

Satisfaction with authority and 3rd party provided smartphone public transport information apps

Mitchell Elzink¹, Graham Currie² and James Reynolds²

¹Department of Civil Engineering, Monash University

²Public Transport Research Group, ¹Department of Civil Engineering, Monash University

Email for correspondence (presenting author): graham.currie@monash.edu

Abstract

This paper explores user satisfaction with public transport apps including both Authority provided apps and 3rd party apps in Melbourne Australia. 5 key apps are available; the PTV app, tramTRACKER, Google Maps, Arevo, Citymapper and Moovit. App user ratings available in android and apple platforms rate CityMapper, Moovit and Google Maps highest and the PTV and tramTRACKER lowest. A study of strengths and weakness of these identified MYKI Top Up and Real Time data as key strengths of the PTV App. While ease of use was highlighted for Google Maps, Moovit and Citymapper. Weaknesses of the PTV map were concerns about app crashes, poor bus location data, app bugs and problems and difficulty in using the interface. The tramTRACKER app had many similar concerns.

A survey of app users found that 45% use these smartphone apps to plan public transport travel. Most had very high awareness of the PTV, tramTRACKER and Google Maps apps. The others had a very low awareness level. Some 86% of respondents had used the Google Maps and PTV App; 54% had used tramTRACKER. Between 8% and 15% had used the other Apps. User ratings of the apps ranked Google Maps highest followed in order by the PTV App and then tramTRACKER. Of the others Arevo was ranked 4th and CityMapper 5th.

A performance analysis of the top 3 apps found a strong link between app feature importance and performance for the Google Maps App, however this app lacked MYKI Top Up and Fare information features. For the PTV App a lack of traffic tracking features, inability to use offline without Wi-Fi, lack of bike route information and lack of international city info were highlighted as concerns.

Overall the study has found strengths and weakness in all apps though Google Maps is a strong and popular alternative to the government run app (PTV) and government operator run app tramTRACKER.

Implications for policy and research are suggested.

1. Introduction

The rapid emergence of smart phone technologies has enabled improvements in public transport information provision for passengers. Smartphone transit apps have allowed for a more efficient way for public transit agencies to distribute customer information (Schweiger C.L., 2011). These apps allow authorities to provide information to customers directly, without the need for costly infrastructure (Cham L. et al., 2006). In Victoria, a range of third-party private companies and public sector organisations now provide these apps for travel users. However, this ease of transport information provision has posed various problems for public transit authorities. Which of these third-party apps, if any, should public transport authorities promote?

This paper explores user satisfaction with public transport apps including both Authority provided apps and 3rd party apps which are also used for providing information and trip planning. The research focusses on a study of public transport apps used in Melbourne Australia via an online survey of preferences. It also collates information on app usage from available sources and explores what users think about Government authorities promoting apps provided by 3rd parties.

The paper is structured as follows; the research context is outlined next; this outlines key research literature and explores public transport apps available in Melbourne including data on rating of these apps from secondary sources. The approach to the user survey is then outlined. Results then follow including a review of survey sampling outcomes and findings relative to the key research questions. The paper concludes with a summary and observations on the implications for practice and future research in this field.

2. Research context

2.1. Literature review

Ever since the rise of smartphone ownership, smartphone transit apps have provided an efficient way of communicating public transport data and information to customers (Schweiger C.L., 2011). The technology for app provision is based on data provided by authorities on a now widely accepted standard called the General Transit Feed Specification (GTFS) System. This system was devised by the trip planning service Google Transit in 2005 (Roth M, 2012). According to Barbeau S.J and Antrim A (2013), the GTFS system has become the standard format of public transport data in the world; with over 261 transit agencies worldwide providing the data to the general public. Barbeau S.J and Antrim A (2013) suggest that in order to enable good data provision practices to travellers, the GTFS datasets must be firstly created and then maintained by the relevant public transit authorities. In Victoria, the responsibility for this hence lies with the DoT. This GTFS data can then be used as input data by public sector and private third-party public transport information apps and communicated to users.

Smartphone transit apps have a variety of benefits to both public transport authorities and society. According to Bian et al. (2022), these transit apps provide significant user benefits spanning from increased perceived reliability of services, improved perceived user safety, reduced network wait times and ridership boosts. However, it must be noted that this study was limited as it failed to properly evaluate the effects on infrequent riders; the sorts of users that may be inclined to utilise public transport information apps more regularly due to lack of prior experience. Further research into this area, may be able to feature in this study and presents a significant gap in the existing literature.

Alternatively, despite the various user benefits of these apps, Zhang et al. (2020) identified the potential for smartphone induced transport inequality. This could ultimately result in unequal access to public transport information across different users. Papangelis et al. (2016) uncovered further technologically induced inequities for rural users; due to their lower levels of computer-based skills. Despite these disadvantages, Barbeau S.J and Antrim A (2013) outline a number of key user and societal advantages which may outweigh these previous concerns. They highlight that these public transport information apps provide public transport users with the ability for multi-modal trip planning. This means that users can easily combine methods of transportation such as trains, buses, trams, and other forms under one trip. Additionally, these apps allow for system timetable creation and adjustments by authorities and allow agencies to obtain real-time network user information. This gives authorities greater control over the public transport network. Overall, these apps allow for greater data sharing amongst user and public transport authorities and 3rd party providers of apps.

Published research has also considered what makes a good app is also crucially important to users. According to Flora et al. (2014), there are a number of factors which generally lead to a successful mobile application. In essence, a mobile app should provide good user experiences, an easy-to-use user interface and be able to be integrated alongside other apps (Flora et al., 2014). Additionally, apps should be responsive and able to be personalised by users. Flora et al. (2014) also posit that apps should be constructed in a manner whereby strong feedback loops provide error notifications to developers which can be acted upon to address bugs and issues for users. These app features for a successful app will help in the analysis of the apps available on the Victorian market, potentially allowing for the apps to be ranked which is a current gap in the DoT's public transport app knowledge.

