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Replacing fixed-schedule buses with demand-responsive transport: A modelling approach to equitable, affordable, and low-carbon mobility

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Abstract

Smart card data and agent-based modelling are employed in this paper to examine the impacts of replacing fixed-schedule bus services with Demand-Responsive Transport (DRT) in Melbourne. DRT is an innovative public transport mode that dynamically adjusts routes and schedules based on real-time demand, offering potential efficiency, equity, and sustainability benefits. A simulation model was developed to replicate the performance of current fixed-route services and evaluate an equivalent DRT system operating in the same area. The analysis compares both systems across multiple dimensions: travel time, service reliability, vehicle occupancy, emissions, and service accessibility. The findings indicate that DRT has the potential to shorten average passenger trip times by 30%, increase vehicle occupancy rates from 8% to over 50%, and lower emissions per passenger by more than 70%. These findings demonstrate DRT's potential to deliver more affordable and flexible public transport, particularly in low-density or underserved areas. The study highlights how data-driven modelling can support evidence-based planning for innovative and equitable transport solutions. It also identifies future research needs, including integrating real-time demand prediction and pricing strategies to enhance service performance further.

Keywords: Demand-Responsive Transport; Public Transport Modelling; Transport Equity; Travel Behaviour; Agent-Based Simulation; On-Demand Mobility; Smart Card Data; Low-Carbon Transport; Affordable Transit Innovation

1 Introduction

Digital platforms, mobile applications, and emerging operational business models reshape public transport systems worldwide. These innovations create opportunities to deliver more inclusive, affordable, and adaptive mobility solutions, particularly in areas underserved by traditional fixed-schedule services (Chandakas, 2020). Motivated by declining public transport performance, particularly during off-peak periods, and rising expectations for user-centric, digitally enhanced services, transport planners and policymakers are increasingly exploring alternative models that balance service quality, equity, and sustainability.

Urban transport systems worldwide face mounting pressures to respond to shifting public needs, emerging technologies, and intensifying environmental concerns. Over the past half-century, transport policies have heavily prioritised private vehicle use, often at the expense of public transport investment. This has led to unsustainable urban travel patterns marked by congestion, emissions, and inequities in mobility access (Joël Hazan, 2019). While private vehicles have long been associated with flexibility and independence, public buses, despite being more cost-effective, have often suffered from poor service quality due to limited political and financial support (Goodwill & Carapella, 2008; Joël Hazan, 2019; Linda, 2003; Mageean & Nelson, 2003).

However, recent advancements in digital connectivity and the widespread use of smart personal devices offer a renewed opportunity to improve urban mobility. These developments have enabled hybrid models that blend the cost-effectiveness of shared transport with the convenience of personalised travel without the high expenses of car ownership or taxis (Liyanage & Dia, 2020). One such innovation is on-demand public transport (ODPT), also referred to as demand-responsive transport, a flexible, user-driven system that operates without fixed routes or timetables. Passengers request services via mobile apps or online platforms, and routes are dynamically generated in real-time to respond to actual demand.

This model is particularly effective in low-density areas, during off-peak periods, or for populations with specific access needs. It offers a promising path to address challenges in financial sustainability, equitable access, and environmental impact. This study examines ODPT under a many-to-many service model, represented by services like FlexiRide and Keoride in Australia. These services dynamically adjust routes in response to booking requests across multiple origins and destinations, enhancing both accessibility and operational efficiency:

- FlexiRide (Victoria, Australia): A service in select areas across Victoria where passengers can book rides via an app, phone call, or website. FlexiRide vehicles pick up and drop off passengers from designated stops within a service area, providing a more tailored and efficient transit solution.
- Keoride (Sydney, Australia): In areas like Mount Barker and the Northern Beaches, Keoride is an app-based, on-demand bus service allowing users to book real-time rides. The service dynamically adjusts routes based on passenger demand, optimising travel times and reducing unnecessary stops.

These examples illustrate the diverse applications of on-demand public transport, ranging from community-oriented shuttle services to more extensive public transit alternatives. In this paper, the term "on-demand public transport" will refer to services like FlexiRide and Keoride, where vehicles are shared among multiple passengers and booked through a digital platform to provide flexible, demand-responsive transportation options.

The increasing availability of smart card data in recent years has created new opportunities for evaluating and enhancing public transport system performance (Hawas et al., 2012; Kathuria et al., 2019; Zhou et al., 2017). The present study employs an agent-based traffic simulation developed in Commuter to compare the performance of ODPT systems with traditional fixed-route bus services, using real-world smart card data from Melbourne. The model was calibrated, validated, and applied to test alternative scenarios under ODPT configurations.

The structure of the paper is as follows: Section 2 outlines the methodological framework, detailing the study area, data requirements, and the agent-based modelling approach. Section 3 describes the model structure and scenarios. Section 4 analyses performance outcomes and compares existing and proposed service models. Section 5 concludes with insights into the practical deployment of ODPT and identifies areas for future research to support a sustainable, inclusive, and innovative transport future.

2 Methodology

Using a case study in Melbourne, this study applies a microscopic traffic simulation approach to model existing fixed-schedule bus services and proposed on-demand bus operations. Several scenarios were developed to evaluate performance and conduct comparative evaluations based on pre-determined key performance measures and criteria. The key advantage of traffic simulation is the generation of many testing scenarios that can be easily replicated and analysed. The traffic simulation model used in this study, Commuter, relies on advanced algorithms that model individual travellers' characteristics and behaviours (Autodesk, 2017; Azalient, 2013; Duncan, 2010). As outlined in the following section, the

model was calibrated using actual passenger touch-on and touch-off data alongside bus schedule information.

