan.** By having a greater understanding of equity issues within the target population the intervention can be designed to address/mitigate inequalities and ensure everyone can be involved in achieving the goals of the travel plan.

Literature reviews and meta-analyses

Considering the dearth of available evidence-based literature, this section will introduce the findings of several of the more recent meta-analyses and reviews that have aimed to investigate the effectiveness of TDM activities, with a focus on travel behaviour change measures.

Meta-analyses: Semenescu and colleagues (2020); Möser and Bamberg (2008)

Semenescu and colleagues (2020) proposed that doubts regarding the effectiveness of travel behaviour change interventions have emerged largely due to poor quality evaluations of interventions. Likewise, previous researchers have cautioned that the ability to draw causal inferences from the available research is limited due to the quality of available research (Möser & Bamberg, 2008). To address this, Semenescu and colleagues (2020) conducted a meta-analysis that only included well controlled experimental studies (the meta-analysis comprised of 41 studies, conducted between 1998 and 2017) and found that soft transport measures led to a significant reduction (7%) in car modal split share (the proportion of car trips from the total number of trips). The authors noted that this finding corroborates that of Möser and Bamberg's (2008) earlier meta-analysis of 141 studies that found soft interventions increased the proportion of non-car trips by 7%. Corroborating this finding was somewhat surprising, as it was expected that Semenescu and colleagues' inclusion of only well controlled experimental studies would result in a smaller effect than that obtained by Möser and Bamberg who acknowledged that the studies included in their meta-analysis were of low methodological quality (including poor experimental design and statistical analyses).

In further analyses, the interventions were separated into five categories based on the psychological variable being targeted (Semenescu et al., 2020). These categories were:

- *Attitudes* (an individual's degree of subjectively favourable or unfavourable rational evaluations (Semenescu et al., 2020), i.e., how much an individual likes/dislikes something)
- *Social, cultural and moral norms* (the perceived prevailing attitudes, behaviours, or moral standards in a given context, the perception of how acceptable or normal a behaviour is (Semenescu et al., 2020)).
- *Habit* (behaviours triggered by events or environmental cues that are performed automatically, habitual behaviour is routine and primarily subconscious (Semenescu et al., 2020)).
- *Knowledge and awareness* (facts, information, and skills gained through experience or education, familiarity or understanding of something).
- *Capability and self-efficacy* (the subjective belief that a person can succeed in a task or perform well in a specific situation (Semenescu et al., 2020)).

The results showed that the most effective interventions were the ones that targeted social, cultural and moral norms (approximately a 32% decrease in car modal split share) followed by those targeting knowledge and awareness (approximately a 14% decrease in car modal split share), and then capability and self-efficacy (a 5% decrease in car modal split share). The interventions targeting attitudes and habit did not have statistically significant effects. This suggests that interventions targeting attitudes and habits that are applied alone are not likely to be effective. However, before disregarding the role of targeting attitudes and habits it should be considered that combining other interventions with targeting attitudes and habits may be effective, although further research would need to explore this and investigate the interactions between different types of interventions.

Semenescu and colleagues (2020) also investigated whether targeting individuals who recently located to another city is more effective than interventions targeting individuals who had not moved. Contrary to the authors hypothesis, results did not find a significant difference between groups, and found that both were effective in reducing car use. Other exploratory analyses found that the interventions' effectiveness was not significantly impacted by gender, the presence of participation incentives (i.e., providing free public transport tickets), follow up times, and the size of the city. These findings suggest that men and women respond similarly to soft transport interventions. Since the follow up time was not a significant moderator of interventions' effectiveness, this could suggest that soft interventions can have not only short-term impacts but can also continue being effective for an extended period of time. The lack of influence by incentives and the setting/size of the city they were implemented in indicates that soft interventions are versatile and can be

effective in diverse contexts and circumstances. These findings are useful for informing policy and practice because they provide an evidence base justifying the use of and investment in soft interventions.

Scientometric review: Pawluk De-Toledo and colleagues (2022)

Pawluk De-Toledo and colleagues (2022) conducted a scientometric review and content analysis of travel behaviour change research (including a total of 323 articles). The authors aimed to conduct a wide-angled review to gain a better understanding of the current state of travel behaviour change research. The key takeaways from this research were:

- Segmented and tailored travel behaviour change interventions tend to be more successful than interventions that take a than one-size-fits-all approach (Pawluk De Toledo et al., 2022, p. 149).
- 'Segmentation' was found to be a common keyword in the literature. With segmentation research including stage of change, normative beliefs, behavioural, attitudinal, situational, and socio-demographic characteristics.
- It is common for behaviour change elements to be implemented concurrently, and the results of intervention elements are pooled. Consequently, it is difficult to determine which specific elements lead to behaviour change and which approaches are most effective.
- Trip avoidance research was noticeably absent from the literature. As the COVID-19 pandemic has shown, working from home and flexible working arrangements could have a significant positive impact on transport systems. The review found that no studies analysed behaviour change interventions that encouraged changing the timing of travel, or discouraging travel entirely (e.g., telecommuting/working from home).
- Systematic reviews have highlighted that research in the travel behaviour change field has often been of poor quality, as it often used small sample sizes, was conducted over short durations, and lacked before and after controls or randomised research designs.

Based on the trends and gaps identified in their review the following research directions were suggested for future travel behaviour change research and interventions:

1. Where it is practicable data should be collected from multiple data sources to strengthen the results and develop a better understanding of the effectiveness of behaviour change programmes.
2. The research needs to go beyond pooling the intervention results. The specific elements that are most effective need to be explored further.
3. Research should be locally contextualised. It is proposed that localised approaches could result in more effective and long-lasting behaviour change.
4. Segmentation research should be developed further.
5. Long-term behaviour change research needs to be conducted, this could involve collecting data across multiple time points over several years.
6. Trip avoidance research needs to be conducted. Travel behaviour change research currently focuses on mode-shift rather than trip avoidance. As evidenced by the experiences stemming from the COVID-19 pandemic, including mandatory working from home 'lockdowns', post-COVID-19 could provide an ongoing change in working behaviour that could be used to change travel behaviour. This research is needed urgently to ensure that people do not return to their pre-COVID-19 travel habits, or worse that people do not turn to greater private vehicle use, in which previous users of public transport switch to using private transport.

Cross fields review of voluntary behaviour change: Kent and Ampt (2012)

Kent and Ampt (2012) identified four common themes among successful voluntary behaviour change methods across a range of fields including transport, energy, and water:

1. Create opportunities for engagement that have a personal human element. This can be with in person contact, or personalised feedback.
2. Create content that is locally specific. Tailored information that appeals to different aspects of peoples' lives and values is likely to be more effective than broad-reach content.
3. Provide ongoing support through both passive and active measures.

4. Show that the desired behaviours are normal. This can be achieved by relating stories to participants communities and making the desired behaviour feel commonplace.

The information and content that is disseminated within a comprehensive behaviour change programme should include three approaches, a logical approach, an emotional approach, and a practical approach (Kent & Ampt, 2012). The logical approach should include facts and statistics that appeals to the logical aspect of changing a behaviour. The emotional approach should highlight a sense of belonging or moral imperative that will promote positive feelings or feelings of acceptance when engaging in the desired behaviour. While the practical approach should include practical instructions or interactive prompts that are aimed at getting people to try the behaviour to create a change.

Furthermore, the language that is used is important in gaining participant engagement. Participant accountability should not be overridden with a sense of guilt or pressure, but rather the social norm of keeping one's word. It has been suggested that language such as "we'll see how you're going" is more effective in obtaining participant commitment compared to formal terms such as "follow-up, check-in, or on-track" (Kent & Ampt, 2012, p. 10).

Literature review: Carran-Fletcher and colleagues (2020)

Carran-Fletcher and colleagues (2020) conducted a literature review on general Travel Demand Management (TDM) strategy, their report identified five key factors that contribute to effective TDM programmes.

1. Goals and interventions should be established collaboratively between national, regional, and local governments this helps to ensure that the overall goals are aligned and that local needs are being met.
2. TDM should be considered at all stages of planning and having legislation requiring TDM to be included in the planning process is an important factor for success.
3. Developing a programme that is flexible and adaptable to various local contexts is important.
4. Having staff dedicated to overseeing the TDM strategy at national, regional, and local levels is important to support the integration and implementation across stakeholders.
5. Gaining stakeholder and industry engagement and collaboration is an important factor. Involving communities and businesses in identifying the problem and the best solution for their context helps create commitment to a project.

In summary, recent meta-analyses and reviews of travel behaviour change literature have identified some of the factors that contribute to successful travel behaviour change programme and conclude that generally travel behaviour change programmes are of value. However, as stated by Carran-Fletcher and colleagues (2020, p.8) "there are no silver bullets when trying to change travel behaviour on a large scale", each strategy requires effort and has a cost (i.e., financial cost, time cost etc.).

General literature and evidence

Presented below is a summary of key findings from general travel behaviour change literature and consultations with those working in the transport industry with travel plan experience.

Collected key findings:

*   Bamberg and Rees (2017) conducted a meta-analysis of soft transport interventions, specifically those that focused on personal travel planning, finding an effect that corresponded to approximately a 5% reduction in car modal split share.
*   Möser and Bamberg's (2008) meta-analysis found that work travel plans result in a mean increase of 12% of employees not travelling to work by car, however their analysis of the effectiveness of school travel plans was inconclusive.
*   Research from a health-related cycling campaign in Denmark found that localised intervention activities had a significant positive effect, however the national mass communication campaign did not show a significant effect (Nielsen et al., 2019). However, it can be argued that the key elements of the national efforts were promoted through the local activities and therefore the national campaign efforts

were reflected in the local results (Nielsen et al., 2019). Nonetheless, this finding highlights the importance of localised interventions.

- In many circumstances if driving is the most convenient and cheapest option, soft interventions will be ineffective in changing behaviour. To encourage mode shift, soft interventions will need to be combined with 'hard' interventions that discourage driving (e.g., parking pricing) (Whilllans et al., 2021). Behavioural interventions are only effective when people can realistically change their commuting behaviour, without incurring a significant penalty in safety, convenience or cost.

- Collecting smartphone data, public transport ridership, or parking data can be useful. When objective behaviour is measured continuously and passively it contributes to quality outcomes because the study is less intrusive, simpler to conduct, not prone to self-report biases, and can track dynamic longitudinal changes (Whillans et al., 2021).

- Marketing should only be used once services are operating effectively, it is counterproductive to promote services that provide consumers with a negative experience (Victoria Transport Policy Institute, 2019).

- Information alone is not enough to change travel behaviour, the same is true of pricing initiatives (Kent & Ampt, 2012).

- To create an effective plan an understanding of the target audience is vital. This research needs to be meaningful and used to inform the pre-design process and not just collected and disregarded. Part of this research should involve applying an equity lens. With a greater understanding of the equity issues within a target audience it can inform the content of the travel plan's interventions to work toward addressing existing inequalities and mitigating creating new inequalities or exacerbating existing inequality.

- The aim is to have relatively short travel surveys (presented digitally rather than on paper) that collect the necessary information (previous travel surveys for travel plans may have been unnecessarily lengthy and resulted in an overwhelming output of findings).

- An array of solutions and activities need to be presented within a travel plan, a one size fits all approach is unlikely to lead to success.

- Transportation efficient communities (2022) provides five key points of 'Best Practice Actions for implementing travel demand management strategies', these are:
    1. Engage local partners to understand their goals for transportation and to find opportunities to coordinate investments and resources.
    2. Monitor implementation and measure/evaluate performance.
    3. Be willing to engage in discussions that may challenge assumptions of effectiveness of current programmes in order to develop new strategies and actions for implementation.
    4. Set challenging but attainable goals within a reasonable time frame.
    5. Use disincentives for parking and implement designs that encourage public transport and active travel.
    6. Commit to the long-term plan and establish accountability and progress measurement.