2.2. Victorian smartphone apps and their use

Table 1 summarises the public transport smartphone information apps available for use in Melbourne. Essentially, there are two types of public transport information apps in Melbourne; the first type of app is the public sector app ; the PTV app sponsored by the Victorian Department of Transport and Planning. The second type of apps are the third-party private sector apps which are privately owned and developed by entrepreneurial app developers. These private apps can be further broken down and categorised into three categories. Firstly, there are the domestic apps like Arevo which are developed in Victoria specifically for Victorians. Secondly, there are the operator-based apps like tramTRACKER which is run by Melbourne's licensed tram company Yarra Trams. Finally, there are the international apps which have been developed overseas and applied to the Victorian market. Examples of these include Citymapper, Moovit and Google Maps. Each of these apps exhibit a range of different features and these are summarised in Table 3 below.

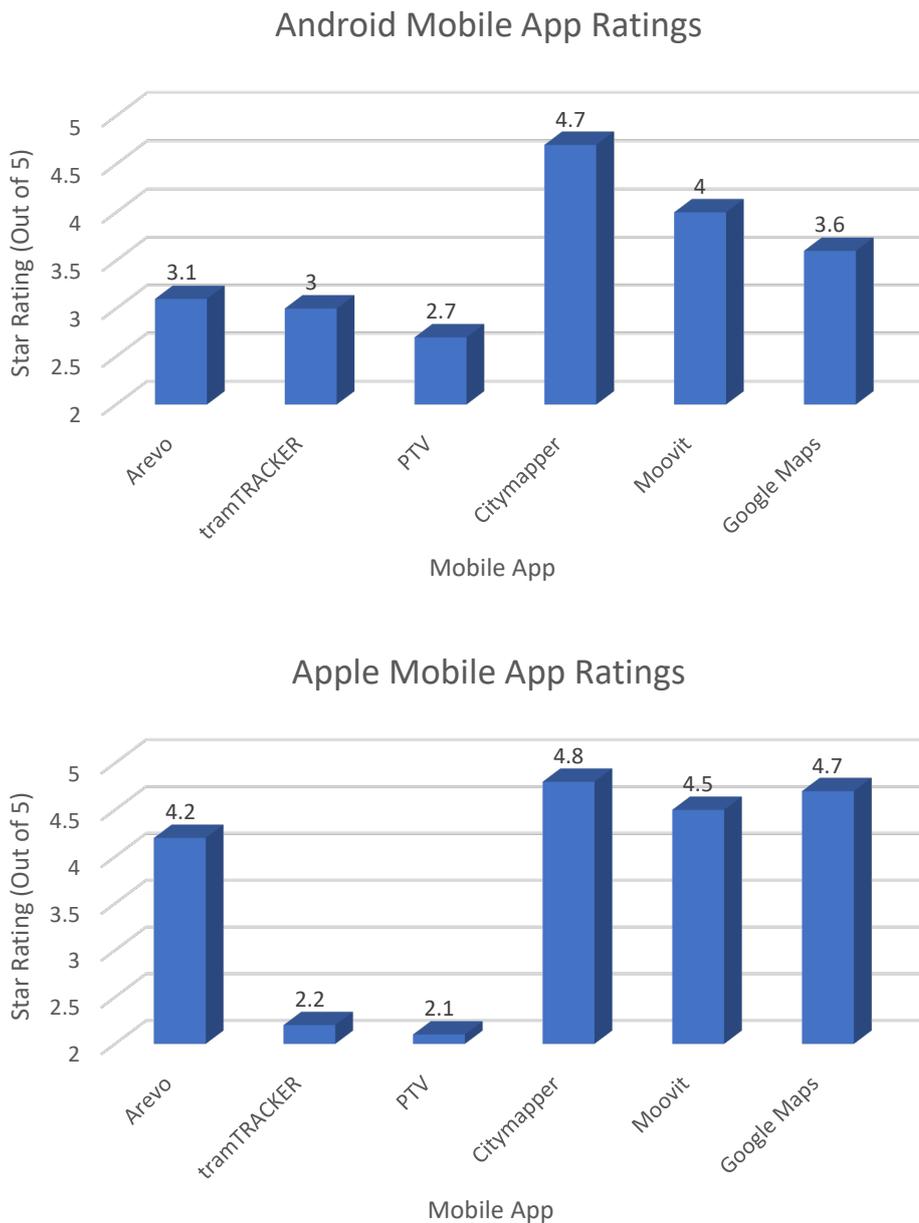
Figure 1 summarises data on app user rating of these apps from Android phone platforms and Apple phone platforms. The Google Play Store allows for users to provide reviews of particular Android platform apps and a five-star rating (top graphic). Here, one star can be provided for a poor app and five stars for a great one. It can be observed that the international apps perform better than their domestic counterparts, with Citymapper ranking the highest with an average rating of 4.7. The only public sector sponsored app, PTV, performs the poorest on this occasion. A large discrepancy can be observed between the international and domestic apps. With the PTV being the lowest rank app by a considerable margin this may support the case for the promotion of private third-party apps by the public transit authorities.

Figure 1 (bottom) provides the rating data from the Apple Store for Apple platform smartphone users.

Table 1: Melbourne public transport smartphone apps

App	Provider	Key Features	URL
<p>PTV</p> 	Public Sector	<ul style="list-style-type: none"> • 9 modes of transport including train, bus, regional train, regional coach, SkyBus, walking, cycling & driving • Ability to distribute real-time public transport information regarding delays & route changes • Links to Myki accounts allowing users to make trip payments • Provides journey cost estimates • Can view live tracking of buses and trains on a virtual map 	https://www.ptv.vic.gov.au/footer/about-ptv/digital-tools/mobile-apps/
<p>tramTRACKER</p> 	Public/Private Sector Operator	<ul style="list-style-type: none"> • Provides predicted tram arrival time, disruption updates & information about Melbourne's tram network • Bespoke app developed by the commercial tram company for public use 	http://tramTRACKER.com/
<p>Google Maps</p> 	Private Sector International	<ul style="list-style-type: none"> • Satellite imagery, aerial photography, street maps, panoramic street views, real-time traffic conditions, trip planning for travel via car, bike, foot, air or public transport • Provides density data for crowdedness of public transport services 	https://maps.google.com/
<p>Arevo</p> 	Private Sector - Domestic	<ul style="list-style-type: none"> • Variety of transport options including public transport, driving, walking or bike riding • Provides information on the types of bike routes available alongside car parking and petrol prices 	https://arevo.com.au/aboutus
<p>Citymapper</p> 	Private Sector International	<ul style="list-style-type: none"> • Provides navigation between two points in a city • Includes real-time navigation options • Possesses a calorie counter • Displays estimated costs of various transport options and the costs of rideshare services such as Uber 	https://citymapper.com/melbourne?lang=en
<p>Moovit</p> 	Private Sector International	<ul style="list-style-type: none"> • Features mobile route options including train, bus, ferry, bike and ride-share • Provides bike routes which incorporate real-time updates on bike docking stations 	https://moovitapp.com/melbourne-2803/poi/en-gb

Figure 1: Smartphone public transport information app user ratings (mid 2022)



Once again, a trend can be defined with the international apps all outperforming the domestically created ones in Victoria. Arevo scores significantly higher at 4.2 than its 3.2 on the Android platform. However, once more the public sector PTV app ranks the lowest with a score of 2.1 out of 5.