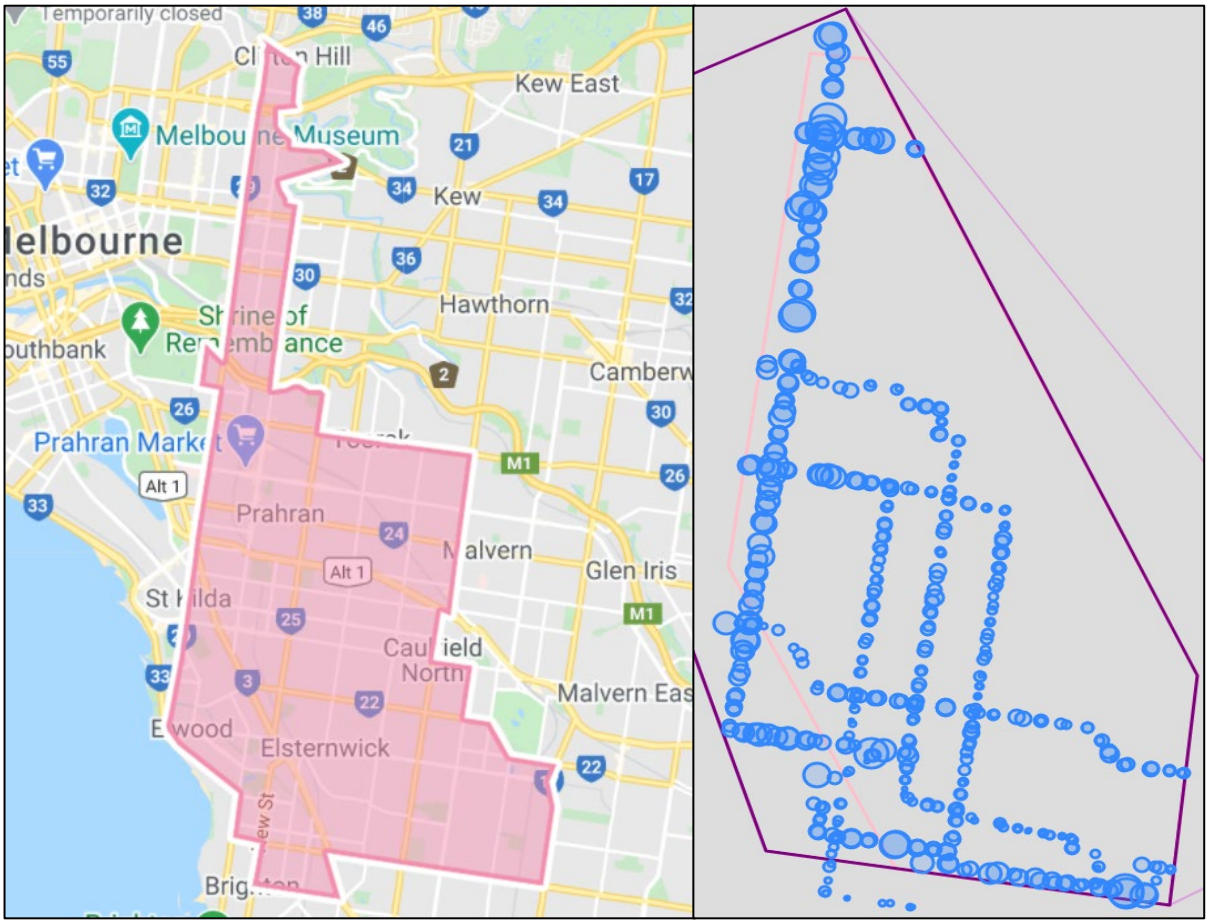
2.1 Study area

Melbourne, Australia, was selected as the case study for this research. With a population exceeding 5 million, Melbourne represents Australia's largest urban centre. For comparison, Sydney's population is approximately 4.9 million, Los Angeles houses around 3.99 million residents, New York has 8.2 million, and London has 9.4 million (World population review, 2021). The study area (Figure 1) encompasses several inner southeastern suburbs of Melbourne, incorporating major arterial roads known for heavy congestion. This area benefits from extensive public transport services, including fixed-route buses with MyKi smartcard readers. In Figure 1, each circle denotes an existing bus stop, with the size of each circle reflecting the total volume of trips generated and attracted at that location.

2.2 Data collection

This study uses data from Melbourne's MyKi smartcard system, capturing passenger touch-on and touch-off events on buses within the study area. The dataset, provided by the Victorian Department of Transport, includes daily records from 1–27 May 2018 across all relevant bus routes and stops. Due to factors like fare evasion, faulty cards/readers, or passengers not touching on, survey data was used to apply weighting factors that estimate true patronage to account for under-reporting. Around 10–14% of transactions lacked route information ("headless mode"), and only about 60% of passengers typically touched on, with fewer completing touch-offs. The anonymised dataset was cleaned to remove invalid trips and excluded school bus data.

Figure 1: Study area in southeast Melbourne (left); Locations of bus stops within the study area (right)