- Arroyo and colleagues (2018) conducted a trip characteristics analysis of the effects of a travel behaviour change programme aimed at reducing private vehicle use. Overall, their findings showed that participating in the travel behaviour change initiative led to a significant reduction in private vehicle use. In more detail, their results also suggested that the people most likely to be impacted by travel behaviour change programmes are those travelling alone and on afternoon trips. For those travelling with others, people travelling with household members are more likely to be influenced by travel behaviour change programmes compared to non-household companions (e.g., colleagues, acquaintances). That is, travelling with companions was found to make travel mode choice more rigid (i.e., likely to continue travelling via private vehicle), particularly if the travel companions are colleagues or acquaintances. Based on this evidence, Arroyo and colleagues provided transport policy implications, suggesting that specific actions within a travel behaviour change programme should be designed to target those that travel in groups, and alternatives to car use need to be easily available during evenings and nights.

Travel behaviour change targeted at schools

School travel plans aim to reduce the traffic congestion caused by school drop offs, reduce traffic danger, and to support students that are already travelling via more sustainable means (Möser & Bamberg, 2008). Typical school travel plans could include days where walking and cycling are promoted, training for safe pedestrian and cycling behaviour, curriculum activities to educate and involve children in developing the plan, physical changes to the area around the school (e.g., lowered speed limits, pedestrian crossings, cycle lanes), and including a travel policy in the prospectus (Möser & Bamberg, 2008).

Key findings

- School travel planning commonly uses the "six E's" as an organising framework. The six E's have been updated to **remove 'enforcement' and include 'equity' and 'engagement'** forming a framework that is comprised of: **engagement, equity, engineering, encouragement, education, and evaluation.** Each of these six components should be considered when creating a travel plan.
- **Tailored** travel behaviour change interventions are more successful than interventions that take a 'one-size-fits-all' approach. The travel plan and related content should be **tailored to the school, location, and transport context.**
- Frequent in-person **relationship building** with the school is seen as critical to success, rather than creating a lengthy documented paper plan.
- **Student-led groups that meet frequently** are vital tools for engagement and the success of a travel plan.
- **Involving schools and their communities** in identifying the problem and the best solution(s) for their context helps to create **commitment** that is likely to improve the outcomes.
- The **perception of an issue** is important, as the activities included in a travel behaviour change programme depend on the way the travel issue is defined. For example, the less problematic an issue is perceived as, then the more limited in options and impact the intervention.
- **An equity lens should be applied when designing a travel plan.** By having a greater understanding of equity issues within the target population the intervention can be designed to address/mitigate inequalities and ensure everyone can be involved in achieving the goals of the travel plan.

The foundation of school travel plans – 'The E factors'

Over the past 15 years many travel plans designed for schools have used the '5 Es' as their organising framework, with the five Es being education, encouragement, enforcement, evaluation, and engineering (Isidro, 2020). However, in more recent years a sixth E of 'equity' was added (Isidro, 2020). Following this, in 2020, the Safe Routes to School programme (an initiative aiming to make it easier for students to walk and bike to school), has intentionally removed 'enforcement' from their framework and instead added 'engagement' to their framework forming the current 6 E's (Isidro, 2020). Engagement was added to the Safe Routes to School programme to acknowledge the importance of tailoring school travel plans to the needs of the community that it serves. In order to create an effective travel plan, activities or action points for each of the six Es (engagement, equity, engineering, encouragement, education, and evaluation) need to be included (or at least considered) in the travel plan. Older school travel plans almost always included the enforcement factor, and generally lacked engagement and equity within their framework that underpinned their intervention. A brief introduction to each of 'E' factors that should be used to inform a school travel plan is presented below.

Engagement

School travel plans should begin by listening to students, teachers, and parents. The goal is to involve students in the process of creating a travel plan and to build relationships and ongoing engagement opportunities (Safe Routes Partnership, 2020). A novel case study demonstrating the importance of engagement in school travel plans is provided in Appendix A.

Equity

Equity should be considered at all stages of the travel plan process, this means ensuring that the travel plan as a whole and actions within it benefit all groups of people (Safe Routes Partnership, 2020). The inclusion of equity as one of the 6 Es acknowledges that in order to increase the number and safety of students walking and cycling to school it is vital to address the needs of low-income students and families, and other disadvantaged groups (Zimmerman, 2015). Equity needs to be built into the analysis and action items for each E. On top of this, equity needs to be considered separately to ensure that the overall programme is meaningful and does not inadvertently disadvantage a particular group of people (Zimmerman, 2015).

Engineering

The Engineering aspect of travel plans involves creating physical improvements that make active transport safer and easier, such as pedestrian crossings, lower speed zones, and cycle paths (Safe Routes Partnership, 2020). It is reported that the most successful programmes include a thorough community involved assessment of the barriers of walking and cycling to school (Safe Routes Partnership, n.d.). Applying an equity lens to the engineering element involves ensuring that the physical improvements address safety for all, this can mean ensuring that the physical improvements are implemented in low-income communities where bike lanes, lighting and other safety features are often absent (Zimmerman, 2015).

Encouragement

Events, activities, and programmes should be used to generate enthusiasm for active transport (Safe Routes Partnership, 2020). Examples of encouragement activities include student led groups, events to promote specific modes such as 'Walk to School Day', and partnerships with other school or extra-curricular groups. Applying an equity lens, encouragement activities should influence children from different backgrounds and socio-demographic groups (Zimmerman, 2015).

Education

Information about the range of transport options available should be provided, along with providing the skills to ensure that students are able to walk and cycle safely. Education regarding the benefits of different modes of transport should be part of the education package (Safe Routes Partnership, 2020). Pedestrian safety and bicycle safety training can be held in the classroom and family and community member education should also be included. An equity lens should be applied to ensure the content is engaging and useful for all student groups (Zimmerman, 2015).

Evaluation

Following travel behaviour change activities an evaluation should be conducted that assesses which activities were successful and applies an equity lens to ensure that equitable outcomes are being supported. Any unintended consequences of the programme should be considered as well as any opportunities to improve the effectiveness of the intervention (Safe Routes Partnership, 2020).

Enforcement

Enforcement involves partnering with local law enforcement to address parking, speeding, and other traffic/crime concerns in the surrounding area and along school routes (Zimmerman, 2015). Importantly, education should be used prior to enforcement activities and an equity lens should be applied to enforcement activities to ensure that enforcement activities do not target (or disproportionately impact) people who are low income, ethnic groups, people with disabilities, and other minority groups (Zimmerman, 2015). While the enforcement factor has officially been removed from the Safe Routes to School programme that underpins school travel plans, in some instances enforcement activities may still be part of a travel plan (e.g., to combat unsafe parking or speeding around school areas).

Evaluating the use of 'the Es' in school travel interventions

Buttazzoni and colleagues (2018) review of school travel interventions

Buttazzoni and colleagues (2018) conducted a systematic review of school travel interventions in a North American context applying the original six Es of education, encouragement, enforcement, engineering, equity, and evaluation. Given the timing of the research and engagement being a recent addition to the E framework, engagement was not considered within this review. The review included 22 articles published between 2011 and 2016 and found that encouragement and education were the most commonly observed themes in school travel interventions. Equity was the least frequently included, with the review finding only 18% of the studies incorporating it. The authors acknowledged that while equity is the most recently added of the six Es they considered, they proposed this finding may have occurred because access to lower socio-economic schools can be more complicated and additionally that equity appears to be more of a lens that can be applied to interventions rather than being a robust strategy on its own. The review also found that data relating to the intervention structure and organisation tended to be lacking. Furthermore, detailed explanations of the expectations of those involved in the intervention process were rarely found.

The review found that the tools used to evaluate the success of the interventions varied, with surveys/questionnaires being the primary form of measurement, followed by observations and in-class assessments. The timeframes for follow ups also varied from the short end of one day and one week, to up to three years later. Outcome success measures were categorised as participation related (54.5% of the interventions), awareness and safety, behavioural, education, and perception. Each study reported at least one positive outcome, however the impacts varied significantly with participation related interventions showing increases in active school travel ranging between 13% and 333% (as cited in Buttazzoni et al., 2018, p. 120). Interventions with short follow up times (less than 6 months) tended to show a huge initial success but noted that the post-intervention results were short lived. Conversely, a longer term follow up (greater than 6 months) reported more modest results and acknowledged the complexities of accounting for multiple variables over time.

Buttazzoni and colleagues proposed that the process of determining what was likely to be a successful approach is contingent on whether the issue is defined as problematic or not. For example, the less importance attached to an issue (e.g., injury prevention, physical activity promotion) the more limited in options and impact the intervention is likely to be. This highlights the importance of considering more than the school's preferred strategy and desired outcome (as the school may not attach importance to an issue and consequently be uninterested in the intervention). The authors note that community capacity and perceptions of priority should be considered during the intervention selection process.

Creating effective school travel plans

The existing literature generally forms a consensus highlighting several key success factors that the 'good practice' school case studies included. Newson and colleagues (2010) found that for the case study schools in their sample, the average reduction in total car use was 23% with some schools reducing car use by more than 50%. Summarised below are the key factors for creating effective school travel plans (Department of Transport, 2009; Newson et al., 2010):

- A positive relationship with the local authority.
- A head teacher that was particularly supportive of the travel work and other staff participation.
- Continued travel work for at least 2 years.
- Awareness raising work.
- Leadership from a champion and/or working group.
- Having student involvement in travel work and decision making resulted in more successful travel plans.
- Including the school travel policy in the prospectus or with induction information was common in schools that achieved a greater level of travel behaviour change.
- Safety improvements in the surrounding area.

- Off-road cycle lanes and school cycle parking were important in increasing cycling rates.
- Even without safety measure changes, increases in walking were recorded when walking school buses and other walking incentive schemes were implemented.
- For schools that reduced driving there were usually parking restrictions in place.
- Although successful initiatives may appear similar, the solutions involved can be varied as they respond to the individual needs of the school. It is important to be open minded in considering what the school needs and to think creatively about solutions that will work in the context of the school.

Consultation with practitioners implementing travel plans in New Zealand schools

Following the literature search of school travel plans, practitioners currently implementing travel plans in New Zealand schools were consulted for this research. The overall aim was to gain an understanding of how New Zealand is currently creating school travel plans, and local experts' insights into how travel plans have changed over the years, and what factors contribute to success (and importantly what can be considered as success).

The practitioners consulted for this research were experienced in implementing travel plans in New Zealand Schools and based on their expertise they highlighted the following key points that make school travel plans successful:

- Frequent in-person relationship building with the school is seen as critical to success, rather than creating a lengthy documented paper plan. Relationship building with the school is critical, and it was suggested that a single contact person that coordinates everything related to the travel plan for the school is important to the success of the action plan. For example, even if the school requires other people (e.g., an engineer) to implement an action, this should be arranged by the constant point of contact overseeing the action plan, as this contact aims to build ongoing rapport with the school.
- Four E's (Education, Engineering, Encouragement, Enforcement) provide the framework to form a school 'action plan'. Generally, the aim is to use less 'enforcement' strategies, however it was noted that following education initiatives focussed on parking it was often deemed necessary to include enforcement activities directed at parent parking to combat unsafe parking and drop-off behaviours. While the 4 Es provide the framework and all "Es" needed to be considered, engineering and enforcement are not included in every action plan as the plans need to be tailored to the school.
- Travel plans are more effective when they are built into the ethos of the school. When schools embrace travel plans in their documentation (e.g., information for new students, school newsletters etc.) there tends to be greater engagement and consequently better results.
- Student led groups are one of the most vital tools for engagement as getting students engaged can change not only students' behaviour but also parents' behaviour can be targeted via the students. Creating 'student leaders' in these student-led groups, and inter-school meet ups for these groups can add to student engagement. These student-led groups are important because they are independent of teacher-time and do not overburden teachers already stretched time and resources. The student-led groups also help to ensure that the material is understandable for the age group. It was suggested that the student-led groups should meet weekly/monthly (depending on age) as schools that held their student-led meetings less frequently were less engaged in their travel plans.
- National level resources/information that are intended to be discussed or distributed in schools need to be specifically created for multiple age groups, as resources designed at a population level (pitched at adults) may be unsuitable or inappropriate (e.g., too complex or frightening) for young children.
- Regarding the way in which travel plans have evolved through the years, it was noted that walking school buses played a key role in early travel plans, however more recent travel plans tend to include walking school buses less. This was suggested to possibly be due to improved infrastructure, whereby it is now perceived as safer to walk alone than previously, and fewer parents available or willing to assist with walking school buses. On the other hand, the popularity of "small wheels" such as roller-skates and scooters that children can use to get to school and other initiatives of "park and stride" where parents park away from the school and groups of children walk together to school, may have replaced or reduced the need for walking school buses.