Clearly these findings provide a useful context to explore what factors users like and don't like about these apps. This is the focus of the app user survey.

3. Research methodology

Two research methods were undertaken including :

1. a textual analysis of online feedback about the performance of apps
2. an online survey of app users

3.1. User app review textual analysis

App users provide reviews of each of the apps they use. A random sample size of 160 user app reviews from each of the apps was selected. This, sought to gain a qualitative insight into the user perceptions of apps via a textual analysis with the computational program NVivo. The NVivo analysis was adopted in order to identify the key strengths and weaknesses of each of the apps, whilst also identifying which app features were important to users.

3.2. App user online survey

The survey sought to measure app users:

- a. Awareness and use of each smartphone public transport apps
- b. App frequency and purpose of use
- c. Views on app feature importance
- d. Views on app feature performance
- e. Comparative ranking of apps
- f. Views on PTV promotion of 3rd party apps

The Questionnaire is included in Attachment A. A major feature of the design of the questionnaire was the adoption of an Importance/Performance Analysis framework (IPA) to rate app features in terms of both importance and performance (Currie and Delbosc, 2015).

The questionnaire was loaded into an online data collection platform (Qualtrics) hosted by Monash University. The questionnaire took broadly 10-15 minutes to complete. The questionnaire was reviewed and achieved ethical compliance for administration via the Monash University Human Ethics Team (Project 25146). It only sampled respondents aged over 18 years of age.

Sampling for the survey used social media marketing/broadcasting of the sample link using email, LinkedIn, Twitter and direct contact with public transport interest groups including Public Transport Victoria.

4. Results

4.1. User app review textual analysis

Table 2 summarises the strengths and weakness of the apps identified from the textual analysis of user ratings. In general trend, PTV app users were most pleased with the Myki top-up feature and access to real-time network data. International apps Citymapper and Moovit were praised for their user interfaces which was the most important feature for a successful app according to Flora et al. (2014).

The PTV app had the greatest number of disadvantages identified by users. There are four major disadvantages ; app crashes, bugs, bus location tracker inaccuracies and the app being too time consuming due to its large number of features. It is likely that these weaknesses of the PTV app, explain why the PTV app was rated as the worst app available to Victorians by both Apple and Android mobile users in Figure 1.

The tramTRACKER app shared most of the problems identified with the PTV app but was also noted to have issues with trams disappearing in the app. App crashes were not noted with the other apps (excluding PTV). However, a scattering of other problems existed; a lack of route options was noted with Arevo while provision of bike routes that are unsafe was noted for Arevo and Citymapper. Google Maps and Moovit had few weaknesses noted in app reviews. Voice navigation was mentioned as an issue for Google Maps while intrusive advertising was noted with Moovit.

Table 2: Apps strengths/weaknesses – textual analysis of app user feedback (2022)

Strength/ Weakness	Arevo	tramTRACKER	PTV	Citymapper	Moovit	Google Maps
Strengths						
<i>Good bike route options</i>	X					
<i>Enables effective MYKI top-up</i>	X		X			
<i>Network real-time data</i>			X			
<i>International Usage</i>				X	X	X
<i>Easy to use user interface</i>				X	X	
<i>Live traffic tracking features</i>						X
Weaknesses						
<i>Fails to provide multiple route options, often only offering the shortest route</i>	X					
<i>Diverts users to Google Maps</i>	X					
<i>Bike routes that are unsafe</i>	X			X		
<i>Issues surrounding app crashes</i>		X	X			
<i>Problems reported with the tram register, with tram services often being delayed, cancelled or disappearing from app</i>		X				
<i>Bus location tracker inaccuracies</i>			X			
<i>App bugs & problems surrounding updates</i>		X	X			
<i>App has too many features and is thus time too time consuming</i>			X			
<i>Inaccuracies surrounding trains and the train timetables</i>				X		
<i>Users are inundated with advertisements, making the app slow and time consuming</i>					X	
<i>Voice navigation issues</i>						X

4.2. App user online survey results

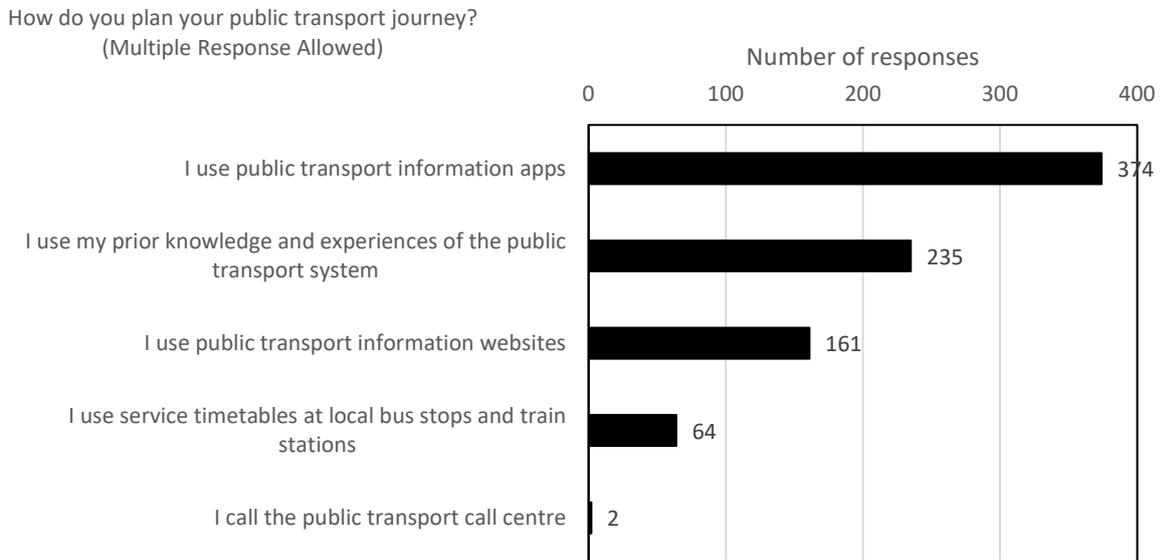
After checking survey responses for quality. Some 456 total valid responses were adopted for analysis. The following results summarize findings in relation to:

- Approaches adopted for journey planning
- App Awareness
- App usage
- App use frequency
- App rankings
- App Performance - strengths/weaknesses (importance performance analysis)
- Views on PTV promotion of 3rd Party Apps.