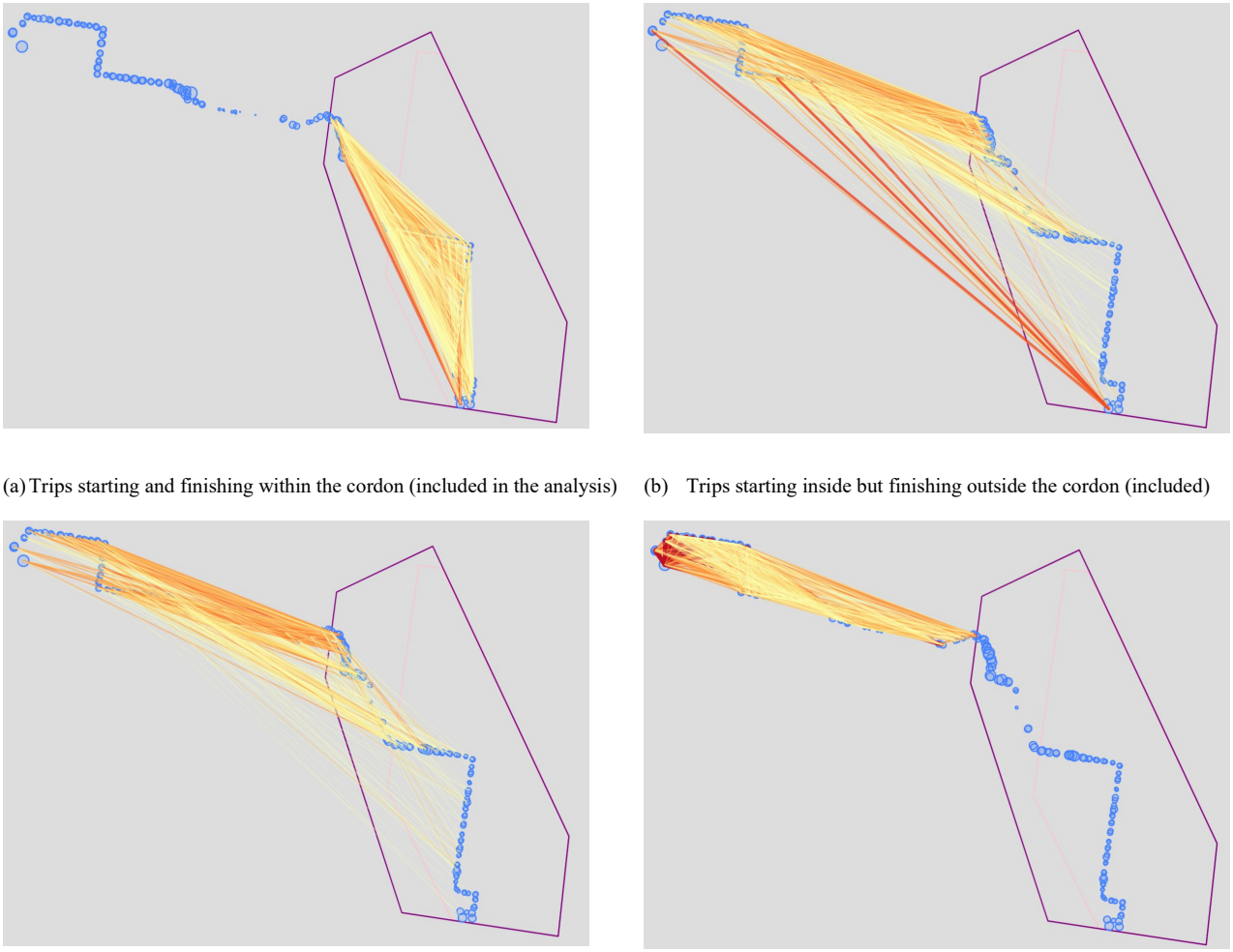
2.3 Data description

The smartcard data provided valuable insights into the existing bus passenger demand profiles, enabling the development of more realistic and reliable simulation models. The dataset encompassed information from all bus routes, covering 18 service routes in both directions. The dataset accounted for trips that had at least one endpoint (either the start or finish) within the study area boundary, excluding trips that only crossed the boundary without making a stop. Figure 2 provides examples of relevant trips for bus route 220. After this inclusion and exclusion process, 225,548 usable trips from May 1–27, 2018, were included in the study. This data was used to build a simulation model representing an area of 35.3 square kilometres, which included 462 bus stops and 18 bus routes (36 round trips) that passed through the study area.

2.4 Overview of total trip distribution

The operating timetables for the existing bus services within the study area, corresponding to the same period as the MyKi data collection, were obtained from the Public Transport Victoria travel information portal (PTV, 2021). The daily bus passenger trips derived from the MyKi data are depicted in Figure 3.

Figure 2: Inclusions and exclusions of trips for bus route 220



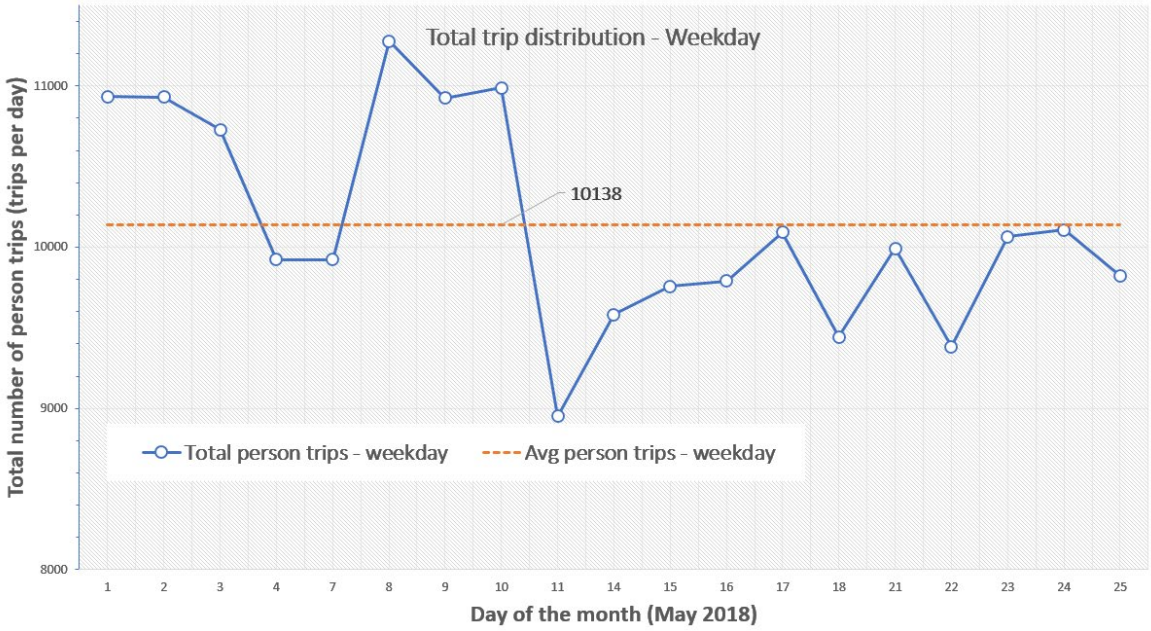
(a) Trips starting and finishing within the cordon (included in the analysis)

(b) Trips starting inside but finishing outside the cordon (included)

(c) Trips starting outside but finishing inside the cordon (included)

(d) Trips not passing through the cordon (excluded)

Figure 3: Weekday bus passenger trip distributions (person trips per day)



3 Modelling framework

This study employed Commuter, an agent-based traffic simulation platform, to model demand-responsive public transport services. In Commuter, individual agents represent travellers across different modes (drivers, cyclists, pedestrians, and public transport users), dynamically selecting the least-cost routes based on time, distance, and monetary factors. The model captures detailed traveller behaviour, including walking to bus stops, waiting times, boarding, and alighting processes. A feedback routing system recalibrates costs periodically to reflect real-time congestion and waiting conditions. Outputs include network performance indicators such as travel times, speeds, passenger counts, waiting times, trip durations, and bus utilisation rates.

An external Java-based plugin was developed to allow irregular bus departure times and varying vehicle capacities to support the modelling of flexible transport services. This extension enabled a realistic simulation of on-demand shared vehicles within the Commuter environment.

Model development involved verification, calibration, and validation using smartcard data for passenger travel times under existing fixed-route bus services. As on-demand services are not currently operational in Melbourne, calibration relied on matching observed and simulated travel times, achieving 89% accuracy (Asensio & Matas, 2008).

Several scenarios were simulated from 5:00 AM to 1:00 AM (next day), incorporating scheduled and on-demand services. The base case reflected current operations with diesel buses (43-passenger capacity) on fixed routes (PTV, 2021), supplemented by background car traffic based on VISTA survey data (VISTA, 2021).

