Journey Planner Usage Analysis

Final Report

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About PATREC

The Planning and Transport Research Centre (PATREC) is collaboration between the Government of Western Australia and local universities, constituted to conduct collaborative, applie research and teaching in support of policy in the connected spaces of transport and land use planning. The collaborating parties are: The University of Western Australia, Curtin University, Edith Cowan University, Department of Transport, Main Roads Western Australia, Western Australian Planning Commission and the Wes Australian Local Government Association.

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Executive Summary

Journey planner applications are commonly available through digital systems such as websites, smartphones, tablets, watches and car-based information systems. While available on the web for many years, the ubiquity of internet-connected smartphones has meant that their timely use has only become apparent in the last few years.

Combined with new sensor data, this has meant that transport consumers are now able to access 'up to the minute' data regarding a journey they are about to undertake shortly before they do so and as such may be influenced in their mode choice by the ability to access more accurate information for their particular journey – such as timing and cost, alongside greater information about the physical infrastructure used throughout the journey, like cycle paths or speed limits.

As such, there was a desire to understand whether the use of journey planners throughout Perth contributed to a shift towards or away from shared (such as public transport) or active (such as cycling and walking) transport modes, or whether it reinforced existing mode preferences. This first meant that the level of journey planner use had to be ascertained before determining whether feature and information provision could help precipitate a movement towards said shared or active modes.

Firstly, a literature review was undertaken to ascertain survey techniques for travel behaviour and mobile app usage. This led to the use of a stated preference-style survey where respondents described what they had done with respect to transport and journey planner usage and what their preferences were in the future.

Next, a market analysis of journey planning applications was undertaken of approximately 40 apps and websites to understand what features they provided and which apps provided which features.

A survey was then undertaken of 402 Perth residents over the age of 18, which was considered representative when considering the parameters of the sample, which were considered 'standard' for a survey of this scope. Due to the current COVID-19 pandemic, the scope of the survey was extended to also understand how travel behaviour had changed due to the pandemic.

The survey was undertaken as a computer assisted telephone interview by the ECU Survey Research Centre in the last week of June and first week of July, around the time 'Phase 3' COVID restrictions were moved to 'Phase 4'.

The research undertaken showed that approximately two-thirds of respondents used journey planners at least 'occasionally', indicating that these systems are an important service and hence their ability to function consistently and accurately impacts the travel decisions made by respondents.

A wide range of journey planners were found to be used on a variety of devices, with Google Maps and the Transperth apps most common, with many users also using Apple Maps and Uber. Primarily, this was on smartphones such as the Apple iPhone.

Many consider journey planners only relevant to shared and active transport modes. It was found that the vast majority of respondents (approximately 88%) used them for car trips taken as a driver. Approximately one-fifth of respondents who used journey planners used them for journeys including a bus and one-quarter of respondents used journey planners for journeys including a train.

Approximately 90% of respondents that used journey planners used them for new journeys they had not undertaken before, approximately three-fifths of these respondents did not use journey planners for regular journeys undertaken. Interestingly, a third of respondents indicated that they had used journey planners within multi-modal journeys.

While travel time estimation and routing/navigation were deemed useful by most respondents, there was also a level of importance given to live journey information such as live travel time. There was, however, an unmet need of information regarding the destination within journey planners such as search and discovery of the destination – such as attractions at the destination or 'services' such as food or petrol along the way.

New information such as weather information, environmental impact, booking and paying in advance alongside alternate formats (such as smart speakers) were also of interest to respondents. Many suggestions were provided for rewards systems, however the most popular suggestions either involved money or equivalents or were related to discounts on travel.

Most respondents indicated that their behaviour would not be changed by these improvements. However, approximately one-fifth of respondents indicated that there was at least a moderate likelihood that these changes would lead to behaviour change.

The COVID-19 related questions showed that travel demand markedly decreased during the pandemic, with over two-thirds of respondents indicating that they had

reduced the number of journeys taken with only 3.7% of respondents indicating that they had increased their journeys. This was to be expected with restrictions introduced and reductions in activities due to the pandemic.

The number of respondents working from home approximately doubled compared to before the pandemic, with a drop of approximately two-thirds in the number of respondents who used public transport to get to work during the pandemic, compared to before. Similar changes were seen for journeys undertaken for social/recreational purposes.

Most responses indicated the return of activities in some manner would be an impetus to increase journeys undertaken again, however there was a reasonable number of respondents (approximately 8%) who indicated that the fear of catching the virus would prevent them from using shared modes and hence it is implied they would wait for the virus to disappear before using these modes.

As such, these findings led to recommendations to ensure the continued use and availability of journey planners, as well as provision of existing and new information underlying them *for both 'first party' apps provided by Government* and *'third party' apps developed by others*. This will ensure that they will continue to be used by existing users and can help those who indicated that changes to journey planners may lead to their increased use of non-car modes. This includes helping within the COVID-19 recovery where many previous users will need to return to using shared and active modes to ensure the continued well-functioning of Perth's transport system. Through providing accurate and timely data to all journey planners, the friction of using these modes is reduced and their uptake can be encouraged.

Specifically, as detailed in Section 8 of the report, based upon the results gathered and interpreted from the survey, the following recommendations are made:

1. *Ensure the continued supply of accurate and timely transport data in an open format*: There is a desire for live and timely transport data from respondents, and the survey has shown that respondents use many different apps to access this data. As such, making 'live' information about the transport network – road, active and public transport – available to third-party apps will ensure that it is spread as widely as possible to end users of the system. This can encourage people to use shared or active transport modes and will enable the provision of multi-modal journey planners. There is also a desire

for public transportation crowding data, especially relevant during the COVID-19 pandemic and its recovery and the provision of this information will help the return of patrons to public transport.

2. *Ensure the continued supply of accurate 'secondary' data in an open format*: The provision of information regarding the accessibility of infrastructure in a standardised format will also ensure maximum usability of shared transport modes by those with accessibility difficulties. For example, this would include the number of park and ride bays at railway stations, the number of disabled bays at railway stations, whether a railway station is fully accessible, the condition and slope of cycle and walking paths, detailed information regarding common destinations as well as entrances to stations by location and type. This will not only help accessibility to non-car transport modes, but also provide more accurate information for mobility-as-a-service systems that can be used to better estimate the nature of a journey, as well as satisfy users' desire for more information on destinations and advanced routing systems.

3. *Continue development of the Transperth app*: While some jurisdictions (such as Adelaide) have moved away from first-party apps, the Transperth app remains a popular choice of transport users within Perth. As such, its use should be continued to be encouraged and supported as to not alienate existing users. Integration of weather information within journey planners was identified as a popular feature by respondents and could be implemented within the Transperth app, providing not only an enticement to public transport users but a novel innovation compared with most other journey planners. The integration of weather data could be useful in this regard and help inform the choices made by the journey planner to enhance the comfort of patrons. As detailed in Recommendation 2 above, the provision of new information could enable many journey planners to offer advanced features such as multi-modal trips using Park and Ride availability. Such a feature would be ideal to be integrated within the Transperth app to meet the desires of the public and reduce friction in these types of public transport-containing journeys. Increased information regarding destinations and the discovery of them could also aid in the use of public transport by making it easier for patrons to plan

their journey. These changes will not only improve the attractiveness and usage of the Transperth app through increased functionality but can also provide a base for mobility-as-a-service systems in the future.

4. *Investigate travel discounts for continued use of public and active transport modes*: there is a desire from respondents to be rewarded for continued 'good' use of transport systems. While monetary incentives are a common reward identified by respondents, providing travel discounts is a popular response that encourages further use of said desirable modes.

5. *Investigate provision of data in new and novel formats*: Many respondents identified the provision of transport data in alternate formats as a desirable feature within journey planners. While this could take many forms, one popular format that has been used by other transport operators – notably airlines including Virgin Australia and Qantas – is integration with 'smart speaker' assistant systems such as Amazon Alexa to provide information regarding transport services, or alternatively Google Assistant or Siri. As such, integrating data with third-party apps or providing this as a first-party service will enable an easier interaction with public transport or active transport systems by transport users.

6. *Provision of pre-booking of public transport including integration with Apple Pay and Google Pay*: Also identified by respondents was a desire to integrate transport use with digital wallets such as Google Pay and Apple Pay. While this can include providing contactless payments through a phone, as seen in New South Wales and assumed to be a component of the 'SmartRider 2.0' system under development, this can be taken further to allow for the purchasing of tickets through a smartphone, providing further convenience for transport users. Pre-booking a service, while separate to this, can be integrated with such digital wallets to reduce the friction of public transport usage and also to provide one component of a mobility-as-a-service system.