4.2.1. Approaches adopted for journey planning

Figure 2 shows the consolidated responses for the question regarding approaches used to plan respondents’ journeys. Some 45% said smartphone apps were their main approach followed by prior/existing experience. On line websites were used by 19%. Only 8% used timetables at local stops/stations while less than 1% use call centers. Smartphone apps clearly dominate as a trip planning tool in Melbourne public transport system.

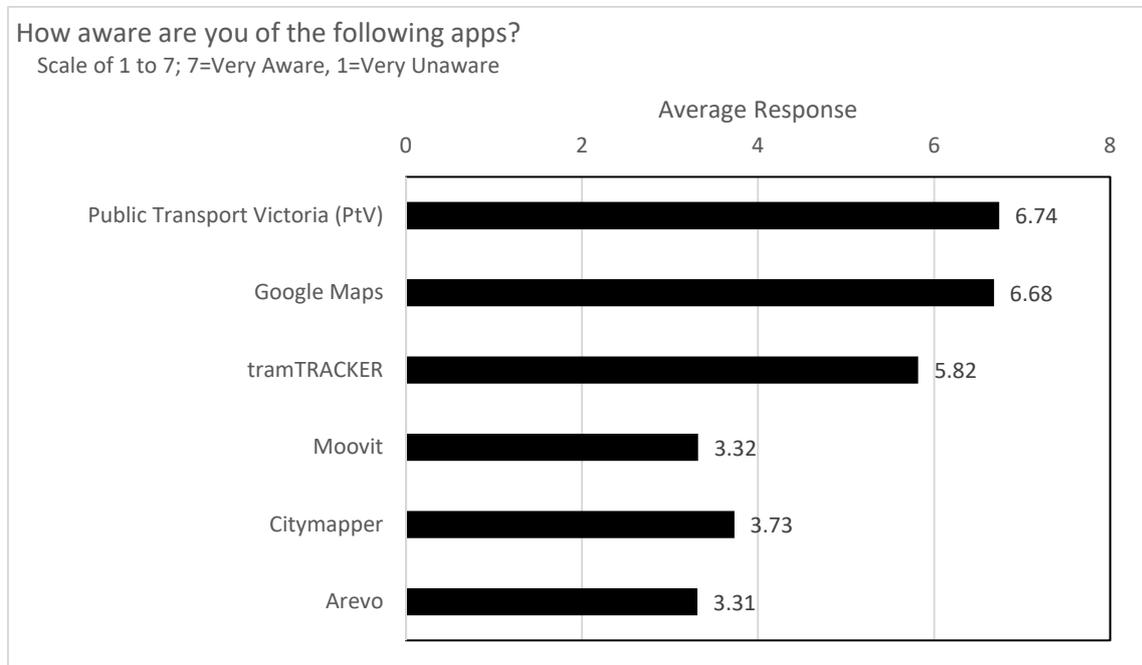
Figure 2: Approaches adopted to plan journeys



4.2.2. App awareness

Figure 3 illustrates responses on app awareness

Figure 3: App awareness



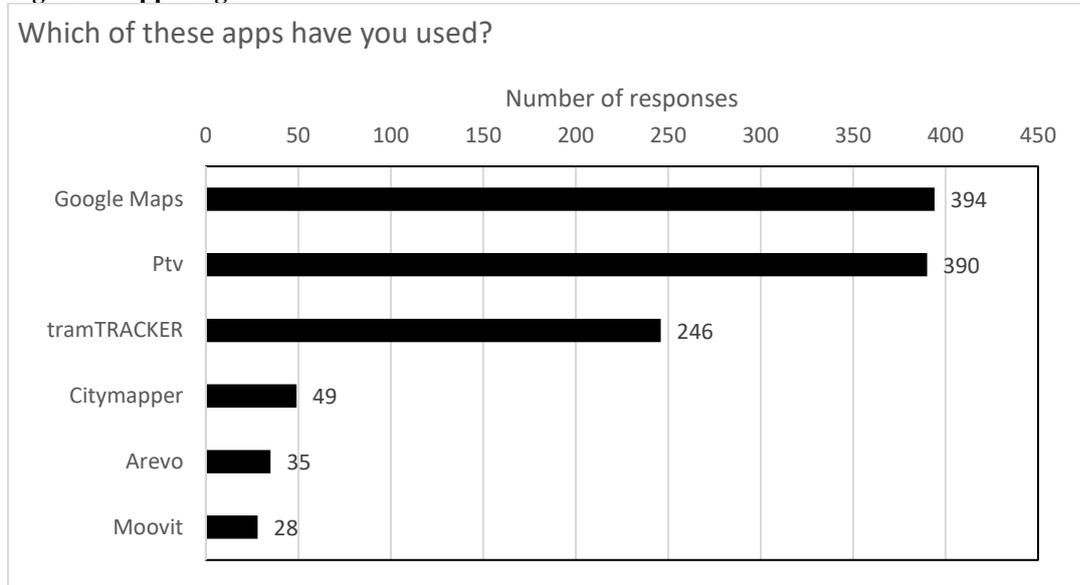
The PTV and Google Maps and tramTRACKER Apps have the highest awareness followed by Arevo, Citymapper and Moovit have the lowest awareness. Google Maps awareness is likely based on the substantive market penetration of google into everyday life activities. The PTV and tramTRACKER are localized apps promoted by Government and the Transit

operators. The lower awareness of the other 3 apps appears related to the lack of google and local operator promotion.

4.2.3. App usage

Figure 4 illustrates responses on app usage.