On-demand services were tested under two broad frameworks:

- Scenario 1: Pre-set routes with partially fixed timetables, utilising fleets of 4, 7, or 12-seater diesel vehicles.
- Scenario 2: On-demand service variations along pre-set routes, flexible fleet deployment based on demand levels and maximum waiting times capped at five minutes.

Performance was evaluated across multiple indicators, including passenger experience, operational efficiency, system-wide impacts, and emissions.

4 Results

The following key performance indicators (KPIs) were used to analyse the outcomes of the simulation experiments:

- Aggregated data on time, distance, and other trip details for each person's journey in the model;
- Aggregated data on time, distance, and other details for each private vehicle journey. This study utilises the same vehicle trip table as background traffic for consistent comparative evaluation;
- Aggregated data for public transport vehicle trips, including buses, covering time, distance, and additional details;
- Data on individual transport service trips, as well as comprehensive details for each stand and passenger

The key objectives for evaluating on-demand services included minimising operational costs, reducing vehicle travel distances, and improving service quality. These were assessed based on the following factors:

- Service Quality and Passenger Experience: Measured by the average time spent by passengers on completed trips;
- Service Efficiency (Commercial Operations): Evaluated through vehicle utilisation rates (passengers per hour);
- System Efficiency (Public Benefit): Assessed in terms of completion rates for both passenger and vehicle trips, total kilometres travelled, and overall travel times and distances for completed journeys
- Environmental Emissions: Measured emissions, including CO2, NO, and PM10, for each completed trip
- On-Time Performance: Evaluated based on the average waiting time for passengers at bus stops.

4.1 Fleet size comparisons for partially fixed services

System performance for different fleet sizes (4, 7, and 12 vehicles) was assessed (Table 1). Using smartcard data, origin-destination matrices were created, and a partially fixed service timetable was developed for on-demand buses, with real-world bus stops as origins and destinations.

Person summary

The first section of Table 1 provides person trip statistics, summarising aggregated time, distance, and other performance measures for all trips. Completion rates consistently exceeded 93%, demonstrating that the system effectively transported passengers to their destinations within the modelling period for each weekday scenario. This indicates a high level of system quantity.

The person-kilometres and person-hours for trips completed during the simulation period were higher on weekdays, reflecting the typical, more extended trip lengths of regular commuters. Emissions indicators, such as CO2, NO, and PM10, were also measured, and results showed that emissions per person were relatively high due to longer commutes, as expected.

From the analysis, increasing the fleet size from 4 to 12 vehicles resulted in slightly higher trip completion rates and reduced emissions per person. However, as the fleet size was increased to 12 vehicles, the distances and durations of completed trips also increased.

Vehicle summary

The second section of Table 1 presents aggregated statistics for public transport service vehicles. Over 96% of buses in all scenarios completed their service routes within the simulation. Fewer service vehicles were required when the fleet size increased due to the constant passenger demand across all scenarios.

In addition, total service vehicle trip distances and times decreased with larger fleet sizes. This was primarily due to a better distribution of passenger demand across more vehicles, reducing the burden on each vehicle. Moreover, emissions per vehicle, such as CO2, NO, and PM10, were lower with a larger fleet.

Service summary

The third section of Table 1 presents detailed public transport service statistics, including average passenger waiting times and instances of unexpected delays at bus stops. The "unexpected wait time" represents the additional time a passenger waits due to vehicle lateness or overcrowding, requiring them to wait for the next bus.

The average waiting time for passengers increased with larger fleet sizes. Specifically, the expected wait time was 5.5 minutes for fleet size 4, 5.6 minutes for fleet size 7, and 7.1 minutes for fleet size 12. However, the unexpected wait time increased only slightly, from 1.3 minutes with a fleet size of 4 to 2.0 minutes with a fleet size of 7, and 1.8 minutes with a fleet size of 12.

Interestingly, Scenario 1.3 (using 12 vehicles) had the lowest number of services needed, as fewer vehicles were required to meet the same demand. This allowed for more spread-out service intervals but also led to higher waiting times, as demonstrated by the higher waiting times in Scenario 1.3.

Finally, the maximum passenger load/vehicle capacity was calculated, which reflects vehicle utilisation efficiency. Ideally, this value should be maximised to improve cost-efficiency. Table 1 shows that vehicle utilisation was lower in Scenario 1.3 (12-passenger vehicles) compared to Scenario 1.1 (4-passenger vehicles). This highlights that the larger vehicles, while reducing the required number, lead to lower vehicle utilisation rates and less efficient operations.

As expected, larger vehicle sizes (12-passenger vehicles) resulted in lower average passenger wait times and fewer vehicles needed. However, this came at the expense of lower vehicle utilisation and higher overall waiting times, reducing service efficiency. This highlights the trade-off between increasing fleet size to reduce operational costs and maintaining a balance with passenger experience.

Table 1: System performance across different fleet sizes for partially fixed services

Performance measures	Weekday		
	Size 4	Size 7	Size 12
Person results			
Trip completion rate for persons	96.0%	96.6%	97.1%
Trip distance for completed trips (km)	23,960	24,258	24,951
Trip time for completed trips (Hour)	2,672	2,978	3,312
Trip CO2 (kg) per person for completed trips	2,454	2,313	1,860
Trip NO (g) per person for completed trips	7,227	9,949	6,536
Trip PM10 (g) per person for completed trips	647	1,011	621
Vehicle results			
Trip completion rate for vehicles	96.3%	97.9%	99.3%
Total trip distance for completed trips (km)	18,900	11,696	7,522
Total trip time for completed trips (Hours)	1,093	720	419
Trip CO2 (kg) for completed trips	3,773	3,018	2,279
Trip NO (g) for completed trips	11,358	12,858	8,033
Trip PM10 (g) for completed trips	1,025	1,330	763
Service results			
Passengers expected to wait at stops (mins)	5.5	5.6	7.1
Passenger unexpected wait at stops (mins)	1.3	2.0	1.8
Maximum passenger load/vehicle capacity	77.2%	71.8%	64.8%

The fleet size comparison analysis for partially fixed services suggests that while larger fleets slightly improve trip completion rates, they also result in higher emissions and longer

passenger wait times. The balance between operational efficiency (reduced fleet size) and passenger convenience (lower waiting times, better vehicle utilisation) remains a significant consideration in deploying on-demand bus services. Therefore, larger fleet sizes may reduce operational costs but compromise passenger experience and vehicle utilisation efficiency.