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1. Introduction

Journey planner applications are a relatively modern development that allow users to, as the name would suggest, plan a journey between two or more locations. These tools take many forms – their interface can be smartphone application-based, web-based or even voice-based. Such applications can be used to plan journeys using a single mode – such as active transport, public transport or private vehicle – or a combination of modes.

The purpose of this project is to ascertain how such applications influence the travel behaviour of Perth residents. As these applications can provide real-time information regarding congestion, parking and the like, the uncertainty of users can be reduced by providing more reliable travel time estimates or understanding of end-of-trip facilities. This therefore may change travel behaviour as the trade-off between options may change – less time is taken for public transport, for example.

This understanding will inform recommendations to the Department of Transport as to which data sources or technologies can be prioritised for the greatest public benefit or to help influence modal shift.

This report described the work undertaken for this research project. Firstly, the methodology designed and undertaken is explored, before the results of the market analysis and literature review are presented. Then, the initial survey design and technical information regarding the undertaking of the survey are presented. The results of the survey itself are then presented and discussed, before recommendations are posed and conclusions presented.

Due to the COVID-19 pandemic, the scope of the project was expanded to also ascertain whether the pandemic made changes to travel behaviour and whether improvements to journey planners could help recover the mode share of public transport, cycling and walking transport modes.

Appendices to this report containing the matrix of journey planners investigated are attached alongside the technical detail of the exact survey questions and information regarding how quotas were determined.

2. Methodology

To ascertain the public's use of journey planner technologies, this project used a multi-stage approach. First, a market analysis was undertaken to ascertain existing journey planner applications which exist not only in Perth but throughout the world and to document their features.

Concurrently, a literature review was undertaken to determine the best methodology for determining the design of a survey to understand the use of mobile applications – a similar group of technologies. Detailed descriptions of the methodologies used for these reviews are located within the relevant sections.

This fed into the design of a computer-assisted telephone interview (CATI) survey to be taken by a representative sample of Perth residents to understand their use of journey planner applications, including which applications are used and how their features influence behaviour.

The results of this survey were analysed to determine patterns and trends of journey planner usage which were then discussed to understand the overarching trends. These were then used to influence a set of recommendations as to how provision of data or services to help journey planners provide services of most usefulness.

The intention was for this survey to be undertaken by the Edith Cowan University Survey Research Centre (SRC) in March. At that time, the SRC suggested that the conduct of a survey regarding travel behaviour was not recommended, as travel behaviour patterns had temporarily changed due to restrictions put in place to contain the COVID-19 pandemic and hence there may be an error introduced by respondents recalling behaviour in the past.

The survey was then adapted to consider questions regarding travel behaviour during COVID-19, both to better understand how behaviour had changed generally but also whether in the context of journey planner use, any changes as described above could be made to entice consumers back to shared or active transport modes after the pandemic.

Finer grained detail of the methodology used in each of these steps are presented in the relevant section for each of the components – the literature review, the market analysis and the survey. Included within each of these sections are also the results and discussion.

3. Literature Review

While the Market Analysis below identifies the common features within publicly used journey planners, the aim of this project was to identify the effect these have had on the travel behaviour of transport consumers within the Perth area.

As such, it must be ascertained from these consumers what their preferences are with respect to the features included within journey planners – be it features that they have already used and find valuable, alongside features which are unavailable but are desirable. It must also be determined which features make travel 'easier' and which features make a change in mode choice more desirable – in other words, to separate what is 'nice' and what is 'essential'.

As this area of research – the use of apps and their influence on travel behaviour - is niche and to a degree novel, a literature review yielded limited directly relevant work. The first section of this literature review covers the most relevant literature for this project – that on the analysis of journey planners themselves and their usage.

Some related work has been undertaken, about using the sensors within mobile devices to measure travel behaviour. Wang, He & Leung (2018) undertook a literature review to summarise this work and have identified that mobile devices are commonly used to identify travel behaviour either through:

a. analysis of (radio-frequency) network connectivity – such as where and when the user has connected or interrogated wireless networks,

b. analysis of (satellite) location – using data gathered from the Global Positioning System or similar to identify location over time;

c. analysis of sensors – using the camera to identify locations based on motion information from accelerometers and gyroscopes.

While these can identify travel behaviour directly – such as journeys undertaken thereby identifying origins and destinations – they do not analyse the information used by users to make choices within their travel behaviour.

As such, the scope was expanded to consider two related fields which, when combined, approximate the field of study and provide insight to it: 'traditional' travel behaviour surveying and application usage surveying.

It is also noted that the IMOVE CRC (2019) recently ran a MaaS trial using a customised version of the TripGo journey planner, produced by SkedGo.

The three sections of the literature review below were completed using a keyword metasearch engine to find relevant academic literature, with the literature analysed and summarised for usefulness by the author.

3.1. Journey Planners and their Usage

Cheung & Dasgupta (2016) undertook a study of journey planners and identified 'best practice' features. The methodology used included identifying the platforms supported and features included for a set of five journey planners. Usability and popularity were also explored. The features examined for inclusion are personalisation, crowdsourcing, real time data, navigation, multi-modality, mapping, points of interest, geocoding (destination suggestion), travel time, customisation and the usability of the results display.

Boratto et. al. (2020) undertook a study of the search, sorting and selection behaviour of users of a single journey planner. Other studies have also been undertaken which use specific journey planners, such as Zografos, Androutosopoulos & Apospori (2012) which also focused not just on usability and capability, but also willingness to pay. The study broadly listed the features of the journey planner into what were primarily non-functional requirements (such as usability and effort) alongside the level of travel time planning.

A book regarding disrupting mobility was examined, with two chapters being relevant work. Shaheen, Cohen & Martin (2017) discuss that four types of transportation apps have emerged, mobility apps, connected vehicle apps, smart parking apps and courier network apps. A review of 83 apps was undertaken where the authors determine the operating system, presence of real-time data and gamification ('rewards') features of the apps, then undertook an exploratory survey of users of a particular journey planner, asking users directly why they used the apps and how it changed their travel behaviour.

Davidson (2017) undertook a similar study using focus groups, partially influenced by the TravelSmart programs in Australia. The focus group was asked about the number of transit rides in the week prior, the number of modes used, the different query types made with journey planners and the directness of their journeys. This was followed by a discussion of a 'decision grid' where the participants chose which mode they would prefer based on a combination of supplied cost, time, calories burnt and CO^2 emitted.

Nelson & Mulley (2013) examined intelligent transport systems in Australia and identified the need for information systems such as real time traffic information to feed into multi-modal journey planners. Three Australian government journey planners were examined as part of the European WISETRIP program which promoted the importance of accurate and quality information within journey planners. The authors posit that such information is vital for future service provision. A description of each system and its technical architecture is provided, but no direct comparison. The article does, however, touch on “flexible transport services” which may be better known as on-demand transport.

Two articles were provided to the *Sustainability* journal in 2019 regarding information services and their impact on travel behaviour. Zhou et. al. (2019) identified that transit service factors and information factors before and during travel influenced the willingness of residents to use public transport between rural and urban areas in China. A survey was undertaken which was analysed using structural equation modelling which used variables regarding demographic information as an exogenous variable, alongside many factors as endogenous variables. These factors included the provision of fare, route, walking distance, transfer and schedule information before travel.

Other factors examined included congestion information, stop and ‘next bus’ arrival location and time information being provided whilst travelling. Furthermore, quality factors of the vehicle (such as smoothness, payment methods, air conditioning, service, punctuality and convenience) alongside hypotheses regarding willingness to use and journey adjustment propensity based on these were included within the structural equation model. The outcome from this research was that information provided before travel was of more influence than information provided during the journey.

Esztergár-Kiss (2019) developed a framework to analyse European journey planner using multi-criteria analysis. The factors examined were methods of data input, visualisations of routes, tariff (or fare) information, payment methods, provision of static data, how personal information is handled, dynamic and estimated data alongside comfort and social/environmental factors. Fifteen different journey planners were examined over common modes, including air travel.

Sunio & Schmöcker (2017) discussed mobile applications used to promote sustainable travel behaviour. This involved persuasive system design and the use of behaviour change support systems (BCSS). The authors examine these apps in the health and transport domains and suggest that greater integration with shared mobility

services platforms will increase their effectiveness. Such persuasive factors examined in existing tools include financial-based, exercise-based and environmental-based.