Figure 4: App usage



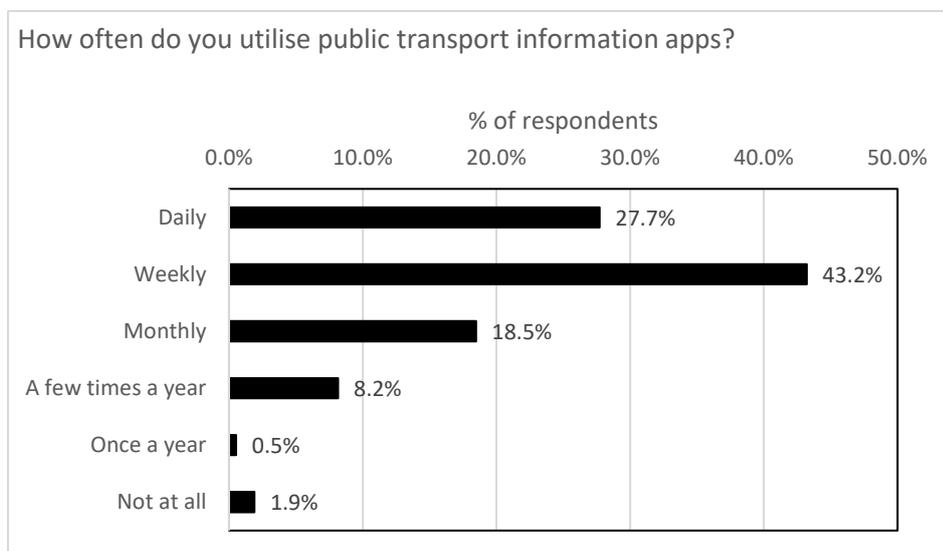
Note: multiple responses permitted

Some 86% of responses had used both Google Maps and the PTV App; slightly more had used Google Maps. Moovit had only been used by 8% of respondents. TramTRACKER by just over half (54%).

4.2.3. App use frequency

Figure 5 illustrates responses on app use frequency.

Figure 5: App use frequency



Over 70% of respondents use public transport information apps weekly or more frequently. Very few (1.9%) don't use them at all. Apps are clearly used frequently by the majority of users.

4.2.4. App rankings

Table 3 shows the average app rankings for each app (1= best, 6 = worst).

Table 3: Average app rankings (1=Best, 6=Worst)

App	Mean Rating (1=best 6=worst)	Rank
Google Maps	1.83	1
PTV	2.13	2
tramTRACKER	3.18	3
Arevo	4.17	4
Citymapper	4.36	5
Moovit	5.32	6

Google Maps is rated highest closely followed by the PTV App. tramTRACKER is third and the others rated below this. Arevo, Citymapper and Moovit have very low ratings.

4.2.5. App performance

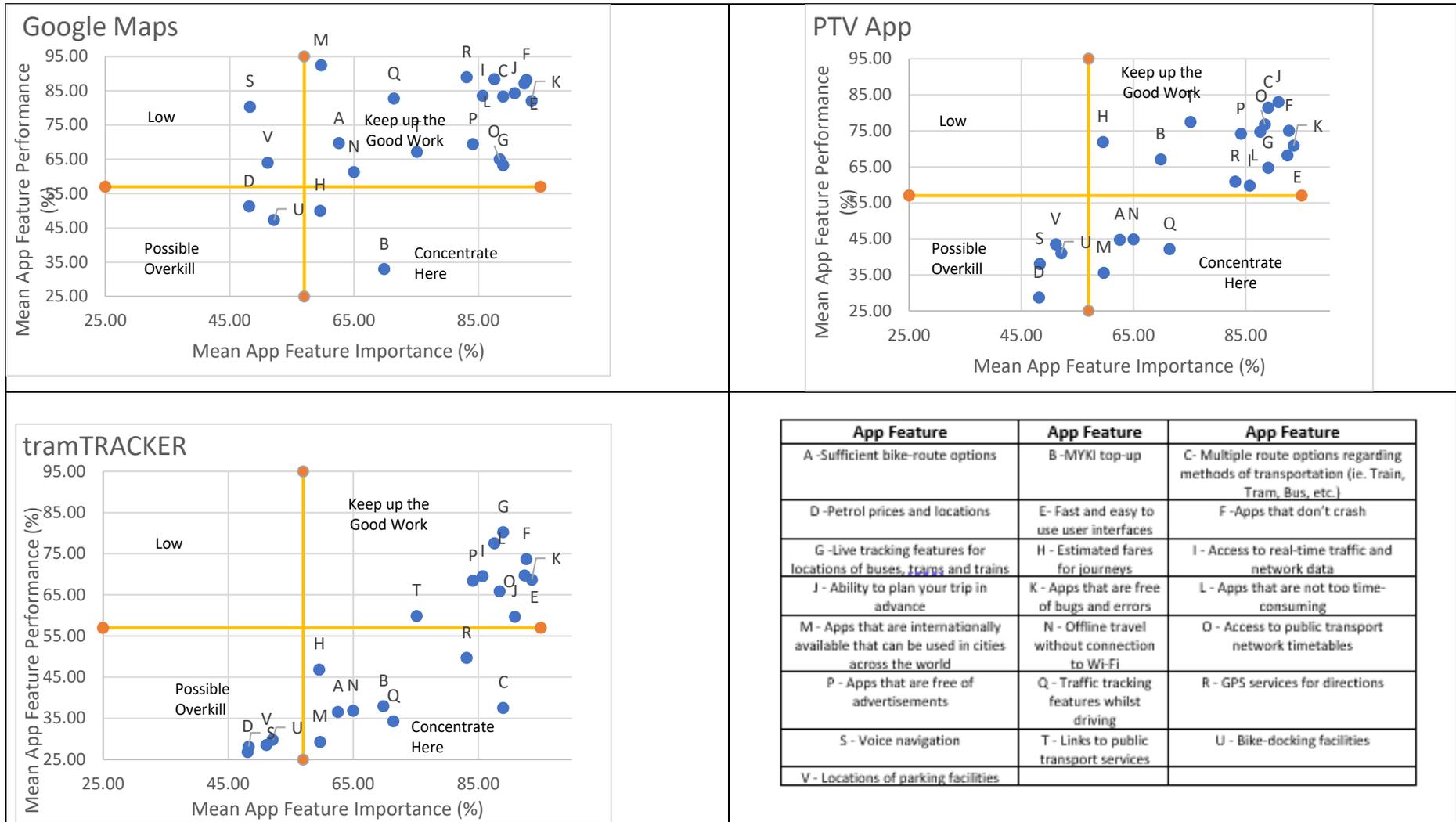
Figure 6 presents the results of the performance analysis for the top 3 main apps; Google Maps, PTV and tramTRACKER. Here an importance performance mapping is undertaken for each app with the app features being assessed are shown in the key on the graphic. In general, the Google Maps app has a larger number of high importance features which perform well. Only item B MYKI Top Up is important and performance poorly for the Google Maps app as this is not available (its only available on the PTV App). Google Maps also has item H Estimates of Fares for Journeys which is considered slightly important and doesn't performance well as fares are not estimated in Google Maps.