Travel behaviour change targeted at workplaces

A workplace travel plan is a package of site-specific measures implemented by an employer to encourage more sustainable travel, primarily to reduce single occupancy vehicle use (City of Sydney, 2020; Möser & Bamberg, 2008). Typical elements of a workplace travel plan include providing public transport information, offering personalised journey plans, deals to reduce the cost of public transport for employees, secure lockers, cycle parking, showers, changing facilities, dedicated car parks for those that carpool, parking charges, improved services onsite to reduce travel, and encouraging flexible working (i.e., flexible hours, working from home, and compressed working hours) (Möser & Bamberg, 2008). A travel plan should involve ongoing work (involving implementation, monitoring, review, and improvement), and be considered as a site management tool (City of Sydney, 2020). The following sections provide a summary of the insights taken from published guidelines and the key points for creating an effective travel plan taken from general literature and practitioners. In addition, to complement and contextualise these findings case studies of workplace travel plans are presented in Appendix B.

Creating effective workplace travel plans

Summary of insights for creating effective workplace travel plans from Wake (2016):

- **Organisational support** is required for a travel plan to lead to behaviour change. If employers do not view commuting as an issue or part of their responsibility, then consequently they are unlikely to commit to an attempt to change it.
- To maintain organisational support travel plans should be seen as **business management tools that have broader value**, this can help to embed travel plans as good business practice. If travel plan measures can become a valued part of workplace operations, then they are likely to be resourced and sustained.
- **Having a workplace champion is a requirement for success**. However, one champion can also be a vulnerability if this person leaves or does not continue with the work. To mitigate this a network of people that support travel plan activities could be created. Importantly, what is needed for success is at least one person with a strong interest and ability to coordinate and support the implementation of a travel plan.
- **The workplace actions should be part of a package of measures** (i.e., not a single action) and should be tailored to the business, location, and transport context. It is important to consider what travel alternatives are realistically available for that workplace and what are the barriers for uptake so that they can be addressed.
- **When a workplace relocates to a new site this should be considered as an important opportunity to influence behaviour**. Importantly, the travel planning process should begin prior to the relocation and not only invoked after the move has occurred.

Published guidelines

Searches of academic databases and general internet searches for published guidelines regarding travel plans identified that many of the published travel plan guidelines are approximately a decade old (both from New Zealand and internationally). This section will provide a summary of the core elements from the published guidelines, including Waka Kotahi's "workplace travel plan guidelines" (2011), the United Kingdom's Department for Transport's "good practice guidelines" (2009) and "essential guide to travel planning" (2008), Ireland's National Transport Authority's "achieving effective workplace travel plans – guidance for local authorities" (2011a) and "workplace travel plan guide for implementers" (2011b). Noting that many of these documents are dated, findings from more recently published documents will also be included in the summary, including the City of Sydney's "travel planning guidelines" (2020), Transport for New South Wales' "travel plan toolkit" (2018), and Dunedin City Council's "travel plan toolkit" (2020). Overall, it appears that the core elements of these guidelines remain relevant.

Summary of the abovementioned published travel plan guidelines

A successful travel plan should:

- Have senior management support.
- Be informed by current travel patterns.
- Have a comprehensive package of measures.
- Have a dedicated travel plan coordinator.
- Provide opportunities for staff involvement and engagement.
- Have ongoing marketing. Promotion and marketing are vital to the success of travel plans, although it is necessary for there to be good travel alternatives to promote to staff.
- Capitalise on change by treating the site relocation or recruitment of new staff as an opportunity to create change.
- Include a monitoring and evaluation programme. The evaluation of the travel plan is critical. Different plans and sites should have different success factors. The monitoring provides evidence of a systematic approach to measuring the performance and impact of the travel plan.
- Focus on results and modify the plan accordingly. Travel plans should be living documents that are updated based on experience.
- Have baseline data. A travel survey and site audit should be completed to establish a baseline.
- Build enthusiasm from the bottom up as well as the top down, senior leaders should set good examples, and staff at all levels should be involved in events.
- Have committed resources (budget, nominated people with responsibility for the travel plan and actions, developed partnerships).

Key points for creating an effective travel plan:

- Each travel plan should be unique because each site is unique. The plan should be responsive to site specific opportunities and barriers, this should take advantage of the 'easy wins' and address the 'missing links' (Department for transport, 2009).
- Good relationships and partnership working (between all stakeholders, e.g., local authorities, public transport operators, employers) are necessary throughout the development and implementation of a travel plan.
- Parking restraint is a hallmark of effective travel plans. Organisations achieving the lowest car use usually have parking restrictions, parking charges, or a combination of both.
- Clear objectives and outcomes that are site specific should be agreed with stakeholders in early discussions of the travel plan.
- Travel plan actions should align closely with the targets set out in the travel plan; it is important to choose actions that are likely to result in progress towards the targets.
- Involved parties should ensure that the agreed outcomes are stretching yet realistic, and that the actions/measurables are deliverable. The targets should be SMART (specific, measurable, achievable, realistic, and time-bound).
- The requirements of the travel plan should be expressed in clear terms, with timetable, monitoring, management, and financial expectations clearly stated.
- While the overall objective may be to reduce single occupancy vehicle tips, the success measures should include vehicle kilometres travelled per week rather than only capturing main travel mode. This is recommended in order to be able to capture smaller changes, such as a staff member that has reduced from driving 5 days a week to driving four days and cycling one day per week.
- Monitoring needs to be done over time, and the review process need to be systematic and planned. The review process should allow opportunities to make changes to achieve the agreed outcomes.
- Travel plans need to be complementary to other tools. Effectiveness is dependent on other policies and actions.
- Good practice should be linked to an outcome rather than an output. The goal of producing a workplace travel plan is poor practice if it is only focused on an output, not an outcome, and therefore the plan is likely to become a shelved artefact. Rather, with the travel plan specific outcome goals should be created, such as the goal to reduce single occupancy car use by *x* amount by *x* date.

- The strength of a travel plan is in the collective value, the sum of the whole is far greater than the individual parts. The actions in the travel plan need to complement and reinforce each other.
- Acknowledge that not everyone in the target audience will be ready to change their behaviour at the same time.
- The benefits of travel plans are broad including employee health (e.g., greater exercise from active travel, employees are likely to healthier and take less sick-leave, productivity increases, contributes to improved workplace culture, morale and engagement, improves work-life balance), efficiency (e.g., improve staff arrival times, repurpose onsite parking spaces, provide better site access, reduce local congestion), cost reduction (e.g., reduce costs associated with sick leave, parking costs, improve recruitment and retention, reduce travel costs), sustainability (e.g., encourage sustainable options, improve employer reputation and image, build community relationships) site-development where applicable (e.g., reduce development costs, increase property value, mitigate adverse traffic impacts, improve community perception of development) (Dunedin City Council, 2020; New South Wales Government, 2018;).
- Ongoing activities and reinforcement are necessary, as change will not necessarily be lasting.
- It is more effective implement a few activities well, than to attempt many activities very poorly (New South Wales Government, 2018).
- Information alone is insufficient to create change, there must be other measures and emotions and interest need to be activated to create change.
- The United Kingdom's Department for Transport provided 'good practice' guidelines (2009) for delivering travel plans, with a focus on new developments and including travel plans in the planning process. The guidelines recommended viewing travel plans for new developments as a pyramid of measures and actions, where each new pyramid layer should build on the previous layer in the context of the desired outcomes. The pyramid levels are summarised below:
  o Pyramid level 1: Consider the location of the new development to provide the foundation for good accessibility. Consider the proximity to existing facilities and services.
  o Pyramid level 2: Physical measures such as a walking, cycling, and public transport friendly design, site facilities such as showers, lockers, and offsite measures such as cycle routes and safer crossings.
  o Pyramid Level 3: The site travel-coordinator should have ongoing involvement in developing and maintaining the plan, including awareness raising, monitoring, and reviewing success.
  o Pyramid Level 4: Services and facilities delivered as part of the travel plan, for example improved bus services, access to pool cars or bike, cycle repair services, and parking management is also included at this level.
  o Pyramid level 5: Awareness, raising, marketing and information. These measures should be designed to inform people about the services and facilities provided through the travel plan.

The process of creating a travel plan involves five steps (Waka Kotahi, 2011):

1. **Set up:** obtain senior management support and staff buy-in, set overall goals and scope, and identify roles and responsibilities including establishing a steering group and a travel plan coordinator, develop a project plan and marketing strategy.
2. **Data collection:** conduct a site and policy assessment, hold staff mode groups, conduct a staff travel survey and business travel audit, analyse the data, prepare a current travel report.
3. **Action planning:** create an action plan and objectives, hold staff workshops for actions and objectives, seek feedback from stakeholders, draft travel plan and seek feedback before finalising.
4. **Implementation:** launch travel plan and implement action plan, communicate the travel plan's achievements.
5. **Monitoring and maintenance:** maintain travel plan, review, spot checks, annual survey, monitor objectives and targets, update and modify initiatives.

Consultation with practitioners implementing travel plans in New Zealand workplaces

Following the literature search, practitioners that work with implementing workplace travel plans in New Zealand were consulted. The key insights gained from this were:

- To make a successful plan, the documentation provided to the workplace needs to be concise and should be presented in a modern digital format. The documentation should be user-friendly and written in natural language. The plan should be customer focused with clear metrics and actions that can be tracked. What is provided should not be an overwhelming lengthy paper-based prescriptive plan like early travel plans may have been.
- The process of creating a travel plan should include creating a partnership agreement between the workplace and those assisting to implement a travel plan, gaining stakeholder buy-in, setting objectives collaboratively, surveying employees to find out how they are travelling and to self-identify what would change their behaviour, and conducting a facilities audit to determine what the facility-based barriers to behaviour change are.
- Key insights from the employee travel survey and facilities audit should be reported, and this research should be used to form the plan that is created.
- Tracking progress is also important, this involves ticking actions off the plan when complete to show progress, this should be digitised and, in some instances, could involve the gamification of rewards.
- The goal is to embed the travel plan in the workplace, to get the workplace employees involved with the design and for people in leadership positions to champion the work so that remains supported.
- Expos or events can be held at work to target groups, such as an expo for new starters, or a cycling expo.

Evaluating success

The way that a travel demand management or travel behaviour change programme is evaluated is important in determining the success of a programme. This is important because people only tend to value what they can measure (National Transport Authority, 2011b.). Travel behaviour change programmes were particularly popular between 1997 and 2017, however many are no longer in use despite their ongoing successes (James, 2017). The discontinuation and decline in popularity of travel behaviour change initiatives is proposed to be at least in part due to poor evaluations that fail to prove the value of the programmes (James, 2017).

Common indicators that are used to evaluate a travel behaviour change programme include commute mode share, vehicle trip generation, and vehicle kilometres travelled (Carran-Fletcher et al., 2020). Although these remain relevant and important metrics of success, these conventional methods of evaluation can underestimate or overlook many of the positive impacts a travel behaviour change programme might have on public health and fitness, wellbeing, independent mobility, and traffic safety (Carran-Fletcher et al., 2020).