Iskandar & Sia (2020) discuss empirical evidence used to understand factors of Generation Y travellers within Malaysia and how 'travel apps' influence their choices. The main factors identified are notifications on trip status and offline access which were benchmarked with a questionnaire to understand why travellers use the apps.

3.2. Application Usage Surveying

Work has been completed by others to ascertain how software applications have been used by end users. Kang (2014) used a web-based survey to ascertain the views of respondents on how they used mobile applications. This led to a survey using Liekert scales for respondents to rate their opinions on various types of mobile applications, alongside their opinions on expectancy, influence and intention after detailing demographic criteria. The results were then analysed using structural equation modelling (SEM). Wang, Liao & Yang (2013) propose a framework along much of the same lines.

The use of surveys to ascertain mobile application usage has also been explored by Krebs & Duncan (2015) with respect to how health apps are used. This survey of mobile phone users, alongside demographic questions, asked the users if and how they used health apps, how well they worked, if they stopped using them and their general health status.

A survey of students by Bowen & Pistilli (2012) examined the difference between web-based and native application usage by students. This was also undertaken as a survey in a similar format, however the survey was promoted to and open to all students of a particular university undertaking the study.

Bohmer et. al. (2011) used an approach of directly measuring application usage using a software application called AppSensor. This system, however, had limitations in that it could only measure what app was being used (and only in some cases) was only available for the Android operating system. This was used to analyse transitions between apps; others such as Huang et. al. (2012) have used this information to predict which app is likely to be used, based on contextual information such as the previous app used.

One other method of analysis undertaken has been that of Guzman & Maalej (2014) and Iacob & Harrison (2013) involves the sentiment analysis of online reviews of

mobile applications to determine users' opinions on these features. However, the limitations of this approach is that there is not as much demographic information available about each user. A similar approach is taken by Johann, Stanik & Maalej (2017) to determine the features of a mobile application from its reviews and description – however, this still does not include some sources such as screenshots.

3.3. Travel Behaviour Surveying

An approach commonly used is the concept of 'revealed preference' versus 'stated preference'. Wardman (1988) explains in a comparison of the models that the revealed preference model is based on a modelling approach of the observation of choices whereas stated preference models use marketing research (i.e. survey) based approaches.

To gather observations for the understanding of journey planner use on devices would require the installation of a cookie or similar piece of software to track the users' behaviour on the device. While this is ideal from a data quality point of view, it raises privacy concerns and would require extensive programming that is not possible on iOS devices and may not be possible on Android devices. An alternative to this approach is to develop another journey planner, however it would be limited to the way it is built – it could not use routing algorithms by others, it would not understand the way people use particular apps and plainly can't be "all things to all people" and as such would not completely understand the market.

Hence, a stated preference-based model of using market research approaches was preferred for this study. This enables users to recall their use of journey planners, but also to offer their opinions on how and why the used them – which would still require a survey-based approach. While this analysis doesn't use a traditional stated preference design, with discrete choices, it builds upon the idea and methodology of asking users of their preference rather than directly observing it.

After all, in this case, we are primarily looking at recall of existing behaviour rather than prediction based on possibilities.

4. Market Analysis

To understand how Perth residents use journey planner applications, it must be understood what a journey planner application is, which applications are in use and what functions of these applications are useful. To achieve this, a methodology was developed to attempt to locate as many popular journey planners as possible. The most popular of these were identified and further analysis of the applications' features was undertaken.

There are many journey planners in existence; in Perth, the Transperth (2020) journey planner web application, alongside the Transperth App, is operated by the Public Transport Authority. The Your Move (2020) journey ~~jlanner~~ is operated by the Department of Transport as part of their 'Your Move' program. While this report aims to cover the most common journey planners, it is infeasible to cover them all. At this point, only the above government journey planners have been specifically included whereas any other ones that have met the requirements in Section 4.1 below have also been included. It was not feasible to examine internal, non-public-facing journey planners, hence they were not examined.

Many rideshare services also operate in Perth, including but not limited to Uber, Ola and Didi. Each of these provide journey planners that are integrated to their service that allow people to book journeys with drivers; this ability is also integrated into some other Apps. These have not been specifically removed from inclusion; where they meet the requirements in Section 4.1 below, the have been included.

4.1. Identification of Journey Planners

To be able to identify journey planner applications, many questions must first be answered to ensure that all relevant applications are considered. Firstly, the platforms upon which journey planners can run on must be enumerated. Taivalsaari et. al. (2008) identified that the Web provides a new platform for application software to be run. Contemporaneously, the Web provides a platform for many applications that run on different devices, for example, social networking websites and content management that use the same web-based application (albeit with different styling) on devices of different sizes.

The alternative is native applications – applications written specifically for a class of device that will only run on the aforementioned class. These classes of devices must

be identified to understand the possibilities upon which the journey planner software can be run.

4.2. Application List Determination

Native applications can run on either mobile devices – such as tablets, phones, watches and car interfaces, or fixed devices – televisions and computers. The majority of these devices run either the Android or iOS operating systems. These operating systems distribute applications through what are termed 'App Stores'.

AppTweak is a service that is primarily intended for measuring the impact of marketing interventions on apps within these App Stores. The service also provides the 'Top 100' most popular apps for specific search terms alongside various categories. As such, a methodology has been developed to locate popular journey planner apps on these platforms through the use of AppTweak:

1. *Identification of relevant search terms and categories*: the category listing for both iOS and Android were explored to determine which categories may include journey planner or similar apps. As the App Stores differ for both platforms, so do the categories. In the case of iOS, the categories chosen were *Health and Fitness*, *Lifestyle*, *Navigation*, *Travel* and *Utilities*. For Android, the categories chosen were *Auto & Vehicles*, *Health & Fitness*, *Lifestyle*, *Maps &* Navigation, *Transportation* and *Travel & Local*.

   As well as looking at the 'Top 100' of various categories, another popular way that App Stores are browsed are through the use of search terms. As it is difficult to systematically detail every permutation of search term, including the use of synonyms or logically similar phrases, a selection of ten common search terms were chosen to locate journey planners and similar Apps:

   - journey planner
   - maps
   - navigation
   - timetable
   - road
   - train
   - ferry
   - bus
   - cycle path

- walk

The choice of simple terms was deliberate with the aim of locating as many apps as possible.

2. *Programmatic download of app charts*: the 'Top 100' charts for the categories and search terms are downloaded programmatically through the AppTweak API. This enables further analysis of information regarding the apps. Charts are downloaded for Australia, the United States, the United Kingdom and New Zealand to investigate trends in other countries, for both free and paid Apps. Each app on these lists was ranked based upon its position in the list and normalised based on the number of lists upon which it appears.

3. *Manual analysis of results*: a "first pass" over the downloaded apps removes completely irrelevant applications, based solely on the name. This is due to the fact that broad categories by their nature will likely include some contents which are not relevant at all. This was achieved through keyword filtering, with the list of keywords used available on request.

4. *Detailed analysis of remaining apps*: for those apps which remained, further analysis was undertaken to ascertain specific features within the apps. As the number of remaining apps sits in the thousands, rankings were used to pull out the top 40 applications (a mixture of those on Android and iOS) to investigate in detail.

The remaining 40 applications were then tabulated with the name and developer. These were chosen as those which had the highest average position in the lists upon which they appeared. From this information, a rank was generated and used to sort the journey planners.

4.3. Application Tabularisation

The list was augmented by indicating the relevant platforms – Android, a desktop app, a web application or the various Apple platforms for phones (iPhone), tablets (iPad), smartwatches (Apple Watch) and vehicles (CarPlay). As there is a requirement to install software to use Android Auto, it was not investigated for this task. There also exists multiple watch-based operating systems for Android smartwatches, hence only popular Android watch-based apps which appeared within the list were investigated. The OS also does not make a distinction between the phone and tablet.

Next, each of the applications were examined to determine which transport modes were supported. The list of transport modes chosen were based off those used within the last survey completed by Jie et. al. (2019) for PATREC as part of a survey of travel intentions in the Yanchep area. Those transport modes are as follows: private vehicle, active (walking), active (cycling), bus, train, ferry, light rail, bike share, ride share (such as Uber), car share (where a car owner shares their car), car pool (such as UberPool) and other (which ended up corresponding to boating, aviation, skiing and other active modes).