The PTV App analysis identified 4 App Features which have above average important but below average performance. Item Q Traffic Tracking Features while driving was rated as of medium importance but didn't perform well on the PTV App. Clearly this is not so important for users who only travel by public transport but there are many multi-modal car-PT travellers who like this feature which is mainly provided by Google Maps. Item N Offline travel without Wi-Fi was also important for PTV App users but is not provided for. Item A Sufficient bike-route option was also noted as this also isn't provided for. Lastly item M Apps that are internationally available had slightly above average importance but very low performance as this isn't provided by the PTV App.

The tramTRACKER app had the most features in the high important low performance category (8 were identified by users). The ones with highest priority are item C; Multiple Route Options regarding methods of transport, R GPS Services for directions, Q Traffic Tracking Features while driving and N Offline travel without Wi-Fi were identified.

Overall this analysis suggests that all apps have features which could be improved. However, the PTV and tramTRACKER apps have specific areas where their features can be improved.

Figure 6: Importance performance analysis results for google maps, PTV and tramTRACKER Apps



4.2.5. Views on PTV promotion of 3rd party apps

Two questions explored users own opinions on whether government authorities should promote 3rd party apps either on board vehicles at stops/stations or on their public transport websites.

Figure 7 shows the results for the question “I am more likely to utilise apps that are promoted by the Victorian Department of Transport”. Overall 59% agreed either strongly or somewhat. 26% neither agreed or disagreed the rest disagreed mainly somewhat.

Figure 7: Likelihood of using apps promoted by the victorian department of transport

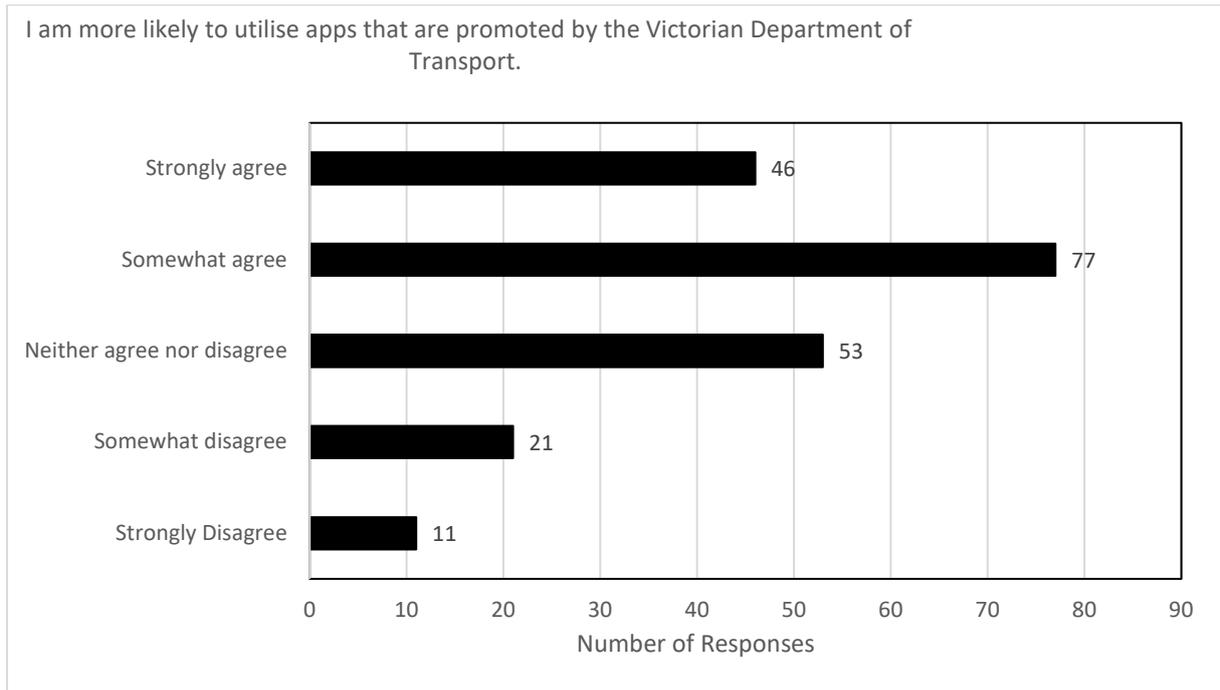
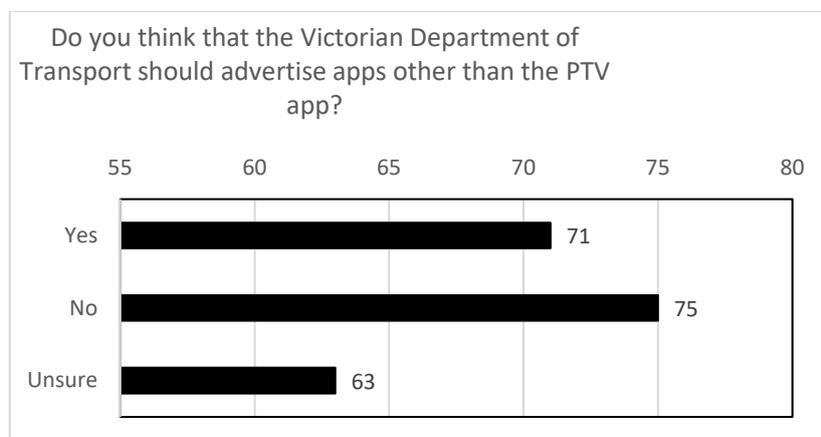


Figure 8 shows responses to the question “Do you think that the Victorian Department of Transport should advertise apps other than the PTV app?”.