Discussion with those that work in the transport industry with travel plan experience have suggested that the focus on greenhouse gas emissions as a metric to evaluate the success of a travel plan has increased, and a reduction of greenhouse gas emissions is more likely to be part of the goals of a current travel plan compared to older travel plans where this may have been perceived as of lower importance. Additionally, current practitioners implementing travel plans in New Zealand schools suggested that the success of school travel plan should be evaluated holistically and can include an array of factors such as helmet wearing while cycling (and other commuting safety behaviours), the engagement and activity of student-led groups, visibility of travel information in school documentation (e.g., including travel plan information in the school prospectus), and schools' willingness to engage in travel behaviour change activities.

Travel behaviour change programmes should involve comprehensive evaluation that considers a wide range of impacts, and the results should be shared. Both quantitative and qualitative data should be included in the evaluation.

Examples of quantitative indicators that can be used to monitor the travel plan (National Transport Authority, 2011b):

- Changes in modal split – both "usual" and "occasional"
- Bikes parked on site

- Demand for lockers /showers
- Number of car parking permits issued / car park spaces in use
- Participation levels in on-site events
- Absenteeism reductions (employees commuting actively are likely to be fitter and therefore healthier, when flexible working practices are introduced including working from home, absenteeism may also decrease)
- Staff retention (particularly where flexible working is available)

Examples of qualitative indicators that can be used to monitor the travel plan (National Transport Authority,2011b.:

- Employee comments and attitudes
- Support from senior management
- Comments from other stakeholders
- Awards, honours, and nominations for travel work and the people involved

Interventions should also have multiple short term (less than 6 months) and long-term follow up times (spanning years). Research evaluating school travel plan interventions found that interventions with short follow up times showed a huge initial success but noted that post-intervention results were short-lived (Buttazzoni et al., 2018). Whereas long term follow-ups reported more modest results (Buttazzoni et al., 2018). The short-term follow up is important as showing success can be a motivating factor and is likely to justify the continued investment in the travel behaviour change programme. Furthermore, alongside the short-term follow up should be longer-term follow ups which are important as they can account for complexities and multiple variables over time (e.g., changes in weather reducing active travel) (Buttazzoni et al., 2018).

Furthermore, Wake (2016) proposed that travel plans should be considered as business management tools that have a larger value than just changing the way people travel. Viewing travel plans as a business tool can help to embed travel behaviour change as good business practice. Consequently, if travel behaviour change can become a valued part of workplace operations, then the workplace is likely to continue to resource it and the travel behaviour change work will be sustained.

As this report has already highlighted, the extant travel behaviour change research generally lacks robust experimental methodology. Although the consensus from the literature is that there is benefit of travel behaviour change initiatives, there is a lack of evidence to be able to comprehensively answer what travel behaviour change activities are most effective and why, and what makes a travel behaviour change programme successful. Therefore, comprehensive evaluations are important not only because poor evaluations can result in travel plans appearing ineffective and being discontinued, but also to fill gaps in the existing travel behaviour change literature. Improving the methodology and evaluation of travel behaviour change is required to gain an understanding of what types of actions are most effective and can be used to inform future travel plans.

Carran-Fletcher and colleagues' (2020) literature review of TDM strategy also identified several key insights regarding the evaluation of a TDM programme:

- Importantly, the way that a TDM programme is evaluated has an impact on the perceived value of the programme. The authors acknowledged that conventional methods of evaluation can underestimate or overlook many TDM benefits, such as public health and fitness, independent mobility, and traffic safety.
- Having a comprehensive evaluation means that TDM benefits are less likely to be unnoticed, and consequently there is likely to be greater support for TDM programmes.
- Common indicators used to evaluate a TDM programme include commute mode share, vehicle trip generation, and vehicle kilometres travelled.
- The TDM performance indicators that are used should directly relate to the objectives of the programme, both qualitative and quantitative data should be included for evaluation.

- Consider what data sources exist and what will need to be collected for the evaluation. Furthermore, ensuring the evaluation and data collection is scaled to different geographic areas (i.e., national or regional) is important to ensure the administrative burden is manageable. The relative value of data for an evaluation will differ between smaller scale local programmes and nation-wide programmes.
- The evaluation should capture both successes and failures of the programme and consider how this can inform development elsewhere and future interventions.

Equity

As described in the school travel plan section with the Safe Routes to School programme, equity is a relatively recent addition to the framework underpinning the behaviour change interventions (Isidro, 2020). Equity should also be considered for workplace travel plans and all travel demand management activities. Equity should be considered at all stages from planning to follow-ups, this means ensuring that the programme as a whole and individual actions within it benefit all groups and do not have unintended consequences of disadvantaging a particular group of people.

Research is required to understand the context of the transport intervention and the different subgroups of people an intervention might impact. It is important to understand the different experiences and transport requirements of different population groups. The positive and negative impacts of a proposed intervention should be considered across all people, not with a majority-group focus but with a focus on historically disadvantaged and minority groups. In Aotearoa/New Zealand this means considering the differential impacts by ethnicity (in particular Māori and Pasifika people), income, gender, age, disability, language, sexual orientation, and employment status. Best practice involves diverse voices in the design planning, and decision-making processes of transport interventions.

To assess equity, measurable equity indicators can be assessed for different groups of people. Examples of equity indicators are transport network coverage, average travel time by mode, and accessibility to opportunities (Litman, 2022). It is important to note that there is no single or correct way to evaluate transport equity. The metrics/analyses used, and subsequent decisions should reflect a community's needs and values while proactively ensuring that those who have historically had fewer transport options are considered.

Updating travel plan guidelines

Opportunities for improvement

Literature has identified some opportunities for innovation and ways to improve workplace travel plans. Presented below is a summary of opportunities for improvement identified by Wake (2016):

- Workplaces that have used travel plans to achieve good business and community outcomes could be promoted, this offers "proof" of success to encourage other organisations to implement them.
- Other business benefits of travel plans such as employee wellbeing and company reputation should be analysed to build the case for workplaces to invest in travel plans.
- Workplace travel plan champions should be connected to other champions to build a support network or shared experience and inspiration.
- Take advantage of change moments such as workplace relocations.
- Simplify the travel planning process. For some, implementing a travel plan is challenging, the process should not be made unnecessarily difficult or be overwhelming. For many workplaces this could mean focusing on smaller achievable activities that build on each other and over time form a comprehensive travel plan.
- Travel plans should be incorporated into the land use planning system.
- Travel plans should involve a comprehensive evaluation and the results should be shared. This is required to gain an understanding of what types of actions are most effective and this can be used to inform future travel plans.

Recommendations for updating travel plan guidelines

Although a large portion of the existing travel plan guidance is dated, it is important to acknowledge that most of the content and recommendations remain relevant. Based on the existing literature and recent evidence it is therefore suggested that the updating of travel plan guidelines involve small tweaks regarding presentation and delivery that are now afforded by newer technologies, new evidence, and changes in transport modes. Recommendations that updated travel plan guidelines (more recently often referred to as a toolkit) could include are presented below.

General recommendations when updating travel plan guidelines:

- The travel plan process should be simplified. The documentation provided should be concise, written in user-friendly, natural, and guilt-free language. The plan should be customer focused with clear metrics and actions that can be tracked.
- Travel surveys should be relatively short and conducted digitally, this allows for more efficient data analysis and evidence collation.
- The travel plan should be considered as a dynamic document that is embedded into the organisation and is updated regularly in line with the monitoring and reviewing outcomes. The travel plan should not be seen as a static shelved artifact.
- Where relevant, working from home and flexible working arrangements (e.g., different start and finish times, compressed work weeks, working from home some/or all of the time, video conferencing in place of face-to-face meetings) should be presented as an important tool. In the past decade working from home and flexible working arrangements has become more common and practicable given technological changes and other societal events (e.g., the COVID-19 pandemic) that resulted in changes to the normal work schedule.
- Equity should be a key consideration in the travel plan process. That means, an equity lens should be applied at all stages from planning to follow-ups, ensuring that the programme as a whole and individual actions within it benefit all groups and do not have unintended consequences of disadvantaging a particular group of people.

New approaches to travel behaviour change

Introduction

Changes in technology and the proliferation of smartphones generally offers new opportunities for behaviour change interventions. Smartphones are ubiquitous, they are also unobtrusive tools (as users voluntarily carry them everywhere in daily life), and the built-in sensors allow for passive and effortless collection of data capturing user behaviour (Lathia et al., 2013). While early travel behaviour change initiatives often utilised paper-based travel surveys and manual analysis, travel behaviour change initiatives that are used today can and should utilise modern technologies of mobile phones and computer software to aid in the creation and implementation of travel behaviour change interventions. Emerging from the recent travel behaviour change literature is the concept of Mobility as a Service (MaaS). MaaS is a concept that generally refers to a digital mobility service platform that acts as a 'one-stop-shop' for all transport needs and has been introduced within travel behaviour change literature as a new opportunity for travel behaviour change interventions.

The primary objective of this section is to introduce the concept of MaaS and provide a brief review of the MaaS literature. In particular, the aim of this research was to find evidence-based research and experiments that can provide insights into whether MaaS can be utilised to create travel behaviour change, and if so, how and when this can be achieved. This section also provides a summary of the main challenges facing MaaS including the necessary conditions required before MaaS can be implemented, the viability of MaaS, and the importance of considering unintended consequences.

Furthermore, with the changes in technology that have occurred over the past few decades as well as the proliferation of smart phones, the literature searches on new approaches to travel behaviour change identified not only the concept of MaaS as a new opportunity but also the concept of gamification. Given the appearance of this concept within transport literature as a new opportunity, gamification will also be briefly introduced and discussed as it relates to travel behaviour change.

Overview

The findings of this section show that Mobility as a Service and gamification are two concepts that present new opportunities for travel behaviour change. Both concepts appear to be potentially useful tools within a modern travel behaviour change strategy. However, given that they are relatively new tools within in the suite of travel behaviour change interventions there is relatively little empirical evidence that demonstrates their effectiveness in practice on a large scale. The majority of the literature, research, and experiments investigating MaaS and gamification are theoretical choice studies, relatively small-scale trials, implemented over a limited period of time, and implemented in specific contexts. Consequently, further research and evidence is required before strong conclusions can be drawn about whether MaaS and gamification can result in significant behaviour change and what effect size their implementation might have. Moreover, while MaaS may appear as a revolutionary concept within the suite of travel behaviour change interventions, it is important to note that there are necessary conditions that need to be met before MaaS can be considered as an intervention option. Notably, public transport services and infrastructure need to be operating effectively in order for MaaS to be applied, as it would be futile to attempt to implement MaaS within a context where the public transport system is unprepared. This means ensuring there are a variety of transport modes available, adequate density and frequency of services, and that services are integrated across both public and private transport modes. When these conditions are met then implementing MaaS may be considered. In addition, it is important to consider that implementing new technologies associated with MaaS and gamification raises challenges around security (e.g., data sharing and privacy policies) and equity (e.g., may exclude those who do not have or know how to use the technology). Consequently, deliberate planning is required to mitigate the risks that come alongside the benefits.

Summary of findings

The key findings from this section investigating new approaches to travel behaviour change are summarised below:

- **Developments in technology** and the proliferation of smartphones offers new opportunities for behaviour change interventions. **Mobility as a Service (MaaS) and gamification** are concepts that can be added to the suite of tools within travel behaviour change strategy and interventions.
- Literature has identified **five vital pre-conditions that need to be satisfied before MaaS should be considered as an intervention option**. These pre-conditions include having adequate: transport services and infrastructure, MaaS enabling technologies, data sharing, policy regulation and legislation, and public willingness to join.
- The expectation of MaaS is that by meeting the individual travel needs and preferences of a user in a **tailored and easy to use way**, people will be less likely to feel they need to own a car. However, it is important to note that good public transport and infrastructure is one of the necessary pre-conditions in order for Maas to contribute to this outcome, as evidence suggests that even one bad experience of public transport can discourage any future use.
- Research from stated choice surveys indicates that introducing **MaaS alongside TDM measures** (i.e., parking fees) could result in a strategy that promotes shared mobility and public transport use.
- MaaS packages that encourage **car sharing will not necessarily lead to reduced car use**.
- Both **MaaS and gamification come with significant implementation challenges**, and **deliberate planning is required to mitigate the risks** that come alongside the possible benefits, in particular considering security, privacy, equity, and sustainability.
- Case studies where gamification has been used in a transport context provide evidence that it **can result in significant behaviour change**.
- **Gamification** appears to be a useful tool in the transport context, however further evidence is required to determine where it may be useful, how it should be designed and utilised, and challenges around funding emerge.