4.4. Feature Catalogue

Finally, each Application was investigated to determine what features were included, including which of the above transport modes were supported by the journey planner. This was primarily achieved through examination of secondary sources regarding the applications – the App Store (Apple, Inc., 2020) and Play Store (Google, 2020) pages which include screenshots of the application, the applications' own web pages and where required, using the app itself on an iOS or Android device.

The list of features were gathered through this discovery process through interpreting the screenshots, descriptions and view flows (where applicable) of each application, influenced by the feature lists discovered in the literature review. While each feature is discriminatory, due to the differing nature of each journey planner and the subjective nature of the method, as well as difference between operating systems upon which the apps run, some features have had slightly different meaning. The features which are catalogued are listed below with a short description of each:

- *See where transit vehicle is*: the ability to locate where a non-personal vehicle is on a map;

- *Pre-book shared transit vehicle*: the ability to book ahead of time a vehicle which is shared with other passengers;

- *Pre-book personal transit vehicle*: the ability to book ahead of time a vehicle which is not shared with other passengers;

- *Request shared transit vehicle*: the ability to request immediately a vehicle which is shared with other passengers;

- *Request personal transit vehicle*: the ability to request immediately a vehicle which is not shared with other passengers;

- *Journey cost estimate*: an estimate (or actual) of the fare for the journey is provided ahead of time for the user;

- *Pre-pay using app for journey*: the ability to use the app to pay for the journey in advance (generally via payment card);

- *Estimated arrival time of vehicle*: the arrival time of the vehicle is provided based on estimation such as through a timetable;

- *'Actual' arrival time of vehicle*: the arrival time of the vehicle is provided based on 'live' data such as GPS;

- *Rewards system*: a form of rewards system where the user is incentivised for each journey taken;

- *Covers multiple modes (PT + Walk only)*: the app provides data for multiple transport modes, however this is only for public transport modes (bus, train, ferry, light rail) and walking;

- *Covers multiple modes*: the app provides data for multiple transport modes, other than as above;

- *Covers multiple areas*: the app provides data about journeys in more than a single area, such as town or city;

- *See where personal vehicle is*: the ability to locate your own vehicle or self;

- *Mapping*: the provision of geographic maps showing the journey;

- *Navigation*: the provision of step-by-step instructions to complete the journey;

- *Choice of Mapping*: the provision of more than one type of mapping;

- *Vehicle Instruments*: the app provides data regarding the operation of the vehicle or self;

- *Route Planning (Estimated)*: a route between origin and destination is generated based on timetabled or similar data;

- *Route Planning (Actual)*: a route between origin and destination is generated based on 'live' data;

- *Route Planning (Own Vehicle)*: a route between origin and destination is generated for a vehicle controlled by the user;

- *In-App Purchase*: the app either requires or has an optional ability to allow the user to purchase features within the app;

- *Suggest Destination*: the app provides suggestions for destinations based on the users' input, which may be partially incorrect;

- *Weather*: the app provides details regarding the current or future weather or other physical phenomena;

- *Waypoints*: the app allows the ability to create journeys with waypoints within them, rather than just pure origin to destination journeys;

- *Logging/Saving*: the app has an ability to log or save data regarding journeys;

- *Equipment Integration*: the app integrated with third-party equipment to integrate data gathered by this equipment;

- *Price/Alternative Comparison*: the app provides alternative journeys to reach a destination, which may differ in price;

- *Third Party Booking*: the app provides the ability to book a journey through a party not within the App;

- *Apple Pay*: the app provides the ability to pay using Apple Pay;

- *Offline Mapping*: mapping within the app can be used without a network connection;

- *Estimate Consumables/emissions*: the app can calculate the amount of consumables/emissions (such as CO^2, calories or petrol) used for a journey;

- *Crowdsourced Data*: the app integrates data sourced from non-authoritative sources;

- *Handoff between devices*: the app allows users to share their data between multiple devices;

- *Share Data with others*: the app allows users to share their data with others, including those which may not be using the app;

- *Non-Geographic Maps*: alternative formats of maps are provided, which could be augmented geographic maps, augmented reality, network maps or the like;

- *Specialised Routing*: the app provides for alternative methods of routing within route planning;

- *Notifications*: the app provides for the ability to use the notification system to inform the user about their journey;

- *Android or Apple Wallet integration*: the app integrates with the 'wallet' feature of Google Pay or the Apple Wallet, generally to store tickets;

- *Speed Limits*: the app provides details surrounding the speed limit for the current road;

- *Points of Interest*: the app provides details surrounding points of interest – locations known not by street address;

- *Voice Navigation*: the app provides a navigation service using sound-based instructions;

- *Timetable*: the provision of timetables for services that can be taken;

- *Ticketing Information*: information regarding the provision of tickets, ticket requirements, ticket costs or even using the app for ticketing.

- *Operational Status Information*: the app provides details about whether the transit modes within the app are functioning normally.

Each app was compared against these set of features and a matrix was generated showing which apps contain which features, which is attached to this report as an Appendix. Where new features were discovered, previous apps were re-analysed to determine if they contained the feature.

4.5. Discussion/Interpretation

Of the forty apps which were analysed for this project, all transport modes that were chosen, except for car share, were available within at least one app. As the ranking system used to choose the forty apps was based off the apps' popularity, this indicates that car share is not yet popular with consumers compared with the other transport modes available.

Most journey planners were available via the web, Android and iPhone/iPad platforms, which indicates that these platforms are appropriate to target. As expected, only private vehicle-related journey planners were available on a car-based interface, whereas support for smartwatches was mixed but covered most types of journey planners. There was limited availability for journey planners being available as Windows or desktop apps; this is likely due to the limited market share of Windows phones and the ability for desktop users to use a web-based version of the App.

The most notable multi-modal journey planner that exists is Transit; this app provides a high number of features and allows the user to use active, public transport and rideshare-style modes. Google Maps also shares most of these modes, as do other journey planners such as TripGo which were not analysed at this point in time.

Notably, none of the journey planners analysed provided the ability for a 'mixed mode' journey containing private vehicle, such as driving to a park-and-ride. With park-and-ride a popular journey method within Perth, this feature could be useful to many people, as it could provide information regarding the availability of parking at a park-and-ride lot.

Some 'Journey Planners' could only be loosely considered so but covered unusual modes such as skiing, boating and other active transport modes but provided insight regarding the type of information provided to users to help plan journeys.

Most journey planners provided a 'core' set of features including mapping, navigation, destination suggestion and route planning. These could be considered what constitutes a "basic" journey planner from a feature set point of view. Many journey planners allowed the ability to add waypoints between the origin and destination and

the ability to share data or save it. Fewer journey planners allowed saved data to be moved easily between devices. Similar numbers of journey planners provided 'live' data which then enabled the vehicle to be seen on a map at its current location.

Specialised features that were only available within a few journey planners yield insight into what could be added to other journey planners in the future, adapted for different modes. For example, weather information was provided by some journey planners but generally those for active transport modes. This information could also be useful for users of public transport and private vehicle modes, as the door-to-door journey of users of these modes may involve a walking component which might also influence mode choice.

Ticketing information and integration of ticketing with the operating system was available in limited circumstances; however, the limits of the operating system may prevent wider adoption. This is discussed further in the next section.

Rewards systems were found in some journey planners but generally those for rideshare systems; this could be rolled out to other modes of transport to incentivise the use or non-use of particular modes. This also goes for the use of 'consumables' in the sense of calories burnt and carbon emitted. Voice navigation also proved popular for journey planners on non-public transport modes, however the operating system may provide limited voice interaction with these apps.

The WA Government journey planners did not contain every feature, however the Transperth JourneyPlanner was competitive with most journey planners in the market. There are opportunities for other features which could be added to make the JourneyPlanner even further feature-rich. The Your Move journey planner provided good cycling directions and a choice of modes, however only provided basic journey planning abilities.

4.6. Future Trends

The concept of Mobility as a Service (MaaS) is tightly linked with the concept of journey planners. While definitions somewhat vary, Hensher et. al. (2020) described one component of MaaS as providing a single multi-modal journey planner application and payment system that enables provision of door-to-door service to minimise transfer penalties. As such, the evolution and rollout of MaaS services can further reduce the 'friction' for the use of non-private vehicle transport modes which may yield a greater modal shift, as they provide for a single interaction by the transport consumer for an entire journey.