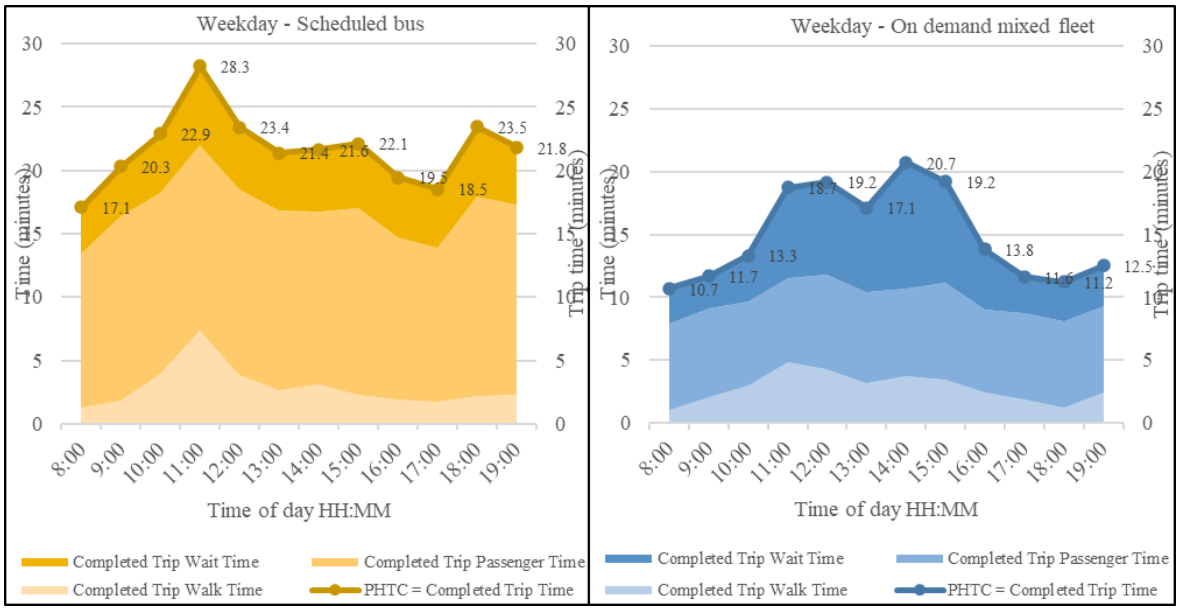
4.2 Comparative evaluations

The comparison between conventional scheduled bus services (Baseline Scenario) and on-demand public transport services (Scenario 2) reveals significant differences in service quality, passenger experience, and operational efficiency.

Service quality and passenger experience

The evaluation of service quality and passenger experience indicates that on-demand services substantially reduce travel times. On weekdays, the average passenger trip duration for on-demand services is 15 minutes, compared to 22 minutes for conventional scheduled buses, a 30% reduction. During off-peak periods, the average travel time drops to 11 minutes for on-demand services versus 23 minutes for scheduled services, reflecting a 52% reduction. These improvements are mainly due to decreased in-vehicle times, shorter waiting periods, and reduced walking distances.

Figure 4: Average passenger trip time for completed trips



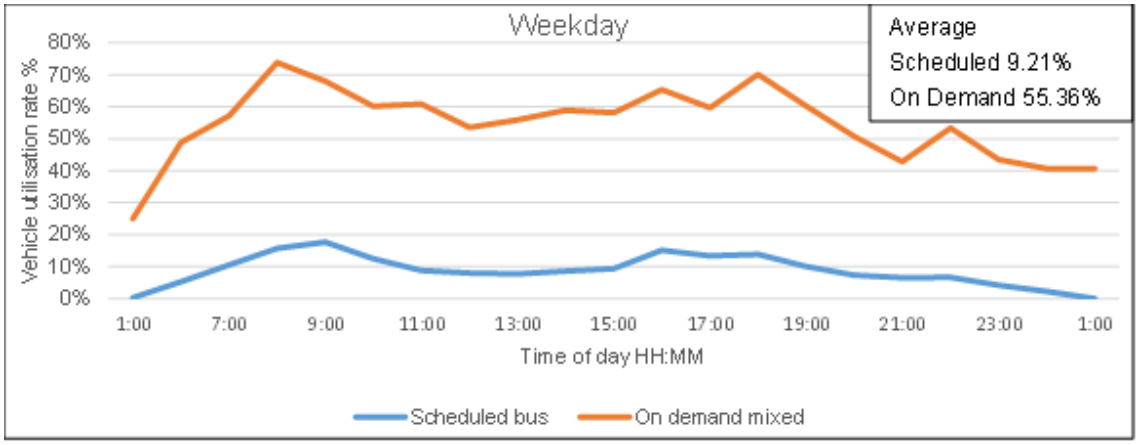
Service efficiency (operator's perspective)

From an operational standpoint, on-demand services present greater efficiency, achieving higher vehicle occupancy rates than conventional fixed-schedule fleets. While average vehicle utilisation for weekday bus services is around 7-8%, on-demand services achieve over 50% vehicle utilisation, even during off-peak periods. During peak periods, vehicle utilisation for on-demand services reaches as high as 74%, indicating that demand-responsive services are more efficient for operators, helping to optimise fleet use.

System efficiency (public benefit)

On-demand services were significantly higher than fixed-schedule bus services in terms of system efficiency and public benefit. A key aspect of this efficiency was the substantial increase in vehicle occupancy for on-demand services. Occupancy rates for scheduled buses were typically low, averaging around 9%, while on-demand services saw occupancy rates increase to over 50%. This improvement in vehicle occupancy maximised the use of available resources and led to more effective use of the fleet, reducing operational costs per passenger and enhancing overall system efficiency.

Figure 5: Hourly vehicle utilisation rate



The assessment indicates that on-demand services can meet the same travel demand while significantly lowering passenger trip times. Especially during peak periods, passenger trip times are reduced by more than 50%, primarily due to shorter waiting times at bus stops (see Figure 6). Despite the need for more vehicles to meet demand, the completed trip bus times for on-demand services are comparable to those of scheduled services, with slight variations depending on fleet size and demand (Figure 7).