Mobility as a service (MaaS)

Although there is no globally accepted definition of mobility as a service (MaaS), it usually refers to a digital mobility service platform that integrates several transport modes into a single interface (Farahmand et al., 2021). In other words, MaaS is a one-stop-shop that integrates public transport (e.g., train, bus, tram etc.,) and private transport (e.g., car sharing, bike sharing, taxi, scooter etc.,) information into one digital platform to supply them to people as a single service (Farahmand et al., 2021). MaaS plans aim to offer users the option to buy monthly subscriptions that include a certain amount of each transportation service that satisfies all of the users' mobility needs (Matyas & Kamargianni, 2017). MaaS can be tailored to meet the travel needs and preferences of the user by providing convenient alternatives to using private vehicles.

While MaaS is predicted to contribute to sustainability by reducing private car use, sharing mobility resources, and simplifying multimodal travel, in order to reduce car ownership and car use people are still required to change their behaviour (Strömberg et al., 2018). Consequently, MaaS can be considered as a new travel behaviour change intervention. The expectation of MaaS is that by meeting the individual needs and preferences of a user in a tailored and easy to use way, people will be less likely to feel they need to own a car (Strömberg et al., 2018).

Creating subscription plan designs that both cater to the preferences of users while also supporting the shift away from private vehicle usage is not a simple task (Matyas & Kamargianni, 2017). Some key information about user preferences and behaviour is required to guide the developments, implementation, and 'best practice' MaaS plans. MaaS plans involve product 'bundling' which is the practice of marketing multiple products or services in a package for a special price (Matyas & Kamargianni, 2017). These bundles can be purchased and grant customers a defined volume of access to each mode (usually quantified in kilometres or hours).

Choice surveys and general findings

Farahmand and colleagues (2021) examined the role of Mobility as a service (MaaS) as a TDM tool to influence mode choice. Their research conducted a stated choice survey in the Netherlands and concluded that introducing MaaS alongside TDM measures (i.e., parking fees) could result in a strategy that promotes shared mobility and public transport use. In particular, they found that young, low-income, and multi-modal commuters and car users who use street/garage parking are likely to change their mode choice behaviour as result of MaaS combined with TDM measures (i.e., parking fees). Conversely, MaaS is not likely to be an effective tool when trying to influence the commuting behaviour of older, high-income, and car dependent employees. The authors also noted two unwanted consequences of using MaaS as a TDM tool. Firstly, it was found that car users are likely to prefer car sharing over public transport. Secondly, some employees that commute using only public transport would want to switch to shared modes (i.e., car or e-bike sharing). This means that MaaS packages that encourage car sharing will not necessarily lead to reduced car use.

Several other stated preference or choice experiments have been conducted in an attempt to understand the market for MaaS. The findings around bundled subscription approaches in comparison to pay-as-you-go models are somewhat conflicting. Vij and colleagues (2018) found that pay-as-you-go option was more popular than subscription based MaaS, while conversely, Ho and colleagues (2018) found that subscription based MaaS was more popular than pay-as-you-go. Ho and colleagues (2018) also found that infrequent car users might be the most interested in a bundled approach to MaaS. These findings show that the results are highly dependent on what the bundle includes, the discounts included, and characteristics of the users.

Other key points from MaaS research and literature:

- The potential benefits of MaaS can only be realised if the needs and expectations of users are met, and existing barriers are identified and overcome (Zhao et al., 2020).
- MaaS packages should be able to be subscribed to as a household or with a number of registered users rather than only as an individual, this is because transport decisions (such as the ownership of a car) are likely to be household based and have household rather than individual impacts (Ho et al., 2018).
- MaaS increases awareness of other modes and expands people's perceived available mode choice (Matyas, 2020).
- For users, the single app reduces the difficulty of accessing transport information, and ticket and payment is simplified (Arias-Molinares & García-Palomares, 2020).
- MaaS relies on cooperation and collaboration, with an interconnected transport system where the boundaries of public and private transport are blurred (Karlsson et al., 2016).
- The population needs to be more willing to share resources in the future in order for MaaS to be successful (Ho et al., 2018).
- MaaS requires careful consideration of service design and attributes, providers that are committed to the project, and the larger regulatory context needs to be addressed (Karlsson et al., 2016).

Evidence from MaaS trials

Strömberg and colleagues (2018) acknowledged that there is a dearth of empirical studies of how MaaS impacts behaviour, as MaaS implementations are limited thus far, and are lacking published evaluations. Presented below is a summary of key findings from several case studies where MaaS has been trialled around the world. Appendix C presents the case studies and their findings in greater detail.

Key findings from international MaaS trials:

- A MaaS trial in Sweden found that all subgroups identified within the trial used cars less and walked more (Strömberg et al., 2018).
- Behavioural changes as a result of MaaS vary depending on the users initial motivations (Strömberg et al., 2018).
- The flexibility of the MaaS package is important. Participants were found to often have incorrect assumptions about their own travel behaviour, and it is valuable to allow participants to change their subscription at a later stage (Strömberg et al., 2018).

- The MaaS service made people feel as though there were more transport options available (Karlsson et al., 2016).
- A MaaS trial in Switzerland found that change was only found for routes that were frequently travelled in a high-car dependent area. In Zurich, where high quality public transport was already available the mobile app did not result in any statistically significant effects (Cellina et al., 2019).
- A MaaS trial in Australia found that subscribing to monthly mobility bundles influenced monthly car use in a statistically significant way (Hensher et al., 2021a). This finding indicates that MaaS subscriptions could have the potential to change travel behaviour in line with sustainability objectives (Hensher et al., 2021a).

Challenges facing MaaS

Necessary conditions for MaaS

Another challenge of implementing MaaS is the context in which it is to be employed. Kamargianni and Goulding (2018) proposed five key ingredients that are necessary for MaaS. Without these key factors in a given context, MaaS is unlikely to be successful. Before implementing MaaS it needs to be considered if these necessary pre-conditions are met, or if improvements are required. Kamargianni and Goulding proposed the key ingredients required before MaaS can be utilised are:

1. **Transport services and infrastructure**. The current transport system needs to be prepared including the variety of modes, density and frequency of services, and the integration of services.
2. **MaaS enabling technologies.** Devices, internet access, and smart ticketing are needed.
3. **Data sharing.** Transport operators need to share data and mechanisms that enable software to be integrated. Strong data privacy policies are also needed.
4. **Policy regulation and legislation.** Key policies at a city/national level need to support MaaS, this includes ticketing and fair competition aspects.
5. **Peoples willingness to join.** Lifestyles and behaviour need to align with a MaaS model of transport.

Considering these necessary pre-conditions for MaaS is important, as MaaS can realistically only be of value as a travel behaviour change intervention once these conditions are met. Importantly, implementing MaaS should not be considered as an acceptable alternative to infrastructure upgrades and generally having good transport services and infrastructure. It is acknowledged that in many contexts these pre-conditions will not be met, and instead efforts are likely best focussed elsewhere, particularly on ensuring transport services and infrastructure are adequate. Furthermore, given the pre-conditions alongside the aims of MaaS, MaaS is suited to more densely populated cities and urban areas that have existing robust public transport services and infrastructure. In contrast MaaS is not likely a viable intervention for rural areas as there is unlikely to be the population and transport services to sustain it. In the context of Aotearoa/New Zealand this means that there are limited areas where MaaS could be considered as an intervention option.

Viability

Hensher and colleagues (2021b) raised the question of what MaaS offers over and above that of good journey planner such as Google or Apple maps. Given that these apps currently can provide directions, information about timings for several modes, and in some cases can be integrated with Google and Apple pay, it suggests that MaaS will need to offer significantly more if it is to be profitable and gain social support. Without the subscription options, MaaS appears to be merely an attractive trip planner, that could result in travel behaviour change because of improved information, but this is not guaranteed (Hensher et al., 2021a).

However, despite research revealing overall positive findings regarding subscription plans, Hensher and colleagues (2021a) cautioned that the findings should not be construed as evidence that MaaS is a commercially viable mobility strategy. In other words, although Hensher and colleagues' (2021a) trial found that MaaS has the potential to gain subscribers and reduce car use, this is not necessarily a profitable activity. In Hensher and colleagues (2021a, 2021b) trial over 36% of the participants opted for a bundle rather than pay as you go, however this was achieved with a subsidy to users. Hensher and colleagues (2021b) propose that without a monetary incentive or taking a gamified approach travellers will see little use in MaaS given the existing services, and therefore would not be a viable solution. Identifying a suitable business model is possibly the most critical supply related challenge facing MaaS (Hensher et al., 2020).

Furthering this, Ho and colleagues (2021) conducted a revealed preferences study (in contrast to many of the previous studies that utilised stated preference) and tracked choices made in the Sydney MaaS trial. Their findings indicate that there is a market for customers who want to select a subscription bundle rather than pay as you go, and that people tend to pay more than the expected savings for a bundle. This finding provides some evidence of a viable business model. However, there needs to be enough variation in the bundle offers to cater to the varied needs and wants of different people.

In addition, in order for MaaS to be successful people need to be willing to change their travel behaviour. Matyas (2020) conducted in-depth interviews about attitudes towards MaaS, with the findings highlighting key barriers that make people apprehensive towards adopting certain modes.

The key barriers identified by Matyas were:

- o Safety was a prominent concern in regard to cycling.
- o Uncertainty about the service characteristics (particularly for people with certain needs, e.g., parents requiring children's car seats, and pet owners need to know if they can take their pet).
- o A deterring factor for some modes is the annoyance or complexity of the administration (e.g., car share).
- o People can lose trust in a service easily, and one bad experience can discourage any future use.
- o Some individuals have deeply entrenched preference and dependence on using their own private bike or car.

Matyas proposed that interventions that focus on the socio-demographic groups that are most affected by the abovementioned barriers could help to make other modes more appealing. Analysis also found that people evaluated the transport modes included in MaaS plans by sorting them into three categories:

1. *Essential modes.* These were deemed as crucial elements and users would not consider a MaaS plan without their inclusion.
2. *Considered modes.* These are modes that people would consider having in their MaaS plan but are not critical.
3. *Excluded modes.* Modes that people tried to exclude from their plans.

It is important to note that the essential, considered, and excluded modes are different for each person. However, Matyas proposed that soft interventions should target "considered modes" as this is where MaaS could make the most impact on travel behaviour change.

Unintended consequences of MaaS

An additional challenge of implementing MaaS is that the unintended consequences should be considered and mitigated where possible. Using new technologies can create challenges around security, privacy, equity, and sustainability. Consequently, deliberate planning is required to mitigate the risks that come alongside the possible benefits of MaaS. The current literature on MaaS has acknowledged several unintended consequences regarding the implementation of MaaS, including:

- Private vehicle usage and congestion could reduce, however MaaS may be unsustainable if active modes compete with public transport rather than private vehicles (Arias-Molinares & García-Palomares, 2020).
- The most often mentioned potential negative consequence of MaaS is having a low number of private car users join, which consequently could negatively impact public transport usage (i.e., public transport users and those who normally walk or cycle could instead shift to taxis or car sharing) (Arias-Molinares & García-Palomares, 2020).
- Transport networks have a finite capacity, not everyone can travel at once and MaaS implies that any trip can be completed on demand (Pangbourne et al., 2020).
- If MaaS is a pre-paid package of 'unlimited' modes it could result in users taking more discretionary trips (e.g., taxis) to feel they are getting value for money (Pangbourne et al., 2020).
- Public transport use could be reduced due to the availability of shared vehicles (e.g., uber, etc) (Pangbourne et al., 2020).