Changes to payment systems also provide an opportunity for features to be integrated within journey planners. For example, many modern 'smart' devices such as smartphones provide the ability for NFC (near field communication) which can emulate smartcards such as SmartRider. As such, the ability to add, use and interrogate transit cards may be integrated within journey planners in the future. Minimal features in this space already exist; some journey planners allow the user to top-up smartcards, such *Opal Travel* from as Transport for NSW (2020) or to view the current balance, such as the *Transperth* app by Transperth (2020).

However, the ability to use the phone itself as a smartcard is limited; the card emulation features available in Android is used through the *Mobile Myki* of Public Transport Victoria (2020) which allows an Android phone to be used as a smartcard. The abilities in the Apple space are more limited, with only a few areas worldwide where Apple (2020) provides the ability to add transit cards to use an iPhone as a transport smartcard.

Digital Wallet apps such as Android Pay or Apple Pay, which allow emulation of a debit or credit card through a smartphone for general payment services provide some of this infrastructure as a 'stop-gap' in systems that allow contactless payment via credit or debit cards, such as in Sydney.

Arguably, it could be said that Digital Wallets are supported within the Transperth system as cash tickets can be purchased at most railway stations using contactless payments, be it through a smartphone or a plastic card.

5. Survey Generation

The insights gained from the literature review and market analysis above informed the development of the survey below, alongside consultation with the Edith Cowan University Survey Research Centre (SRC) who were appointed to conduct the survey as a CATI (computer assisted telephone interview). Further consultation, discussion and modification of the survey was undertaken with the Steering Committee.

Due to the COVID-19 pandemic, the start of the survey was delayed until restrictions were lifted on the was advice of the SRC due to changes in working and travel patterns.

5.1. Survey Parameters

The aim of the survey was to understand how journey planner applications have influenced the travel behaviour choices of people within the Perth metropolitan area. As such, it was recommended to survey approximately 400 people to achieve a good cross-section of the population through limited quotas and a random dialling approach.

Ethics approval for undertaking the survey was obtained from the University of Western Australia Human Ethics Office (approval RA/4/20/6284) which was granted reciprocal approval by the Curtin University Human Research Ethics Committee (approval HRE2020-0338).

5.2. Survey Objectives

The generation of the survey objectives was an intermediate step undertaken to scope the questions within the survey.

The research questions to be answered for the purpose of this survey are as follows:

- Do journey planner software applications influence the travel behaviour choices of people within the Perth metropolitan area?

- Do specific features within the journey planner software provide an impetus to change travel behaviour, or do they only provide an improvement to the perceived quality of service for a journey?

- Are these specific features common in many journey planners, or are they only available in specific journey planners? What changes could be made to enable these features to be provided more widely?

- Are there any impediments to changes in travel behaviour caused by problems with journey planners, such as usability?

In the section below, these questions were used to influence the design of the survey questions.

5.3. Survey Questions

The survey script is detailed below.

1. *Demographic questions:* as per the suggestion of the SRC, the respondent will be asked whether they fit the required demographic (randomly chosen until filled) or to pass the telephone to someone who does. If not, the call will end here.

2. *Preamble*: the purpose of the survey will be explained to the respondent, alongside who is conducting the survey and the approvals which they have. Consent to continue will then be sought from the respondent.

3. *Are you familiar with the concept of a journey planner? That is, software applications that allow you to plan how to get places, be it in a car, using public transport or other means?*: this will be a yes/no question that will also disambiguate the respondents' understanding of what a journey planner is.

4. *Which journey planners are you aware of?*: this is an open-ended question which will allow the user to specify those journey planners they know of.

5. *Of these, which have you used?:* this open-ended question will gain an understanding of those which are used compared to those which are known.

6. *What type of journeys have you used a journey planner to plan? For example, your journey to work, to study or to the shops?*: this open-ended question will gain an understanding as to the types of journeys that are planned with journey planners.

7. *With these types of journeys, did you plan it once or plan it each time? Why so?*: this follow-on open-ended question will ascertain whether the use of journey planners is a 'set and forget' or an ongoing matter. Those which 'set and forget' may not be using all the features in their journey planner.

8. *On which type of devices did you do the planning? Computer, Android, iPhone, iPad, Car System or something else?*: this multiple choice question will ascertain whether the user is using a car-based solution, a tablet or a phone, or a computer.

9. *On these journeys, which transport modes did you use? For example, bus, train, car, rideshare or walking?*: this will ascertain the types of transport modes used by the user when using journey planners.

10. *Do you think that there was any features or information missing which would have helped you plan and complete your journey?:* this open-ended question will yield information will be used to determine desired features by users.

11. *What features within the journey planners did you find useful?*: this question will ascertain what is currently 'working' for people.

12. *Do you think that any of these features have influenced your mode choice?:* this is the 'big question' regarding what features may have made people choose certain modes.

13. *Do you find the apps difficult or easy to use?:* this question is asked to understand whether the user actually 'wants' to use the app or just uses it because they have to.

These questions were modified and expanded upon to develop the final questionnaire which is attached as Appendix B to this report. Some questions were modified or changed for brevity, clarity or to ensure that the survey could be conducted in a timespan that did not lead to respondent disinterest.

6. Survey Results

The following section describes the methodology undertaken to conduct the survey alongside the results.

6.1. Survey Methodology

The survey was undertaken as a CATI of 400 residents within greater Perth, an area determined by an aggregation of Statistical Areas, Level 4 (SA4) of the Australian Bureau of Statistics (ABS) that includes the metropolitan area of the city of Perth and the conurbation of Mandurah. For ethical reasons, the survey was restricted to residents aged 18 or older, which number approximately 1.4 million in this area, calculated from ABS 2016 Census data.

A sample was taken from the Australian Residential Database, which contained landline and mobile telephone numbers and approximate locations, of telephone numbers that were thought to be within the above aggregation of areas. This was used as the basis for selecting the respondents, which were randomly chosen from this sample.

Interviewing was undertaken over a two week period between 22 June 2020 and 3 July 2020. Respondents were called at different times of the day and week to minimise selection bias.

Soft quotas were used to introduce a level of representativeness to the sample of 400 residents. Soft quotas were used for gender, age and location, with weightings based on the population distribution but with a variability of ±10%. This required the adjustment of some region quotas that were less than ten percent to be 10%. Soft quotas were chosen to balance the diversity of respondents with the limited funding available to conduct the survey.

The location was confirmed with the respondent based on their postal code, with Greater Perth broken down into six areas – Perth Inner, Perth North West, Perth North East, Perth South West, Perth South East and Mandurah. Postcodes were allocated to these regions – smaller statistical areas (Level 4) within the region – based upon which region the majority of the postcode area fell into. A table of this is presented as Appendix B.2 to this report.

The survey was designed to take approximately 10 minutes for respondents to complete. In the end, on average it took respondents slightly less than this.

Once the results of the survey had been checked for quality, descriptive statistics were calculated. Data cleaning and integrity validation had already been undertaken by the team undertaking the interviews as part of the interview process.

Firstly, the total number of interviews was counted, which totalled 402. This exceeded the requirement for 385 interviews for representativeness by 17 and as such was deemed suitable for the purpose and hence further analysis was undertaken.

As such, the demographic indicators were calculated to compare them with those of the population at large.

6.2. Demographics

The soft quotas – which, where possible were ±10% of the population distribution – were compared with the actual distribution of respondents (calculated from census data) as seen in Table 6.1 below, where the difference between the soft quota and the actual value is noted in parentheses.

Table 6.1 Quota Distributions (Gender, Age, Region).

Criteria	**Soft Quota**	**Actual Distribution**
Gender		
Male	49% ±10%	44.78% (-4.22%)
Female	51% ±10%	55.22% (+4.22%)
Other	0% +10%	0.00%
Age		
18-34	33% ±10%	28.36% (-4.64%)
35-54	35% ±10%	36.82% (+1.82%)
55-65	15% ±10%	14.43% (-0.57%)
66+	17% ±10%	20.40% (+3.40%)
Region		
Mandurah	10% ±10%	8.96% (-1.04%)
Perth Inner	10% ±10%	8.96% (-1.04%)
Perth North East	10% ±10%	13.18% (+3.18%)
Perth North West	25% ±10%	25.87% (+0.87%)

Perth South East	25% ±10%	25.12% (+0.12%)
Perth South West	20% ±10%	17.91% (-2.09%)

Overall, the actual distribution for each criteria fell well within the quota bands, with the largest deviation being 4.64% which is notable as the permissible value was over twice the size at 10%. As such, the data provides a reasonable level of representativeness of Perth with a wide range of different respondent groups.