Figure 6: Passenger trip time for completed trips

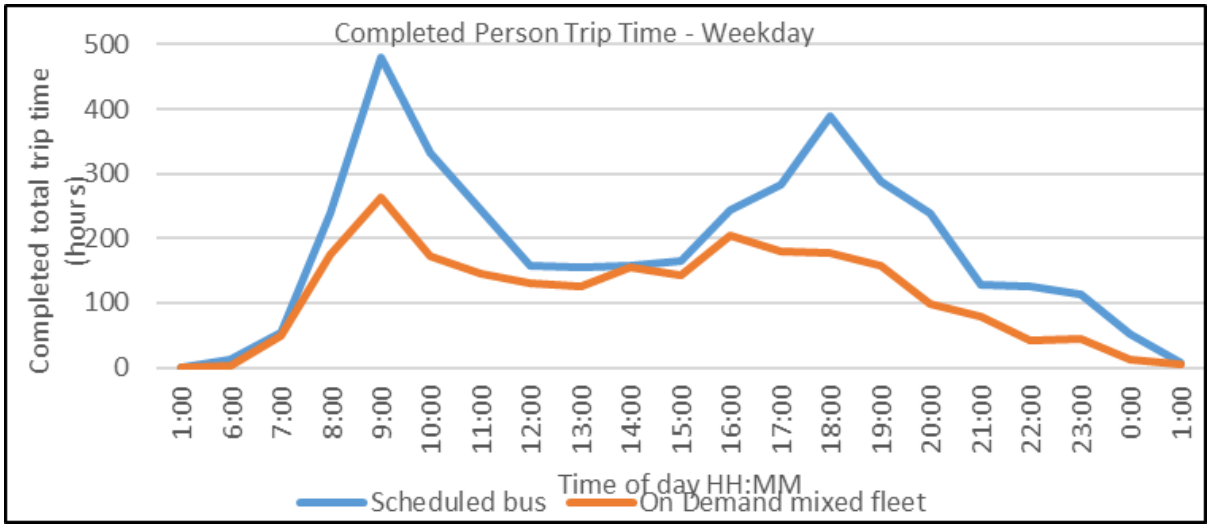
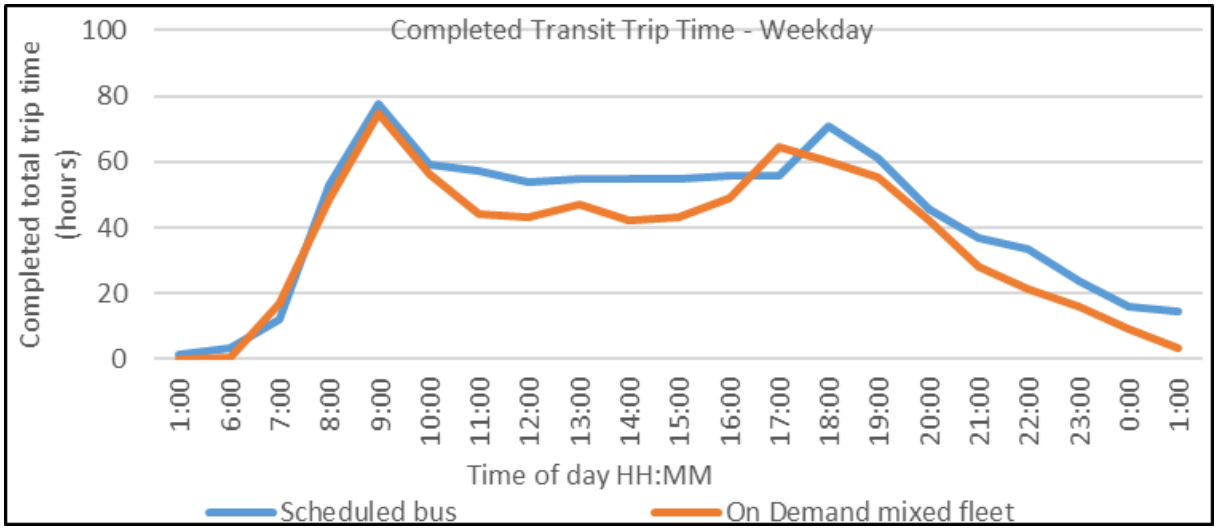


Figure 7: Transit trip time for completed trips



Environmental emissions (CO2, NO, PM10)

The environmental benefits of on-demand services are also significant (Table 2). Compared to scheduled diesel buses, demand-responsive services significantly reduce emissions, with CO2 emissions per person reduced by 74.5%, NO by 90.9%, and PM10 by 71.5%. This substantial reduction in environmental impact highlights the potential of on-demand services as a more sustainable alternative to traditional bus fleets.

Table 2: Environmental emissions

	Weekday		% reduced
	Scheduled	Demand	
CO2 (kg) per person for completed trips	7,445	1,900	74.5
NO (g) per person for completed trips	74,105	6,767	90.9
PM10 (g) per person for completed trips	2,363	672	71.5
CO2 (kg) for completed trips	11,382	3,380	70.3
NO (g) for completed trips	113,254	11,836	89.5
PM10 (g) for completed trips	3,588	1,168	67.5

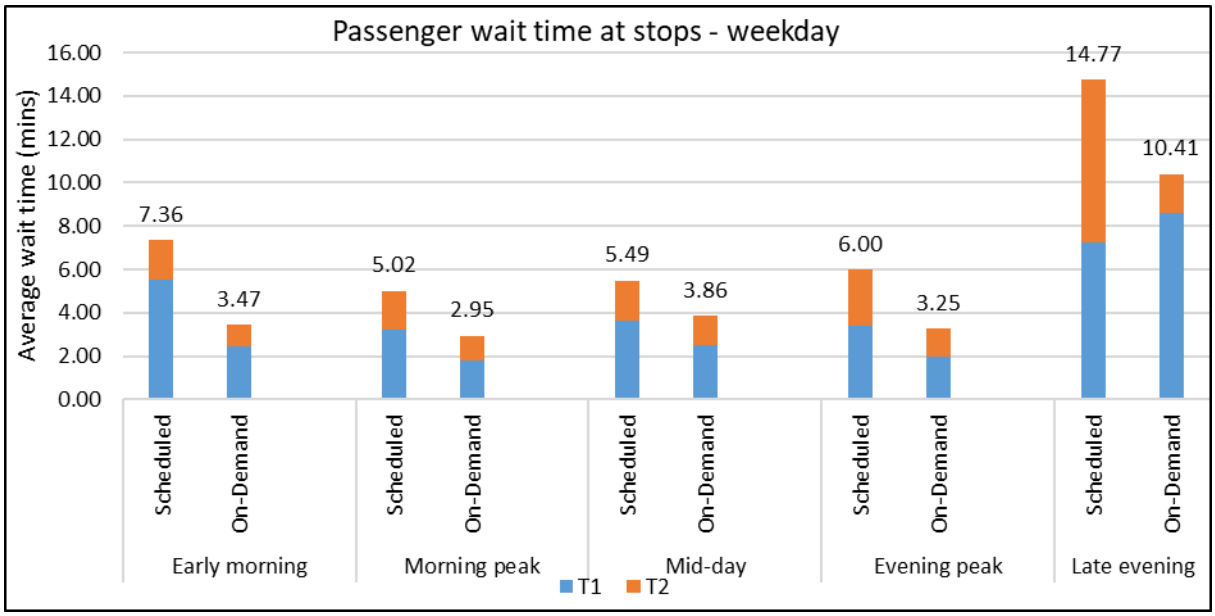
On-time performance (waiting times at bus stops)

On-demand services demonstrate substantially improved on-time performance, with significantly shorter waiting times at bus stops than conventional services (refer to Table 3 and Figure 7). Waiting times during peak periods (morning and evening) are at least 40% lower for on-demand services than scheduled buses. Off-peak waiting times also reduce by around 30%, illustrating the efficiency of on-demand transport, especially during high-demand hours.