- Active and healthier travel modes (walking and cycling) are not prominent in current MaaS products which are centred around monetizable modes (Pangbourne et al., 2020).
- A MaaS package may result in shorter journeys usually completed by walking or cycling to be completed using other modes, and minimum amounts of active travel and exercise could no longer occur (Pangbourne et al., 2020).
- MaaS excludes those who do not have access to or know how to use the technology (e.g., older people), which could result in increased transport inequity (Pangbourne et al., 2020).
- Existing MaaS package take up appears to be inequitable, with findings that it tends to favour the urban elite (Pangbourne et al., 2020).
- MaaS innovators are predominantly private sector companies that are attempting to steer mobility for their own interests (financial gain) (Pangbourne et al., 2020).

Gamification

Literature searches on new approaches and additions to the suite of travel behaviour change tools has identified the concept of gamification as an emerging tool. The literature highlights that gamification can be used as a way to increase a smartphone-based intervention's effect on travel behaviour. Gamification refers to the use of game design elements in non-game contexts to foster behaviour change (Bassanelli et al., 2022). It can be a useful tool to promote positive behaviours and keep users engaged and motivated (Bassanelli et al., 2022). Gamification can be utilised primarily when an electronic or app-based tool is being used as part of the travel behaviour change programme.

Examples of game-based functions include points, levels, challenges, badges, and other incentives or rewards. Motivation is an important part of gamification, motivation can either be intrinsic (coming internally from the individual) or extrinsic (created by external 'push' or rewards). Well designed gamification should harness intrinsic motivations that are rewarded, supported, and measured by extrinsic motivation (Yen et al., 2019). Gamification aims to provide more than a simple incentive where the outcome is always known. With gamification the outcome may not be known in advance, but the rules of the game need to be clearly stated in advance (Yen et al., 2019).

Some interventions use monetary incentives. It has been suggested that care needs to be taken when using monetary rewards as monetary rewards can reduce intrinsic motivation. That is, although monetary rewards work, once the incentives cease people tend to return to their original behaviour. Conversely, non-cash incentives (e.g., leader board competitions in active school travel programmes) have been suggested to increase intrinsic motivation and consequently result in longer term behaviour change.

Key findings from transport related gamification literature

As gamification is a relatively new concept being explored within in the suite of travel behaviour change tools there is minimal empirical evidence that demonstrates the effectiveness of gamification in practice. Further evidence is required to determine where gamification may be useful and how it should be designed and utilised to be an effective tool for travel behaviour change. Although further evidence is required, the key findings from the current transport related gamification literature are presented below:

- Research has found that a game-based intervention 'Beat the Street' implemented with school children and their families significantly increased active travel (Harris & Crone, 2021). Following the intervention, low levels of activity decreased by 7%, whereas high levels of activity increased by 13%. Additionally, 53% less vehicles were found travelling on the target road during the morning commute times. This provides some evidence that gamification can increase active travel, however the research did not identify which components of gamification are most effective for creating behaviour change.
- Singapore introduced a gamified approach to address the issue of public transport congestion at peak times (as cited in Yen et al., 2019). Incentives were created for commuters to travel during off peak times, and further incentives were provided to those who encouraged others to join them (i.e., social network invites to join the scheme). The important design aspects were the types of rewards

(including raffle like rewards, and personalised offers of guaranteed rewards redeemed through points earned in the game) and social influence. The six-month trial was found to shift 7.49% of the peak demand (as cited in Yen et al., 2019).

- The introduction of a game in a controlled experiment in Italy resulted in a significant shift towards using more sustainable transport options for daily commuting needs (Kazhamiakin et al., 2015).
- Yen and colleagues (2019) asserted that the question is not whether gamification works in a transport context, but rather where it may be useful, the limitations, and how to design a gamified intervention to be successful.
- Although gamification appears to be a useful and effective tool that could create behaviour change, there is a challenge of funding the incentives, particularly if monetary rewards are used (Yen et al., 2019). In addition, it is important to consider if a gamified approach is suitable for the audience and if it will add value, as creating an app and funding incentives is likely become costly.

Events

Introduction

The final point within the research brief for this travel behaviour change report was to investigate the impact and effectiveness of activation events on travel behaviour change outcomes. The scope of the research was to search for evidence-based literature to investigate if activation events such as open streets initiatives and biking events have a significant impact on travel choice or willingness to change travel behaviour. Further to this, if activation events are having a significant effect, the aim was to understand what are the conditions or success factors that make activation effects successful.

Overview

Literature searches resulted in extremely limited evidence regarding the effectiveness of activation events (e.g., open streets, biking events) in the context of travel behaviour change interventions. Given the dearth of evidence found that focused on activation events this report is unable to provide any meaningful conclusions about the impact and effectiveness of events on travel behaviour change outcomes. Further research with empirical studies is required in order to answer the research question and to provide insight into the effectiveness of activation events and what makes them successful. Nonetheless, a summary of the limited evidence that was found is provided below.

Summary of findings

- 'Ride to Work Day' is an annual event held in Victoria, Australia, that promotes cycling to and from work. Rose and Marfurt (2007) found that in this event, approximately one in five participants were riding to work for the first time. Follow up analyses found that of those who rode to work for the first time, 27% were still sometimes riding to work five months after the event. Furthermore, 80% of those riding to work for the first time indicated that the event positively impacted their readiness to cycle to work. The event was found to have greater impact on creating behaviour change for females than males. This research provides some evidence that events can be an effective strategy in creating travel behaviour change.
- Open streets is an initiative that aims to provide an opportunity to engage in physical activity and use active travel modes by temporarily closing streets to motorised traffic. There is some literature indicating that open streets could be an effective way to promote physical activity, although the extent to which they are effective remains unclear (Salazar-Collier et al., 2018)
- As discussed earlier in the school travel plan section of this report, in the context of school travel plans, student-led groups and events were found to be vital for the success of travel plans. This includes student planning and discussion groups, bike safety and skill-based events, other travel safety events, and inter-school events where student-led groups meet.

Appendix A: School case study - Improving outcomes with increased engagement

Presented below is a novel case study demonstrating the importance of engagement when implementing a school travel plan.

Engagement using citizen science: Rodriguez and colleagues (2019)

Rodriguez and colleagues (2019) conducted a study evaluating the effectiveness of adding a technology-enabled citizen-science engagement model to the standard Safe Routes to School programme in middle and elementary schools in lower density areas in California.

The term 'citizen science' refers to actively engaging the local population in the collection, analysis, and utilisation of data to improve locals' health and wellbeing. The standard Safe Routes to School programme generally involves a standard set of observational evaluations of the local environment involving walkability/bikeability along with observational surveys of pedestrian and cycling safety behaviours. The programme also involves team meetings and action planning meetings, encouragement events, education and training activities.

Rodriguez and colleagues' approach to citizen science involved residents (parents and children) learning to use a mobile environmental assessment app to record their walking route as well as barriers and facilitators of safe walking and biking. With assistance, the residents acted as 'citizen scientists' and held community meetings to categorise the data, prioritise issues and advocate for realistic changes that could be implemented to address the identified issues. The study found that schools that involved the residents with citizen science conducted a greater number of Safe Route to School planning and encouragement events and results showed a greater increase in walking and biking to school compared to the Safe Route to School programme alone. The findings highlight the importance of engaging the community in the intervention and the positive flow on effects of greater engagement (i.e., greater number of encouragement events and a larger increase in active school travel).

Appendix B: Workplace case studies

Summarised below are six case studies of travel plans implemented in Perth workplaces between 2012 and 2016. The case studies are drawn from Wake's (2016) work reviewing the travel plan process facilitated by the TravelSmart programme. The case studies are presented in this report to provide a suite of real-world examples to accompany and contextualise the insights from the previously discussed workplace travel plan literature. These case studies also exemplify the wide variety of approaches that can be taken as well as the range of outcomes that can be achieved, therefore emphasising the importance of designing an intervention that is context specific, rather than taking a "one-size-fits-all" approach.

Summary of findings from case studies, Wake (2016):

Case study 1: Business relocating from suburban sites to central city site, 130 employees

Travel plan actions implemented:

- Information on travel options.
- Staff engagement activities.
- Limited workplace parking (only 20% can park onsite) and fees apply for parking, compared to the previous location's free parking available for all.
- Transport card and credit provided.

Travel behaviour change outcome:

- Single occupancy vehicle commuting reduced from 76% to 22% after relocating.
- Increased public transport use, walking, and cycling, and 61% of the trips to the new office were by bus or train.

Transport was addressed as part of the process for staff transitioning to the new site. The change in parking availability and cost combined with the public transport incentive (travel card and credit) is proposed to have amplified the mode shift.

Case study 2: Suburban local government, 419 employees

Travel plan actions implemented:

- Workplace bicycles provided.
- Staff engagement activities via monthly active commuter breakfasts and incentives, and staff induction events.
- Provided public transport cards to enable trips by bus or train.

Travel behaviour change outcome:

- Increased active commuting from 11% in 2012 to 18% in 2015.
- Single occupancy vehicle commuting decreased.

Active transport was promoted and enabled through workplace activities and improved facilities and was championed by a TravelSmart Officer. However, free car parking is a counteractive factor to shifting towards active transport.

Case study 3: central city business, 25 employees

Travel plan actions implemented:

- Reward scheme to encourage active commuting (points accrued based on travel mode that can be redeemed for public transport card credit, or used for cycling accessories, charity donation).
- Journey insurance cover – covers costs incurred through accidents while commuting to/from work.
- Improved end of trip facilities (i.e., secure bicycle parking, and tools for bicycle maintenance).
- Promoted travel options.

Travel behaviour change outcome:

- Increase in active commuting from 34% to 62%.
- Decrease in car commuting from 49% to 36%.
- 76% of employees participated in the reward scheme.

The reward scheme was an innovative way to engage staff and encourage active commuting. The reward scheme alongside the improved facilities, insurance, and supportive management contributed to the success of the travel plan. Despite the success, it was acknowledged that the challenge will be sustaining motivation over time so that the travel plan can have an enduring positive impact.

Case study 4: Outer suburban shopping centre, 1000 employees

Travel plan actions implemented:

- Information on cycle and public transport routes and facilities.
- Launch event for store representatives and centre management to promote the travel plan.
- Active commuter competition.
- Promoted a walking group.

Travel behaviour change outcome:

- No post intervention survey conducted, limited employee participation was observed and therefore no significant change is expected.

Free car parking is available to employees which remains a barrier to mode shift. The travel plan communication with employees is mediated by store managers and their support is needed to promote active travel.

Case study 5: Two suburban university campuses, 1690 employees

Travel plan actions implemented:

- Partially funded shuttle bus service.
- Improved cycle facilities.
- Transport information included in staff inductions.
- Staff access card integrated with public transport card.
- Car Park staff promoted travel alternatives.

Travel behaviour change outcome:

- A small increase in staff car commuting, however student car use declined.

The engagement activities primarily targeted students rather than staff and the car park cost for staff is low (and can easily be paid through payroll for a year/semester). It is proposed that changes in parking management are required in order to reduce employee car use.

Case study 6: State government agency, central, 880 employees

Travel plan actions implemented:

- Improved facilities for cyclists (i.e., shower refit, changing rooms, bike racks, and secure storage area).
- Work related trips and work events that engaged employees in walking and cycling.
- Cycle training and bike maintenance workshops.
- Promoted activities and information in internal communications.
- Trialled an online carpooling scheme to connect employees interested in carpooling.

Travel behaviour change outcome:

- Reduction in single occupancy vehicle commuting from 41% in 2005 to 32% in 2016 and an increase in active commuting over the same time period from 43% to 54%.

Alongside the improved facilities there was also limited on-site car parking and public transport improvement occurred between surveys. Ongoing staff engagement was observed, and the travel plan activities were championed by the organisation's Sustainability Officer. Collectively, these factors contributed to the success of the travel plan.

Appendix C: MaaS case studies

Presented below is a summary of four case studies where MaaS has been trialled around the world.