Figure 8: Should the Victorian DoT advertise apps other than their own



Some 34% thought they should but a larger share (36%) thought they should not; the remainder (30%) were unsure.

6. Discussion and conclusions

This paper explores user satisfaction with public transport apps including both Authority provided apps and 3rd party apps which are also used for providing information and trip planning. The research focusses on a study of public transport apps used in Melbourne Australia via an online survey of preferences. It also collates information on app usage from available sources and explores what users think about Government authorities promoting apps provided by 3rd parties.

Overall, the research finds that there are 5 key apps available in Melbourne; the PTV app provided by the State Government, the tramTRACKER App provided by the Government Operator, Yarra Trams and 4 3rd party apps provided by Google Maps, Arevo, Citymapper and moovit. Of the later only Arevo is a domestic system the others provide services in many countries. App user ratings available in android and apple platforms rate CityMapper, Moovit and Google Maps highest and the PTV and tramTRACKER lowest. A study of strengths and weakness of these apps from these online user ratings identified MYKI Top Up and Real Time data as key strengths of the PTV App. While ease of use was highlighted for Google Maps, Moovit and Citymapper. Weaknesses of the PTV map were concerns about app crashes, poor bus location data, app bugs and problems and difficult to use interface. tramTRACKER shared many of these and similar concerns.

A survey of app users found that 45% use these smartphone apps to plan public transport travel. Most had very high awareness of the PTV, tramTRACKER and Google Maps apps. The others had a very low awareness level. Some 86% of respondents had used the Google Maps and PTV App; 54% had used tramTRACKER. Between 8% and 15% had used the other Apps. Use ratings of the apps ranked Google Maps highest followed in order by the PTV App and then tramTRACKER. Of the others Arevo was ranked 4th and CityMapper 5th.

A performance analysis of the top 3 apps found a good link between app feature importance and performance for the Google Maps App, however this apps lacked MYKI Top Up and Fare information features. For the PTV App a lack of traffic tracking features, inability to use offline without Wi-Fi, lack of bike route information and lack international city info were highlighted as concerns. Respondents suggested that tramTRACKER had a large number of important features with poor performance. The main ones were lack of multiple route/mode options, lack of GPS services for directions, lack of traffic tracking features while driving and no services while offline without Wi-Fi.

Respondents were also asked to provide their views on state government promotion of 3rd party apps. Some 59% suggested they were more likely to use apps promoted by government. However only 34% thought the government should promote 3rd party apps while 36% thought they shouldn't.

Overall the study has found strengths and weakness in all apps though Google Maps is a strong and popular alternative to the government run app (PTV) and government operator run app tramTRACKER. The other apps have low share and awareness. There are important messages in these results for all app providers as these weaknesses can be targeted for improvement.

So, should the government promote 3rd party apps? Certainly, the popularity of some of these apps seems relevant; if users like them why wouldn't government promote them? Interestingly app users themselves are not sure; slightly more believe government should not promote these apps although a high share (30%) are not sure. We reviewed the research literature about this issue and have compiled table 4 summarising views for and against government promotion and sharing of data for 3rd party apps.

Table 4: Advantages/disadvantages of promotion and sharing of data for 3rd party apps

Author	Year	Advantage/Disadvantage
Advantages		
Schweiger	2011	<ul style="list-style-type: none"> • Most efficient way of communicating transport real-time transport information to users
Bian et al.	2022	<ul style="list-style-type: none"> • Increased perceived user reliability of services • Improved perceived user Safety • Reduced network wait Times • Increased network ridership
Antrim & Barbeau	2013	<ul style="list-style-type: none"> • Provides users with an array of apps for multimodal trip planning • Low costs for the dissemination of data for the public transit authorities
Wong et al.	2013	<ul style="list-style-type: none"> • Entrepreneurial opportunities for private apps • Ability to link trip planning services with other societal services such as parking & rideshare
Disadvantages		
Zhang et al.	2020	<ul style="list-style-type: none"> • Smart-phone induced transport inequality
Papangelis et al.	2016	<ul style="list-style-type: none"> • Technological induced inequalities for infrequent rural users
(Wong et al.)	2013	<ul style="list-style-type: none"> • Legal liability risks from inaccurate information • Loss of control of public transit information for authorities

A number of advantages are highlighted; notably the low cost nature and entrepreneurial and innovative features often provided by 3rd party providers. There are however concerns that authorities might lose control of the quality of public transport information if provided by 3rd parties; there are also potential liability risks if data provided to them to third parties is incorrect or misleading.

From a research perspective this paper has demonstrated a need to monitor app users experiences with apps. This should be undertaken in other cities and also disaggregated to separate user groups to understand variability in experiences by age, gender and also by trip type. The research also found user reported weaknesses such as app crashes, poor bus location data and difficult user interfaces. These topics are worthy of more investigation to isolate and understand the nature of the problems identified such that they can be addressed. The paper has also commenced an investigation of user perceptions about government promotion of 3rd party apps with some in favor and others with reservations. Future research should explore the rationale behind these opinions to better understand differences of opinion.

Overall it is clear that public authorities have much to learn and gain from better understanding user experiences with public transport information apps as new and more effective methods of informing riders about public transport systems develop into the future.

7. References

- BARBEAU S.J & ANTRIM A 2013. The many uses of GTFS data—opening the door to transit and multimodal applications. *ITS America's 23rd Annual Meeting & Exposition*. Gaylord Texan Resort, Texas USA: ITS America.
- BIAN, J., LI, W., ZHONG, S., LEE, C., FOSTER, M. & YE, X. 2022. The end-user benefits of smartphone transit apps: a systematic literature review. *Transport Reviews*, 42, 82-101.
- CHAM L., DARIDO G., JACKSON D, LAVER R & SCHNECK D 2006. Real-time bus arrival information systems return-on-investment study. Washington DC, USA: Booz Allen Hamilton Inc for the United States Department of Transportation.
- CURRIE, G. & DELBOSC, A. 2015. Spiral Plot Analysis of Variation in Perceptions of Urban Public Transport Performance between International Cities. *Transportation Research Record*, 2538, 54-64.
- FLORA, H. K., WANG, X. & CHANDE, S. V. 2014. An investigation on the characteristics of mobile applications: A survey study. *International Journal of Modern Education and Computer Science*, 6, 21-27.
- PAPANGELIS, K., NELSON, J. D., SRIPADA, S. & BEECROFT, M. 2016. The effects of mobile real-time information on rural passengers. *Transportation Planning and Technology*, 39, 97-114.
- ROTH M. 2012. How google and portland's TriMet set the standard for open transit data| streetsblog san francisco. Available from: <https://sf.streetsblog.org/2010/01/05/how-google-and-portlands-trimet-set-the-standard-for-open-transit-data/>.
- SCHWEIGER C.L. 2011. Use and deployment of mobile device technology for real-time transit information *Transit Cooperative Research Program (TCRP) Synthesis 91*, published by Washington DC USA.: Transportation Research Board.
- WONG, J., REED, L., WATKINS, K. E. & HAMMOND, R. Open Transit Data: State of the Practice and Experiences from Participating Agencies in the United States. 2013.
- ZHANG, M., ZHAO, P. & QIAO, S. 2020. Smartness-induced transport inequality: Privacy concern, lacking knowledge of smartphone use and unequal access to transport information. *Transport Policy*, 99, 175-185.