Table 3: Total waiting time

Total waiting time (minutes)		5:00AM - 7:00AM (Early morning)	7:00AM - 9:00AM (Morning peak)	9:00AM - 3:00PM (Mid-day)	3:00PM - 6:30PM (Evening peak)	6:30PM - Midnight (Late evening)
Weekday	Scheduled	7.36	5.02	5.49	6.00	14.77
	On-Demand	3.47	2.95	3.86	3.25	10.41
	% difference	52.9%	41.3%	29.8%	45.8%	29.5%

Figure 7: Passenger wait time at stops



In summary, on-demand services substantially improve passenger experience, operator efficiency, and environmental impact compared to conventional scheduled bus services. These findings suggest that demand-responsive transport could be a more effective, sustainable, and customer-friendly solution for urban transit networks, especially during peak and off-peak periods.

5 Conclusions

This study investigates the potential benefits of on-demand services in improving public transport efficiency and passenger experience, in contrast to fixed-schedule bus services within a case study area. The modelling results highlighted that occupancy for fixed-schedule buses was very low, with passenger occupancies rarely exceeding 20%, and over half of the routes underperforming. In comparison, the simulation of on-demand services in various hypothetical scenarios revealed trade-offs between service quality and operational cost-effectiveness. Reducing the number and frequency of services led to cost savings but negatively impacted customer outcomes.

Key findings from the on-demand scenarios compared to fixed-schedule bus services include:

- A 30% reduction in passenger trip times for on-demand services, enhancing service quality and customer satisfaction.
- Vehicle occupancy for on-demand services rose dramatically from 8% for scheduled buses to over 50%, highlighting the operational efficiency of demand-responsive transport.
- A 50% reduction in total passenger trip times, improving system efficiency.
- No significant differences in trip completion rates, bus times, or distances between the service types.
- A significant decrease in total emissions and emissions per passenger trip with on-demand services, highlighting the environmental benefits of on-demand systems.

This study uses smart card data and a data-driven simulation approach to provide valuable insights into the operational and environmental benefits of on-demand transport. It offers insights into these services' operational and environmental impacts. The study also holds significant policy implications, providing evidence to aid policymakers and regulators in evaluating the potential benefits of on-demand services, including cost savings, improved customer experience, and environmental sustainability.

Future research should focus on optimising schedules and vehicle capacities to improve service efficiency and customer experience. Stated preference surveys examining users' socioeconomic and travel characteristics will also be critical in ensuring services are tailored to high-demand locations. Furthermore, predicting short-term passenger demand remains an area for development, with opportunities to leverage AI-based predictive models for more accurate demand forecasting, ensuring the long-term success of on-demand services.

References

Alonso-González, M.J., Liu, T., Cats, O., Van Oort, N., Hoogendoorn, S., 2018. The potential of demand-responsive transport to complement public transport: An assessment framework and an empirical evaluation. Transp. Res. Rec. 2672, 879–889.

Alonso-Mora, J., Samaranayake, S., Wallar, A., Frazzoli, E., Rus, D., 2017. On-demand high-capacity ride-sharing via dynamic trip-vehicle assignment. Proc. Natl. Acad. Sci. 114, 462–467.

Asensio, J., Matas, A., 2008. Commuters' valuation of travel time variability. Transp. Res. Part E Logist. Transp. Rev. 44, 1074–1085.

Atasoy, B., Ikeda, T., Ben-Akiva, M.E., 2015a. Optimising a flexible mobility on demand system. Transp. Res. Rec. 2563, 76–85.

Atasoy, B., Ikeda, T., Song, X., Ben-Akiva, M.E., 2015b. The concept and impact analysis of a flexible mobility on demand system. Transp. Res. Part C Emerg. Technol. 56, 373–392.

Attard, M., Camilleri, M.P.J., Muscat, A., 2020. The technology behind a shared demand responsive transport system for a university campus. Res. Transp. Bus. Manag. 36, 100463.