MaaS Trial – Sweden

A MaaS service called UbiGo was trialled in Gothernburg, Sweden, between 2013 and 2014 (Strömberg et al., 2018). UbiGo offered multimodal integration with customisable subscription plans comprised of any combination of public transport, taxi, car sharing, bike sharing, and car rental, all managed within a single smartphone app (Strömberg et al., 2018). The results of the trial showed that 93% of the participants stated they were satisfied with the UbiGo service and 69% said they had become more satisfied with the travelling compared to before the trial. The study also identified four different subgroups of people based on the reasons they joined the service and what they were expecting from the service, these four subgroups were categorised by Strömberg and colleagues as:

- Car shedders - wanted to try living without a car, and therefore expected less driving and greater use of other modes.
- Car accessors - wanted to access to a car without purchasing one, expected to do more driving.
- Simplifiers - wanted a smarter way to manage their use of multiple mobility services and expected not to make travel changes only for it to be easier.
- Economizers - wanted a way to save money on public transport, expected travel to be the same but cheaper.

At the conclusion of the trial the key findings from Strömberg and colleagues' research were:

- The overall results showed that all subgroups used cars less and walked more.
- The two car owning subgroups reduced their car use. With 95% of Car shedders and 53% of Economizers reporting using their car less than prior to the trial. The Car shedders spread their former car trips across all other modes, whereas the Economizers tended to use more public transport.
- The Car accessors increased their use of car sharing and rental cars, but reduced private car use (i.e., less borrowing from friends and family). In addition, many also increased their use of public transport, walking, bike sharing, and private bicycle, although some did report less use of active modes.
- Simplifiers did not change their behaviour in a uniform way.
- Some 'lock-in' effects were observed where participants tended to use public transport more if they had already paid for the day compared to if they had no pre-paid.
- The design of the app presented different modes as equally feasible, this made participants reflect on mode choice and possibly had habit-breaking effects.
- Overall, the findings show that behavioural changes as a result of MaaS vary depending on the users initial motivations.
- The participants at the start of the trial were unaware of their travel needs and behaviours, and the flexibility of the MaaS package was important as it allowed participants to change their subscription after they discovered their initial assumptions about their own travel behaviour were incorrect.
- The findings suggest that MaaS packages need to be flexible, and the service should support people to explore their current travel behaviour and which new behaviours they can adopt.
- The authors also noted that UbiGo was based on existing transport services and infrastructure, meaning that potential users were those already deemed to have sufficient access to the existing services and infrastructure.
- While UbiGo was seen as repackaging already available services, it did utilise new mobile technology and aimed to shift consumer attitudes and behaviours.
- If MaaS is to be implemented it should be tailored to the local geography, culture, and stakeholders, and should also be personalised to the individual or household.

An additional paper by Karlsson and colleagues (2016) also discussed findings from the on MaaS Service trial of UbiGo in Sweden. Alongside many of the above-mentioned points, the key findings of Karlsson and colleagues analysis were:

- Participants reported decreases in private car use and increases in alternative mode use. This decrease in private car use was greater than anyone had expected, including the participants themselves (Karlsson et al., 2016). Participants purchased about 30% more car hours than was utilised, due to an overestimation of need (Karlsson et al., 2016).
- Over time participants also become less positive towards private car usage and more positive towards alternative modes.
- The authors proposed that a main reason for the positive outcome of the trial was the 'transportation smorgasbord' concept, with most users' needs offered in a single package. The service made people feel as though there were more transport options available (Karlsson et al., 2016).

MaaS trial - Switzerland

Cellina and colleagues (2019) developed and tested a mobile app aiming to reduce individual car use by promoting public transport. The app was tested in a large-scale, one year long randomised controlled trial, with voluntary individuals in two different urban contexts in Switzerland. The app is designed to work through numerous stages of behaviour change with users from pre contemplation (at which users have no intention of changing their travel behaviour) through to contemplation, preparation and lastly to action and maintenances phases that encourage users to continue the new behaviour. Overall, the results of the study showed that the app did result in a change in mobility patterns for users, reducing emissions and energy consumption. However, the change was only found for routes that were frequently travelled and in the high-car dependent area. In Zurich, where high quality public transport was already available the app did not result in any statistically significant effects. This finding is possibly explained by the fact that public transport use is very common, and cars are generally only used when there is no other option, meaning that the room for change in Zurich is limited, and additional change is more difficult.

Corporate MaaS - Sweden

Hesselgren and colleagues (2020) explored the concept of Corporate MaaS, meaning a MaaS service owned or controlled by a corporation, and focused on transport within/to/from a work site or between work sites. The users of the corporate MaaS service are people working at or visiting that site. Corporate MaaS can be seen as a smaller scale test version of MaaS in general. Due a limited area of operation and the organisation being able to control many of the contextual variables (e.g., pricing) corporate MaaS can reduce some of the barriers to general MaaS adoption.

Hesselgren and colleagues (2020) studied the design, development, and implementation of corporate MaaS at a large workplace in Sweden in 2018. The corporate MaaS system bundled three existing transport modes (commuter bus, shuttle bus, and taxi) and added a fourth mode (e-bike) into one service with cohesive branding, user-friendly interface, online booking capability, and real-time information. This service was provided to 14,000 employees working in 70 buildings.

The results of the study showed limited changes in travel behaviour, and the only significant changes were due to the added e-bikes. That is, during the four months following the launch of the corporate MaaS system employees used the pre-existing transport modes (commuter bus, shuttle bus, and taxi) to the same extent as previously, while the new transport mode of e-bikes was used frequently and highly appreciated by employees. Although a dramatic increase in usage was not expected (or found), the new system did significantly impact employees' experiences, usage of information, and led to some new behaviours. The employees' internal transport patterns (i.e., moving between sites for meetings, getting to lunch places and activities during lunch hours) were somewhat structured by the corporate MaaS system. The system enabled this travel to be more sustainable, as even employees with their own vehicles at work sometimes preferred to use the corporate MaaS system for internal transport. Overall, the service application was frequently used by more than 25% of employees.

As a result of this research, Hesselgren and colleagues (2020) asserted that creating changes in travel behaviour towards more sustainable modes requires more than adding a digital platform. Furthermore, to improve the likelihood of corporate MaaS being successful it was identified that a corporate MaaS system needs to be integrated with external transport systems, integrated within the corporate policy, culture and norms, and integrated with the laws and regulations of the locale.

MaaS Trial – Australia

Farahmand and colleagues (2021) acknowledged that MaaS pilots have primarily been centred around European cities, and few have publicised their results. While most pilots have been conducted in European cities, Australia launched a MaaS trial in Sydney in 2019. The aim was to explore interests in subscription plans for MaaS (in contrast to pay as you go) and assess the extent monthly subscriptions might change private car usage (Hensher et al., 2021a). Controlling for other variables' influences such as seasonal travel activity, the findings indicate that the MaaS subscriptions could have the potential to change travel behaviour in line with sustainability objectives. The subscription to monthly mobility bundles was found to influence monthly car use in a statistically significant way.

References

Anagnostopoulou, E., Bothos, E., Magoutas, B., Schrammel, J., & Mentzas, G. (2018). Persuasive technologies for sustainable mobility: State of the art and emerging trends. *Sustainability*, *10*(7), 2128.

Arias-Molinares, D., & García-Palomares, J. C. (2020). The Ws of MaaS: Understanding mobility as a service from a literature review. *International Association of Traffic and Safety Science Research*, *44*(3), 253-263. Retrieved from: https://www.sciencedirect.com/science/article/pii/S0386111220300455

Arroyo, R., Ruiz, T., Casquero, D., & Mars, L. (2018). Trip characteristics analysis of the effects of a travel behavior change program. *Transportation Research Record*, *2672*(47), 146-158. Retrieved from: https://journals.sagepub.com/doi/abs/10.1177/0361198118773184

Bamberg, S., Fujii, S., Friman, M., & Gärling, T. (2011). Behaviour theory and soft transport policy measures. *Transport policy*, *18*(1), 228-235.

Bamberg, S., & Rees, J. (2017). The impact of voluntary travel behavior change measures – A meta-analytical comparison of quasi-experimental and experimental evidence. *Transportation Research Part A: Policy and Practice*, *100*, 16-26. Retrieved from: https://www.researchgate.net/profile/Jonas-Rees/publication/317289685_The_impact_of_voluntary_travel_behavior_change_measures_-_A_meta-analytical_comparison_of_quasi-experimental_and_experimental_evidence/links/5fbfdee4299bf104cf7c9cb6/The-impact-of-voluntary-travel-behavior-change-measures-A-meta-analytical-comparison-of-quasi-experimental-and-experimental-evidence.pdf

Bassanelli, S., Vasta, N., Bucchiarone, A., & Marconi, A. (2022). Gamification for behavior change: a scientometric review. Retrieved from: https://assets.researchsquare.com/files/rs-1300039/v2_covered.pdf?c=1655914870

Buttazzoni, A. N., Van Kesteren, E. S., Shah, T. I., & Gilliland, J. A. (2018). Active school travel intervention methodologies in North America: A systematic review. *American Journal of Preventive Medicine*, *55*(1), 115-124. Retrieved from: https://reader.elsevier.com/reader/sd/pii/S0749379718316842?token=BD3C44848430D1974BA4F7C224AEB76962B1E6E5B31C38E9A5EAE0A7FB72AA02A19279B95701C6232A4D1E05B7D939F8&originRegion=us-east-1&originCreation=20220516202337

Carran-Fletcher A., Joseph C., Thomas F., & Philbin S., (2020) Travel demand management – strategies and outcomes. NZ Transport Agency research report 661. Retrieved from: https://www.nzta.govt.nz/assets/resources/research/reports/661/661-travel-demand-management-strategies-and-outcomes.pdf

Cellina, F., Bucher, D., Mangili, F., Veiga Simão, J., Rudel, R., & Raubal, M. (2019). A large scale, app-based behaviour change experiment persuading sustainable mobility patterns: Methods, results and lessons learnt. *Sustainability*, *11*(9), 2674. Retrieved from: https://www.mdpi.com/2071-1050/11/9/2674

City of Sydney (2020). Draft travel planning guidelines. Retrieved from: https://www.cityofsydney.nsw.gov.au/development-guidelines-policies/travel-planning-guidelines

Department for Transport. (2008). The Essential Guide to Travel Planning. Retrieved from: https://www.sustainabilityexchange.ac.uk/files/essential_guide_to_travel_planning.pdf

Department for Transport. (2009). Good practice guidelines: Delivering travel plans through the planning process. Retrieved from: https://www.plymouth.gov.uk/sites/default/files/good-practice-guidelines-travel-plans-and-planning.pdf

Dunedin City Council. (2020). Travel Plan Toolkit. Retrieved from: https://www.dunedin.govt.nz/__data/assets/pdf_file/0011/787826/Travel-Plan-Toolkit.pdf

Ebermann, C., & Brauer, B. (2016). The role of goal frames regarding the impact of gamified persuasive systems on sustainable mobility behavior. Retrieved from: https://core.ac.uk/download/pdf/301369836.pdf

Farahmand, Z. H., Gkiotsalitis, K., & Geurs, K. T. (2021). Mobility-as-a-Service as a transport demand management tool: A case study among employees in the Netherlands. *Case Studies on Transport Policy*, *9*(4), 1615-1629. Retrieved from: https://www.sciencedirect.com/science/article/pii/S2213624X21001450

Harris, M. A., & Crone, D. (2021). Using gamification to encourage active travel. *Journal of Transport & Health*, *23*, 101275.