Attachment A – Public transport information apps user survey

1. How often do you typically use public transport?
 - a. 6-7 days a week
 - b. 5 days a week
 - c. 3-4 days a week
 - d. 1-2 days a week
 - e. At least once a month
 - f. Less often than once a month
 - g. A couple of times a year
2. How do you plan your public transport journey?
 - a. Via using public transport information apps
 - b. Through using public transport information websites
 - c. By calling the public transport call centre
 - d. Via service timetables at local bus stops and train stations
 - e. Through my prior knowledge and experiences of the public transport system
3. Please name the public transport information apps that you are aware of?

[next page]

4. Are you aware of any of the following public transport apps? On a scale of 1 to 6, how aware are you of the following apps? [Options are Very Aware, Aware, Somewhat Aware, Somewhat Unaware, Unaware, Very Unaware]
 - a. Arevo
 - b. tramTRACKER
 - c. PTV
 - d. Citymapper
 - e. Moovit
 - f. Google Maps
5. Which of these apps have you used?
 - a. Arevo
 - b. tramTRACKER
 - c. PTV
 - d. Citymapper
 - e. Moovit
 - f. Google Maps
6. How often do you utilise public transport information apps?
 - a. Daily
 - b. Weekly
 - c. Monthly
 - d. A few times a year
 - e. Once a year
 - f. Not at all
7. Please select the options that you identify with. When I am using public transport information apps, I tend to use them for ...
 - a. Trip planning
 - b. Fare estimates
 - c. Obtaining directions
 - d. Searching for alternative routes
 - e. Other (If so please specify)

8. Thinking about mobile public transport information apps, on a scale of 1 to 7 how IMPORTANT are the following features to you personally? *[Options are extremely important, important, somewhat important, neither important or unimportant, somewhat unimportant, unimportant, extremely unimportant]*

[Options to be randomised in presentation order]

- a. Sufficient bike-route options
 - b. MYKI top-up
 - c. Multiple route options regarding methods of transportation (ie. Train, Tram, Bus, etc.)
 - d. Petrol prices and locations
 - e. Fast and easy to use user interfaces
 - f. Apps that don't crash
 - g. Live tracking features for locations of buses, trams and trains
 - h. Estimated fares for journeys
 - i. Access to real-time traffic and network data
 - j. Ability to plan your trip in advance
 - k. Apps that are free of bugs and errors
 - l. Apps that are not too time-consuming
 - m. Apps that are internationally available that can be used in cities across the world
 - n. Offline travel without connection to Wi-Fi
 - o. Access to public transport network timetables
 - p. Apps that are free of advertisements
 - q. Traffic tracking features whilst driving
 - r. GPS services for directions
 - s. Voice navigation
 - t. Links to public transport services
 - u. Bike-docking facilities
 - v. Locations of parking facilities
9. How well do apps PERFORM with regard to the following features, on a scale of 1 to 7?
[Options are Very Well, Well, Somewhat Well, Neither Well or Poorly, Somewhat Poorly, Poorly, Very poorly]
[Apps shown are only the ones the user has stated they use in Q5]
- a. Sufficient bike-route options
 - b. MYKI top-up
 - c. Multiple route options regarding methods of transportation (ie. Train, Tram, Bus, etc.)
 - d. Petrol prices and locations
 - e. Fast and easy user interface
 - f. The app doesn't crash
 - g. Live tracking features for locations of buses, trams and trains
 - h. Estimated fares for journeys
 - i. Access to real-time traffic and network data
 - j. Ability to plan your trip in advance
 - k. The app is free of bugs and errors
 - l. The app can be used in a timely manner
 - m. The app is readily internationally available and can be used in cities across the world
 - n. Offline travel without connection to Wi-Fi
 - o. Access to public transport network timetables
 - p. The app has a good amount of advertisements
 - q. Traffic tracking features whilst driving
 - r. GPS services for directions
 - s. Voice navigation
 - t. Links to public transport services
 - u. Bike-docking facilities
 - v. Locations of parking facilities

10. Of the following apps which one do you think is the best?

- a. Arevo..... go to Q10a
- b. tramTRACKER.....go to Q10a
- c. PTV..... go to Q11
- d. Citymapper.....go to Q10a
- e. Moovit..... go to Q10a
- f. Google Maps..... go to Q10a

10a. Why did you rate this app and not the PTV app?
[Dependent on the answer to Q10]

11. Please select how you feel about the following statement ... I am more likely to utilise apps that are promoted by the Victorian Department of Transport.

- a. Strongly Disagree
- b. Disagree
- c. Neither Agree nor Disagree
- d. Agree
- e. Strongly Agree

The Victorian Department of Transport provides the PTV information app which is widely advertised throughout Melbourne’s public transport system. However there are many other private/independent information apps available but not widely advertised.

12. Do you think that the Victorian Department of Transport should advertise apps other than the PTV app?

- a. Yes
- b. No
- c. I don’t know

13. How old are you?

- a. Under 18
- b. 18-24
- c. 25-34
- d. 35-44
- e. 45-54
- f. 55-64
- g. 65+
- h. Prefer not to say

14. What postcode do you live in
.....

15. What is your gender?

- a. Woman
- b. Man
- c. Non-binary / gender diverse
- d. Prefer not to say
- e. My gender identify isn’t listed. I identify as:

Many thanks for your time in completing the survey