Autodesk, 2017. Mobility Simulator [WWW Document]. URL http://sustainability.autodesk.com/available-solutions/mobility-simulator/
Azalient, 2013. Commuter [WWW Document]. URL http://www.azalient.com/1.php
Bridj, 2018. Bridj [WWW Document]. URL https://www.bridj.com/journey/ (accessed 12.30.20).
Chan, N.D., Shaheen, S.A., 2012. Ridesharing in North America: Past, present, and future. Transp. Rev. 32, 93–112.
Chandakas, E., 2020. On demand forecasting of demand-responsive paratransit services with prior reservations. Transp. Res. Part C Emerg. Technol. 120, 102817.
Coutinho, F.M., van Oort, N., Christoforou, Z., Alonso-González, M.J., Cats, O., Hoogendoorn, S., 2020. Impacts of replacing a fixed public transport line by a demand responsive transport system: Case study of a rural area in Amsterdam. Res. Transp. Econ. 83, 100910.
Downer, K., 2018. On Demand Transport: Co-designing Tailored Mobility solutions [WWW Document]. URL https://www.keolisdowner.com.au/a-community-winner-keoride-on-demand-public-transport-service-in-mount-barker-nairne-and-littlehampton-extended-till-june-2022/ (accessed 11.2.21).
Duncan, G., 2010. From microsimulation to nanosimulation: visualising person trips over multiple modes of transport. Transp. Res. Rec. 2175, 130–137.
Edwards, D., Elangovan, A.K., Watkins, K., 2012. Reaching low-density urban areas with the network-inspired transportation system, in: 2012 15th International IEEE Conference on Intelligent Transportation Systems. IEEE, pp. 826–831.
EU-Japan Centre, 2021. On-Demand Public Transport | Shotl X Odakyu Electric Railway. [WWW Document]. URL https://www.eu-japan.eu/publications/demand-public-transport-shotl-x-odakyu-electric-railway (accessed 4.22.20).
Frei, C., Hyland, M., Mahmassani, H.S., 2017. Flexing service schedules: Assessing the potential for demand-adaptive hybrid transit via a stated preference approach. Transp. Res. Part C Emerg. Technol. 76, 71–89.
Giuffrida, N., Le Pira, M., Inturri, G., Ignaccolo, M., 2021. Addressing the public transport ridership/coverage dilemma in small cities: A spatial approach. Case Stud. Transp. policy 9, 12–21.
Goodwill, J.A., Carapella, H., 2008. Creative ways to manage paratransit costs: final report, July 2008 [summary]. National Center for Transit Research (US).
Gray, L., 2016. What Killed Kutsuplus? 3 Takeaways for Cities Pursuing Mobility-On-Demand [WWW Document]. URL https://sharedusemobilitycenter.org/killed-kutsuplus-3-takeaways-cities-pursing-mobility-demand/ (accessed 4.22.21).
Hawas, Y.E., Khan, M., Basu, N., 2012. Evaluating and enhancing the operational performance of public bus systems using GIS-based data envelopment analysis. J. Public Transp. 15, 2.
Hawkins, A.J., 2019. Ford's On-demand Bus Service Chariot Is Going Out of Business [WWW Document]. Verge. On-line Mag. URL https://www.theverge.com/2019/1/10/18177378/chariot-out-of-business-shuttle-microtransit-ford (accessed 3.30.21).
Hazan, J.; Wegscheider, A.; Fassenot, B., 2019. On-Demand Transit Can Unlock Urban Mobility [WWW Document]. URL https://www.bcg.com/en-au/publications/2019/on-demand-transit-can-unlock-urban-mobility.aspx (accessed 1.23.20).
Hu, X., Zhao, L., Wang, W., 2015. Impact of perceptions of bus service performance on mode choice preference. Adv. Mech. Eng. 7, 1687814015573826.
Inturri, G., Giuffrida, N., Ignaccolo, M., Le Pira, M., Pluchino, A., Rapisarda, A., 2018. Testing demand responsive shared transport services via agent-based simulations, in: New Trends in Emerging Complex Real Life Problems. Springer, pp. 313–320.
Ipart, 2020. OPAL FARES 2020-2024: ON-DEMAND BUS FARES [WWW Document]. URL https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/pricing-reviews-transport-services-publications-opal-public-transport-services-to-june-2024/information-paper
Kathuria, A., Parida, M., Sekhar, C.R., 2019. A review of service reliability measures for public transportation systems. Int. J. Intell. Transp. Syst. Res. 1–13.
Kaufman, R., 2016. Chasing the Next Uber—Next City: Which City Will Be the First to Crack on-Demand Mobility? [WWW Document]. URL https://nextcity.org/features/view/helsinki-kutsuplus-on-demand-transportation-m obility-next-uber (accessed 10.17.20).
Linda, S., 2003. Can public transport compete with the private car? IATSS Res. 27, 27–35.
Liyanage, S., Dia, H., 2020. An agent-based simulation approach for evaluating the performance of on-demand bus services. Sustainability 12, 4117.
Liyanage, S., Dia, H., Abduljabbar, R., Bagloee, S.A., 2019. Flexible mobility on-demand: An environmental scan. Sustain. 11. https://doi.org/10.3390/su11051262

Mageean, J., Nelson, J.D., 2003. The evaluation of demand responsive transport services in Europe. J. Transp. Geogr. 11, 255–270.
Mohamed, M.J., Rye, T., Fonzone, A., 2019. Operational and policy implications of ridesourcing services: A case of Uber in London, UK. Case Stud. Transp. Policy 7, 823–836.
Pettersson, F., 2019. An international review of experiences from on-demand public transport services. K2 working paper.
PTV, 2019. PTV, Public Transport Victoria [WWW Document]. URL https://www.ptv.vic.gov.au/timetables (accessed 9.23.19).
Public Transport Users Association, 2019. Myth: Replacing 'underperforming' buses with microtransit will save money and be better for passengers [WWW Document]. Victoria, Aust. URL https://www.ptua.org.au/myths/taxibus/ (accessed 4.24.21).
Rissanen, K., 2016. Helsinki Regional Transport Authority (HSL) [WWW Document]. URL https://www.hsl.fi/en/hel sinki-regional-transport-authority (accessed 9.6.20).
Shaheen, S., Cohen, A., 2020. Mobility on demand (MOD) and mobility as a service (MaaS): early understanding of shared mobility impacts and public transit partnerships, in: Demand for Emerging Transportation Systems. Elsevier, pp. 37–59.
Shamshiripour, A., Rahimi, E., Shabanpour, R., Mohammadian, A.K., 2020. Dynamics of travelers' modality style in the presence of mobility-on-demand services. Transp. Res. Part C Emerg. Technol. 117, 102668.
Sharmeen, F., Meurs, H., 2019. The governance of demand-responsive transit systems—A multi-level perspective, in: The Governance of Smart Transportation Systems. Springer, pp. 207–227.
Sulopuisto, O., 2016. Why Helsinki's Innovative On-Demand Bus Service Failed. Citiscope [WWW Document]. URL http://citiscope.org/story/2016/why-helsinkis-innovative-demand-bus-service-failed (accessed 4.10.21).
Tim Bennett, 2019. Keoride: The future of on-demand transport? [WWW Document]. Futur. Cities. URL https://www.goget.com.au/blog/keoride-the-future-of-on-demand-transport/ (accessed 4.20.21).
Transport for NSW, 2021. Keoride case study [WWW Document]. URL https://www.transport.nsw.gov.au/data-and-research/nsw-future-mobility-prospectus/nsw-future-mobility-case-studies/procurement-as-3 (accessed 4.23.21).
Tsoukanelis, A., Genitsaris, E., Nalmpantis, D., Naniopoulos, A., 2018. Conjoint analysis for optimising a potential flexible transport service (FTS) in the region of Zagori, Greece, in: The 4th Conference on Sustainable Urban Mobility. Springer, pp. 478–486.
VISTA, 2021. Victorian Integrated Survey of Travel and Activity [WWW Document]. URL https://transport.vic.gov.au/about/data-and-research/vista (accessed 9.14.21).
World population review, 2021. World Population Review [WWW Document]. URL https://worldpopulationreview.com/world-cities/melbourne-population (accessed 11.7.21).
Zhou, Y., Yao, L., Chen, Y., Gong, Y., Lai, J., 2017. Bus arrival time calculation model based on smart card data. Transp. Res. Part C Emerg. Technol. 74, 81–96.