Hensher, D., Mulley, C., Ho, C., Nelson, J., Smith, G., & Wong, Y. (2020). Understanding MaaS: Past, present and future. Retrieved from: https://ses.library.usyd.edu.au/bitstream/handle/2123/21714/ITLS-WP-20-02.pdf?sequence=1

Hensher, D. A., Ho, C. Q., & Reck, D. J. (2021a). Mobility as a service and private car use: Evidence from the Sydney MaaS trial. *Transportation Research Part A: Policy and Practice*, *145*, 17-33. Retrieved from: https://www.sciencedirect.com/science/article/abs/pii/S0965856420308065

Hensher, D. A., Mulley, C., & Nelson, J. D. (2021b). Mobility as a service (MaaS)–Going somewhere or nowhere?. *Transport Policy*, *111*, 153-156. Retrieved from: https://ses.library.usyd.edu.au/bitstream/handle/2123/24890/ITLS-WP-21-09.pdf?sequence=1&isAllowed=y

Hesselgren, M., Sjöman, M., & Pernestål, A. (2020). Understanding user practices in mobility service systems: Results from studying large scale corporate MaaS in practice. *Travel Behaviour and Society*, *21*, 318-327. Retrieved from: https://www.diva-portal.org/smash/get/diva2:1282705/FULLTEXT01.pdf

Ho, C. Q., Hensher, D. A., Mulley, C., & Wong, Y. Z. (2018). Potential uptake and willingness-to-pay for Mobility as a Service (MaaS): A stated choice study. *Transportation Research Part A: Policy and Practice*, *117*, 302-318. Retrieved from: https://www.researchgate.net/profile/Chinh-Ho/publication/328664895_Potential_uptake_and_willingness-to-pay_for_Mobility_as_a_Service_MaaS_A_stated_choice_study/links/602c5f82299bf1cc26cf3020/Potential-uptake-and-willingness-to-pay-for-Mobility-as-a-Service-MaaS-A-stated-choice-study.pdf

Isidro, C. (2020). Dropping Enforcement from the Safe Routes to School 6 E's Framework - Safe Routes Partnership. Retrieved from: https://www.saferoutespartnership.org/blog/dropping-enforcement-safe-routes-school-6-e%E2%80%99s-framework

James, B. (2017). TravelSmart: an obituary and epitaph. In *Australasian Transport Research Forum 2017 Proceedings*. Retrieved from: https://www.australasiantransportresearchforum.org.au/sites/default/files/ATRF2017_105.pdf

Karlsson, I. M., Sochor, J., & Strömberg, H. (2016). Developing the 'Service' in Mobility as a Service: experiences from a field trial of an innovative travel brokerage. *Transportation Research Procedia*, *14*, 3265-3273. Retrieved from: https://www.sciencedirect.com/science/article/pii/S2352146516302794

Kamargianni, M., & Goulding, R. (2018). The mobility as a service maturity index: Preparing the cities for the mobility as a service era. In *Transport Research Arena* (Vol. 7). Zenodo. Retrieved from: https://discovery.ucl.ac.uk/id/eprint/10063087/

Kazhamiakin, R., Marconi, A., Perillo, M., Pistore, M., Valetto, G., Piras, L., Avesani, 5., & Perri, N. (2015). Using gamification to incentivize sustainable urban mobility. In *2015 IEEE first international smart cities conference (ISC2)* (pp. 1-6). IEEE. Retrieved from: https://cris.fbk.eu/bitstream/11582/301779/1/SmartCities_cameraReadyPDFExpress.pdf

Kent, B., & Ampt, E. (2012, September). Why 'building it'doesn't always mean they will come: Understanding reactions to behaviour change measures. In *Proceedings of the Australasian Transport Research*

Forum, Perth, Australia (pp. 26-29). Retrieved from:
https://www.australasiantransportresearchforum.org.au/sites/default/files/2012_Kent_Ampt.pdf

Lathia, N., Pejovic, V., Rachuri, K. K., Mascolo, C., Musolesi, M., & Rentfrow, P. J. (2013). Smartphones for large-scale behavior change interventions. *IEEE Pervasive Computing*, *12*(3), 66-73. Retrieved from: https://ieeexplore.ieee.org/abstract/document/6562720

Litman, T. (2022). Evaluating Transportation Equity: Guidance for Incorporating Distributional Impacts in Transport Planning," *Institution of transport Engineers Journal. TE* Journal,92(4), Retrieved from: https://www.vtpi.org/equity.pdf

Matyas, M. (2020). Opportunities and barriers to multimodal cities: Lessons learned from in-depth interviews about attitudes towards mobility as a service. *European Transport Research Review*, *12*(1), 1-11. Retrieved from: https://link.springer.com/article/10.1186/s12544-020-0395-z

Matyas, M., & Kamargianni, M. (2017). A stated preference experiments for mobility-as-a-service plans. In *2017 5th IEEE International Conference on Models and Technologies for Intelligent Transportation Systems (MT-ITS)* (pp. 738-743). Retrieved from: https://discovery.ucl.ac.uk/id/eprint/10037889/1/Kamargianni_MT-ITS2017_MaaS-SP_revised.pdf

Meyer, M. D. (1999). Demand management as an element of transportation policy: using carrots and sticks to influence travel behavior. *Transportation Research Part A: Policy and Practice*, *33*(7-8), 575-599.

Möser, G., & Bamberg, S. (2008). The effectiveness of soft transport policy measures: A critical assessment and meta-analysis of empirical evidence. *Journal of Environmental Psychology*, *28*(1), 10-26. Retrieved from: https://www.researchgate.net/profile/Sebastian-Bamberg/publication/221985580_The_effectiveness_of_soft_transport_policy_measures_A_critical_assessment_and_meta-analysis_of_empirical_evidence/links/6038b681a6fdcc37a851f43a/The-effectiveness-of-soft-transport-policy-measures-A-critical-assessment-and-meta-analysis-of-empirical-evidence.pdf

National Transport Authority. (2011a). Achieving effective Workplace Travel Plans: Guidance for local authorities. Retrieved from: https://www.nationaltransport.ie/wp-content/uploads/2020/08/Achieving-Effective-Workplace-Travel-Plans-Guidance-for-Local-Authorities211.pdf

National Transport Authority. (2011b). Workplace Travel Plans: A guide for implementers Retrieved from: https://www.nationaltransport.ie/wp-content/uploads/2013/04/Workplace-Travel-Plans-A-Guide-for-Implementers.pdf

New South Wales Government. (2018). Travel Plan Toolkit. Retrieved from: http://data.mysydney.nsw.gov.au/documents/Travel%2BPlan%2BToolkit%2B2018.pdf

Newson, C., Cairns, S. & Davis, A. (2010). Making school travel plans work: experience from English case studies. Transport for Quality of Life. Retrieved from; https://www.transportforqualityoflife.com/u/files/Making_School_Travel_Plans_Work_Nov_2010.pdf

Nielsen, T. A., & Haustein, S. (2019). Behavioural effects of a health-related cycling campaign in Denmark: evidence from the National travel survey and an online survey accompanying the campaign. *Journal of Transport & Health*, *12*, 152-163. Retrieved from: https://backend.orbit.dtu.dk/ws/portalfiles/portal/169851611/Nielsen_Haustein_Ta_cyklen_accepted.pdf

Pangbourne, K., Mladenović, M. N., Stead, D., & Milakis, D. (2020). Questioning mobility as a service: Unanticipated implications for society and governance. *Transportation research part A: Policy and practice*, *131*, 35-49. Retrieved from: https://www.sciencedirect.com/science/article/pii/S0965856418309601

Pawluk De-Toledo, K., O'Hern, S., & Koppel, S. (2022). Travel behaviour change research: A scientometric review and content analysis. *Travel Behaviour and Society*, *28*, 141-154.

Rodriguez, N. M., Arce, A., Kawaguchi, A., Hua, J., Broderick, B., Winter, S. J., & King, A. C. (2019). Enhancing safe routes to school programs through community-engaged citizen science: two pilot investigations in lower density areas of Santa Clara County, California, USA. *BMC Public Health*, *19*(1), 1-11. Retrieved from: https://link.springer.com/article/10.1186/s12889-019-6563-1

Rose, G., & Marfurt, H. (2007). Travel behaviour change impacts of a major ride to work day event. *Transportation Research Part A: Policy and Practice*, *41*(4), 351-364. Retrieved from: https://www.researchgate.net/publication/222686256_Travel_behaviour_change_impacts_of_a_major _ride_to_work_day_event

Safe Routes Partnership (n.d.). The Basics of Safe Routes to School | Safe Routes Partnership. Retrieved from https://www.saferoutespartnership.org/safe-routes-school/srts-program/basics

Safe Routes Partnership. (2020). The 6 Es of Safe Routes to School. Retrieved from https://www.saferoutespartnership.org/safe-routes-school/101/6-Es

Salazar-Collier, C. L., Reininger, B., Gowen, R., Rodriguez, A., & Wilkinson, A. (2018). Evaluation of event physical activity engagement at an open streets initiative within a Texas–Mexico border town. *Journal of Physical Activity and Health*, *15*(8), 605-612.

Semenescu, A., Gavreliuc, A., & Sârbescu, P. (2020). 30 Years of soft interventions to reduce car use–A systematic review and meta-analysis. *Transportation research part D: Transport and environment*, *85*, 102397. Retrieved from: https://www.sciencedirect.com/science/article/pii/S1361920920305848

Strömberg, H., Karlsson, I. C., & Sochor, J. (2018). Inviting travelers to the smorgasbord of sustainable urban transport: evidence from a MaaS field trial. *Transportation*, *45*(6), 1655-1670. Retrieved from: https://link.springer.com/content/pdf/10.1007/s11116-018-9946-8.pdf

Transportation efficient communities. (2022). Transportation Best Practice: Implement Demand Management Strategies. Retrieved from: https://www.transportationefficient.org/implement-demand-management-strategies/#sec4

Victoria Transport Policy Institute. (2019). TDM marketing information and encouragement programs. TDM Encyclopedia. Retrieved from: https://www.vtpi.org/tdm/tdm23.htm

Vij, A., Ryan, S., Sampson, S., & Harris, S. (2020). Consumer preferences for Mobility-as-a-Service (MaaS) in Australia. *Transportation Research Part C: Emerging Technologies*, *117*, 102699. Retrieved from: https://www.australasiantransportresearchforum.org.au/sites/default/files/ATRF2018_Abridged_Paper _26.pdf

Waka Kotahi. (2011). Workplace travel plan guidelines. Retrieved from: https://www.nzta.govt.nz/assets/resources/travel-planning-toolkit/docs/workplace-travel-plan-guidelines.pdf

Wake, D. (2016). TravelSmart to Work: Insights from voluntary travel planning with Perth workplaces. In *38th Australasian Transport Research Forum (ATRF)*.Retrieved from: https://www.australasiantransportresearchforum.org.au/sites/default/files/ATRF2016_Full_papers_res ubmission_82.pdf

Whillans, A., Sherlock, J., Roberts, J., O'Flaherty, S., Gavin, L., Dykstra, H., & Daly, M. (2021). Nudging the commute: Using behaviorally informed interventions to promote sustainable transportation. *Behavioral Science & Policy*, *7*(2), 27-49. Retrieved from: https://www.researchgate.net/profile/Shibeal_O_Flaherty2/publication/354688141_Nudging_the_Com mute_Using_Behaviorally-Informed_Interventions_to_Promote_Sustainable_Transportation/links/620b9b9fafa8884cabe560c1/N udging-the-Commute-Using-Behaviorally-Informed-Interventions-to-Promote-Sustainable-Transportation.pdf

Yen, B. T., Mulley, C., & Burke, M. (2019). Gamification in transport interventions: Another way to improve travel behavioural change. *Cities*, *85*, 140-149. Retrieved from:

https://ses.library.usyd.edu.au/bitstream/handle/2123/19093/ITLS-WP-18-06.pdf?sequence=1&isAllowed=y

Zhao, X., Vaddadi, B., Sjöman, M., Hesselgren, M., & Pernestål, A. (2020). Key barriers in MaaS development and implementation: Lessons learned from testing Corporate MaaS (CMaaS). *Transportation Research Interdisciplinary Perspectives*, *8*, 100227. Retrieved from: https://www.sciencedirect.com/science/article/pii/S259019822030138X

Zimmerman, S. (2015). The 6 E's of Safe Routes to School: Embracing Equity | Safe Routes Partnership.