Next, the number of weekly hours of employment of the respondents was investigated. The respondents were requested to detail the number of hours they worked in an average week. It is to be expected that a reasonably sized proportion of the respondents will have responded to this question with an answer of 0 – those who are not in the workforce, those of retirement age, the unemployed and others.

Figure 6.1 below shows the distribution of responses for this question. One respondent was removed from this analysis as they provided an answer of ‘Don’t Know’. 118 of the 401 respondents reporting working no hours. Considering those that work between 35 and 45 hours a week inclusive, which could be considered ‘full time’, there are 130 respondents that fit this definition. Fewer respondents work between 1 and 34 hours a week inclusive and less again work 36 hours or more a week, with a maximum response of 96 hours per week.

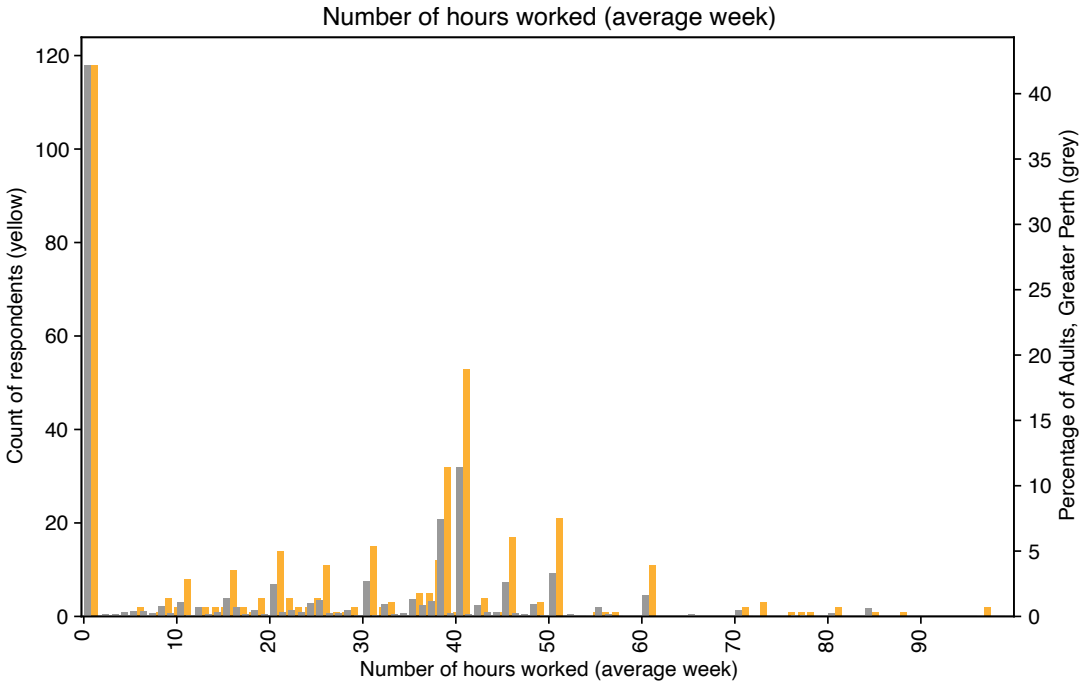

Figure 6.1 Working hours distribution (n = 401).

The distribution of responses is further detailed in Table 6.2 below, showing how many respondents fell into each band of work hours.

Table 6.2 Working hours – by band (n = 401).

Number of Hours (inclusive)	**Respondents (Percent)**
0 hours	118 (29.4%)
1 hour to 9 hours	9 (2.2%)
10 hours to 19 hours	31 (7.7%)
20 hours to 29 hours	41 (10.2%)
30 hours to 39 hours	75 (18.7%)
40 hours to 49 hours	78 (19.5%)
50 or more hours (maximum 96 hours)	49 (12.2%)

As such, the respondents represent a diverse and expected range of number of weekly hours of employment. In Figure 6.1 above, the distribution has been compared to that of the general population as recorded at the 2016 Census for the same parameters (those in the selected SA4 regions aged 18 and over). While not identical, the distribution is similar.

As the results of these demographic questions were satisfactory, the next set of questions investigated were those regarding travel behaviour in the context of COVID-19.

6.3. COVID-Related Questions

While not an original objective of this survey, due to the context and situation of the COVID pandemic around the world at the same time as when the survey was drafted and constructed, questions were asked to ascertain the effect the pandemic had on respondents' travel behaviour, such that the effect on the transport system could be quantified alongside insight gained to help plan the road out and back to the 'new normal'.

A focus was on the active and public transport systems, as there had been anecdotal evidence of increases in active transport usage and the shared nature of public transport systems may cause a disincentive to their use post-COVID-19. The results broadly showed that this was the case, which is explained in further detail below.

6.3.1. Journey quantity before and during COVID-19

The first item examined was that of the quantity of journeys; namely asking the respondents whether the number of journeys they had taken in an average week had increased or decreased during the COVID-19 pandemic compared to before the pandemic. 274 of the 402 respondents reported taking less journeys (either 'a few less' or 'a lot less'); this corresponds to 68% of respondents in total. Only 15 respondents (4%) reported any increase in trips; as such, it is seen in this sample that the effect of the COVID-19 pandemic, in general, was a reduction in travel. This is shown in Figure 6.2 below.

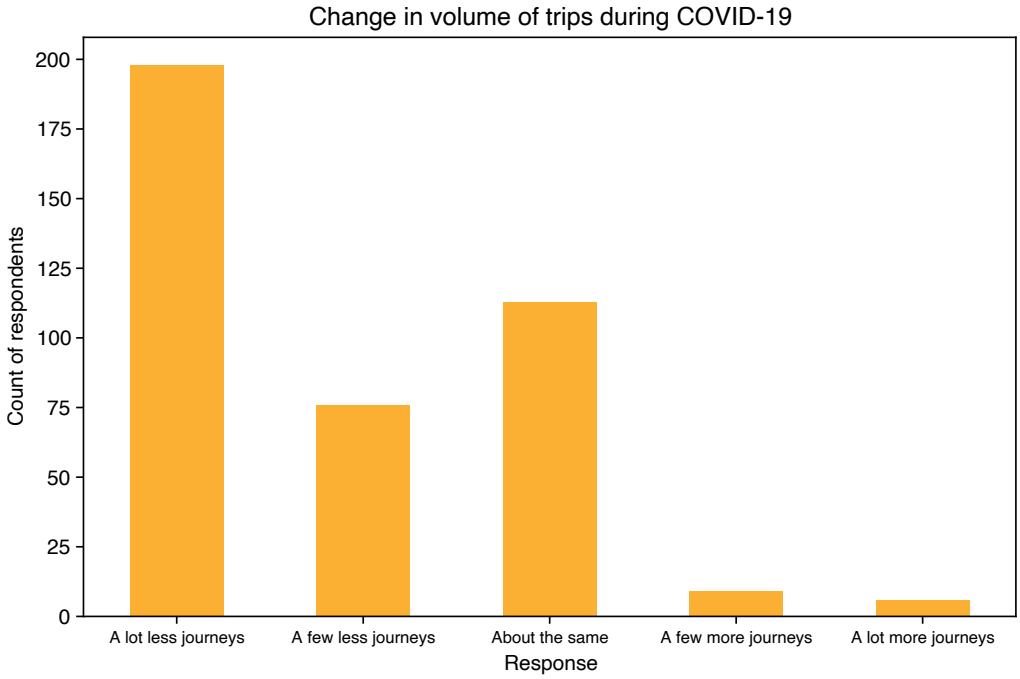

Figure 6.2 Change in journey quantity during COVID-19 (n = 402).

The results above are summarised in Table 3 below; with the responses also grouped by the general direction of change (more/less/same). While almost 50% of respondents reduced their journeys 'a lot' during the COVID-19 pandemic, the total proportion of respondents who reduced their journeys at all grows to over two thirds, as indicated above. With changes to working conditions (such as an increase in working from home) and restrictions on leisure activities and non-essential services reduced, this is not unexpected.

This is broadly consistent with the work of Beck and Hensher (2020) regarding transport use during COVID-19, which demonstrated with a different metric that on average, household trips decreased by about 50% 'after' COVID-19 compared to before COVID-19. As such, these results also show a great decrease in the number of journeys taken, albeit from a differing perspective.

Table 6.3 Change in journey quantity during COVID-19, including groups (n = 402).

Response	Count (Percent)	Grouped Count (Percent)
A lot less journeys	198 (49.3%)	274 (68.2%)
A few less journeys	76 (18.9%)	
About the same	113 (28.1%)	
A few more journeys	9 (2.2%)	15 (3.7%)
A lot more journeys	6 (1.5%)	

6.3.2. Mode choice before and during COVID-19

The next four questions of the survey investigated the 'usual' mode choice before and during COVID-19 for two different purposes: work (for those who did work) and social/recreational.

To avoid respondent fatigue, these two purposes were chosen for investigation out of a wider range of possible purposes for travel. These were chosen due to the quantity of work-related trips and the overrepresentation of public transport (before COVID-19) in social and recreational trips.

Figure 6.3 below shows the differences between stated mode choices before and during COVID-19 for work and social/recreational purposes. As this is a multiple response question – respondents can use more than one mode for a journey – the number of responses will not match the number of respondents. The work questions were only asked of the 196 respondents who indicated a non-zero number of hours worked and indicated that their number of journeys did not stay the same. The social questions were asked of the 289 respondents who indicated that their number of journeys did not stay the same.

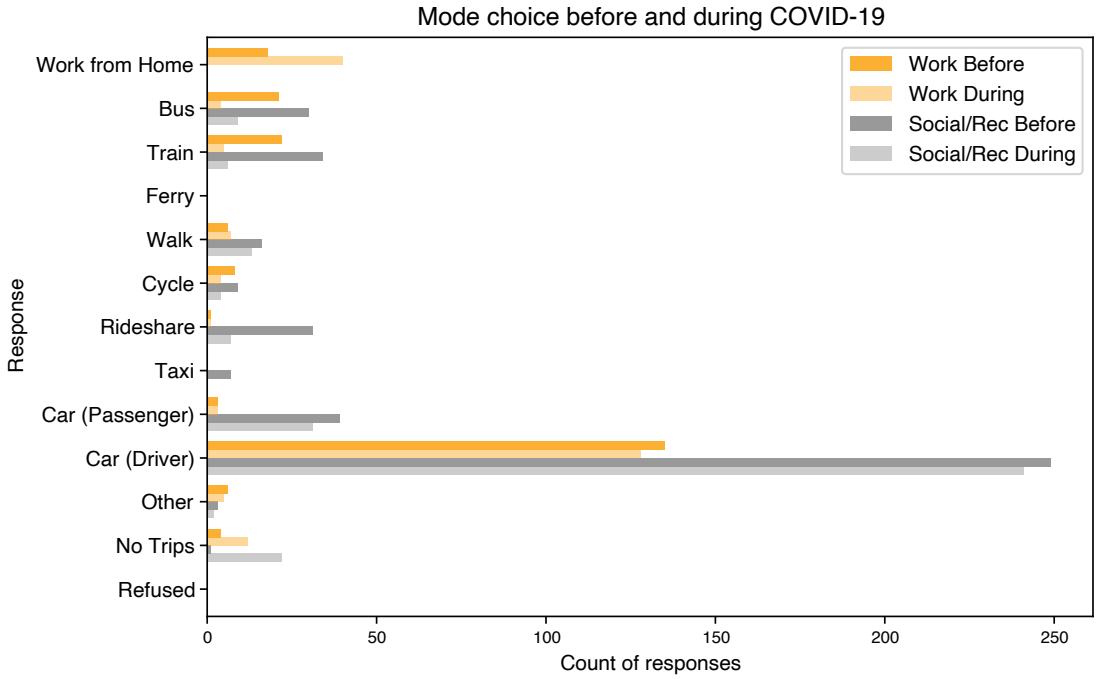

Figure 6.3 Mode choice before and during COVID-19 (n_{Social} = 289, n_{Work} = 196)

These results are summarised in Table 6.4 below. It is notable from the Figure above and the Table below that the most commonly used mode is car (as driver) for both work and social/recreational settings – although not as pronounced for the latter. Also of note is the reduction in work trips during COVID-19 – with the number of responses detailing “Work from Home” more than doubling compared to before, alongside a doubling in “No Work Trips”.

As this question was answered by respondents who elected that they work, it is assumed that those with ‘No Work Trips’ are, in the case of before COVID-19, working from home and afterwards either working from home or no longer working.

There is a marked decrease in active and shared modes travelling to work after COVID-19, with approximately 75% of train and bus passengers no longer using these modes to travel to work. This effect is even more pronounced in the case of social/recreational travel; train travel falls by approximately 80%. However, it should be noted that at the time of the survey being conducted, only small gatherings were permitted (with restrictions) in the Perth area. Most notable is the reduction in rideshare for social and recreational purposes, likely due to the lack of venues open for this purpose.

While the methodology was different, this is broadly consistent with Beck and Hensher (2020) and their investigation of transportation in the age of COVID-19 which showed marked decreases is the number of train, bus and walk/cycling journeys undertaken weekly by each household – a different metric, but one that also shows how mode choice has changed. However, the research differed in showing a much larger drop in private car travel compared to the results of this survey. The same study also showed a decrease in trips by purpose – with commute trips decreasing by over 50% and social/recreational by approximately 75% - which again is a different metric but much more pronounced than this investigation.

Table 6.4 Mode choices before and during COVID-19 (n_{Social} = 289, n_{Work} = 196)

Mode	**Work**		**Social/Recreational**	
	Before	**During**	**Before**	**During**
Work from home	18	40	N/A	N/A
Bus	21	4	30	9
Car (Driver)	135	128	249	241
Car (Passenger)	3	3	39	31
Cycle	8	4	9	4
Ferry	< 3	< 3	< 3	< 3
No Trips	4	12	< 3	22
Other	6	5	3	2
Rideshare	< 3	< 3	31	7
Taxi	< 3	< 3	7	< 3
Train	22	5	34	6
Walk	6	7	16	13

6.3.3. Reasons for mode change during COVID-19

The next of the COVID-19 related questions were regarding why people changed their mode choice as detailed in the questions above. The results of this question are presented graphically in Figure 6.4 and numerically in Table 6.5 below. While this

question was only asked to those who responded in a manner that indicated they changed mode during COVID-19 compared to before COVID-19 (either for work or social/recreational purposes). Respondents could answer with multiple choices, if applicable.

Each response is summarised as below for brevity in the Figure. The specific wording of each response is:

- **Not in Perth**: coded from 'Other' responses where the respondent indicated they were not in the Perth area at the time, generally FIFO workers;

- **Work from Home**: coded from 'Other' responses where the respondent indicated they were working from home and hence it is implied that any mode change was to 'nothing' and remained the same for other journeys;

- **COVID Restrictions**: coded from 'Other' responses where the respondents indicated that they were abiding with government mandated COVID restrictions;

- **Convenience:** coded from 'Other' responses where the respondents indicated that they were 'too lazy' or it was 'not worth' using shared modes, 'didn't go to Perth' or used the word 'convenience'.

- **Timing Change:** a presented option *'timing of previous mode has changed – such as longer journey time, less services, changed timetabling'.*

- **Activities at Home:** a presented option *'doing activities at home rather than in-person'*.

- **Activity Reduction (COVID):** a presented option '*reduction in activities due to COVID-19*'.

- **Change in Finances:** a presented option *'change in financial situation'.*

- **Worry of Catching:** a presented option '*worry about catching COVID-19*'.

- **Did not Change:** a presented option '*have not changed time on each mode';* the contradictory nature of this is described below.

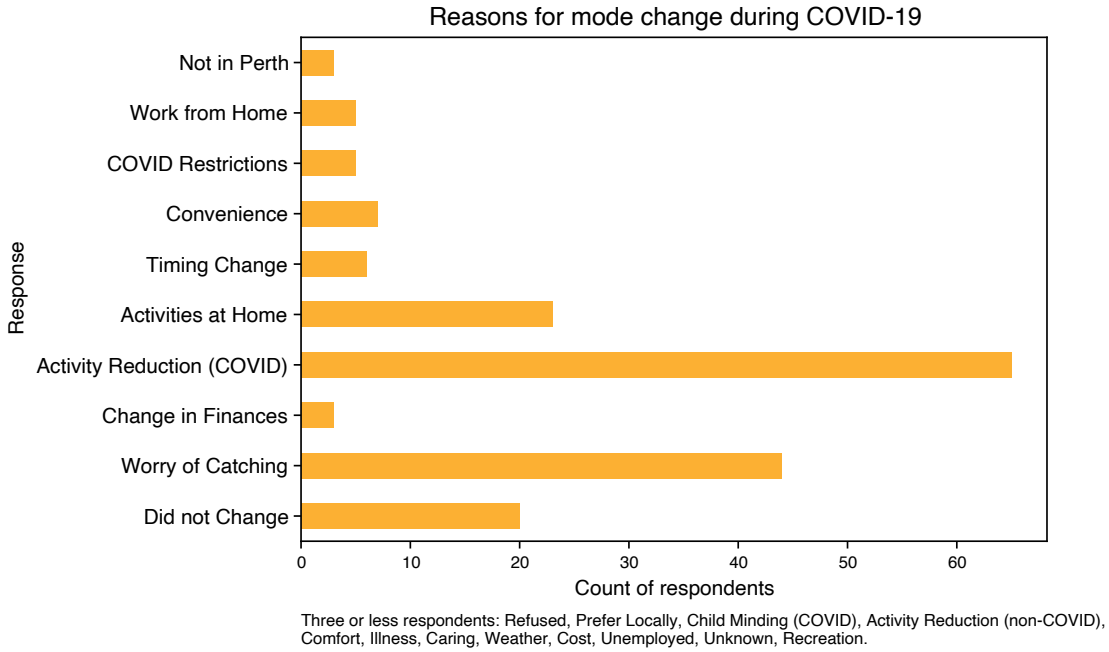

Figure 6.4 Graph of responses to question regarding reasons for mode change during COVID-19 (n = 135).

Again, a reasonably sized group of persons indicated that they did not change their travel modes despite indicating otherwise in previous questions. The responses as indicated in Section 6.3.2 were used to determine which respondents to ask this question of; those who 'did not change' were those who indicated they spent the same amount of time on each mode despite the fact they previously indicated that they had taken different modes. This is inconsistent and may be due to confusion by respondents or that they may consider only a single 'primary' mode of transport which has not changed.

Otherwise, the largest groups were those related to the virus itself: the 'worry of catching' (44 responses) or changes in activities brought on by the virus (65 responding 'activity reductions due to COVID' and 23 responding 'doing activities at home'). The work of Beck and Hensher (2020) investigating the impact of COVID-19 also showed that many of their respondents had impacts to a wide range of activities that had been interrupted by COVID-19. As the questions were phrased from a different perspective, direct comparisons cannot be made.

Table 6.5 Table of responses to question regarding reasons for mode change during COVID-19 (n = 135).

Reason	Responses
Activity Reduction – COVID-related *('reduction of activities due to COVID-19')*	65 (16.2%)
Worry of Catching *('worry about catching COVID-19')*	44 (11%)
Activities at Home *('doing activities at home rather than in-person')*	23 (5.7%)
Did not Change *('have not changed time spent on each mode')*	20 (5%)
Convenience (coded)	7 (1.7%)
Timing Change *('timing of previous mode has changed – such as longer journey time, less services, changed timetabling')*	6 (1.5%)
COVID Restrictions (coded)	5 (1.2%)
Work from Home (coded)	5 (1.2%)
Change in Finances *('change in financial situation')*	3 (0.7%)
Not in Perth (coded)	3 (0.7%)

Of note is the similarity between some of these options, however the intentions are slightly different: 'COVID Restrictions' were generally where respondents were prevented from the behaviour they wished to undertake by government restrictions whereas the 'Worry in Catching' regarded respondents that 'feared' the virus on shared modes and hence chose to avoid them.

6.3.4. Reasons to return to using shared transport modes

Finally, the last COVID-related question asked applicable respondents when they are likely to resume using shared transport after COVID-19 – or more accurately, why they will resume using the service. This was only asked of respondents who had identified using non-car modes of transport before COVID-19 but had identified not using the same modes during COVID-19. Respondents could select multiple options.

The results of this question are presented in Figure 6.5 below. The options within the Figure are a combination of coded results and options presented to the respondent. They are described as follows:

- **COVID Worries**: a coded response containing COVID related issues that are not the same as being worried of catching the disease. These are generally hygiene related (paraphrased *'prevention on PT', 'more hygiene practices on PT', 'want to be comfortable with COVID-19')* despite the work that is being done in this area or are related to 'waiting for a vaccine'.

- **Return to Work:** a presented option '*returning to work away from home*'.

- **Timing Changeback:** a presented option '*improved timing of old mode has changed back – such as more bus services or shorter journey times*'.

- **Less Activities at Home**: a presented option '*no longer doing activities at home*'.

- **Activity Increase**: a presented option '*increase of the number of activities'*.

- **Venues Re-Opening**: a presented option '*re-opening of venues after COVID-19*'.

- **No Worry of Catching**: a presented option *'no longer worry about catching COVID-19'.*

- **None:** a 'do not read out' option for when the respondent stated that nothing will make them return to non-car transport.

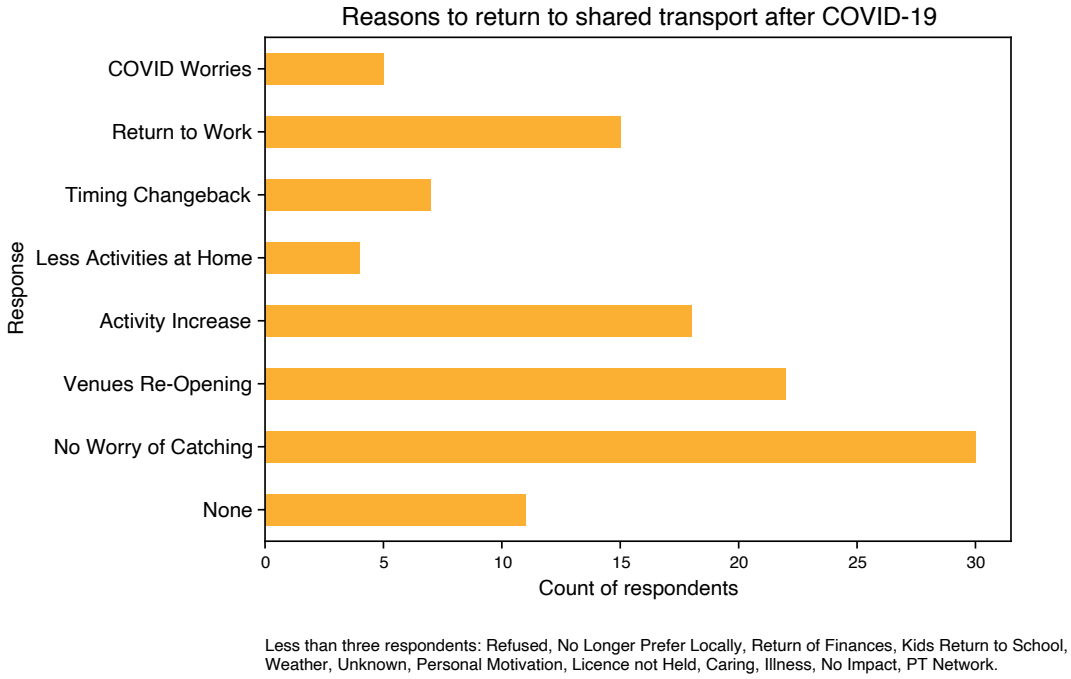

Figure 6.5 Graph displaying responses regarding reasons to return to shared transport after COVID-19 (n = 402).

The responses are widely varied to this question; many are to do with factors outside the control of the respondent, such as changes in timing, work/activities resuming and venues reopening, however the largest is still the perception of catching COVID-19. These responses are shown below in Table 6.6.

Beck and Hensher (2020) investigated the level of concern of respondents to a survey regarding hygiene on public transport. Approximately 85% of respondents were at least 'somewhat concerned' about hygiene on public transport from an Australia-wide perspective, much higher than the rate in this survey.

Coded responses to this question discussed that respondents would wait until a vaccine, desire more 'COVID prevention' on public transport, desired improved cleanliness on public transport vehicles and wanted increased comfortability with COVID-19 before returning to shared (public) or active transport services.

Table 6.6 Responses regarding reasons to return to shared transport after COVID-19 (n = 402).

Reason	**Responses (Percentage)**
No Worry of Catching *('no longer worry about catching COVID-19')*	30 (7.5%)
Venues Re-opening *('re-opening of venues after COVID-19')*	22 (5.5%)
Activity Increases *('increase of the number of activities')*	18 (4.5%)
Return to Work *('returning to work away from home')*	15 (3.7%)
None – nothing will make me change back	11 (2.7%)
Timing Changeback *('improved timing of old mode has changed back – such as more bus services or shorter journey times')*	7 (1.7%)
COVID Worries – prevention, lowering of risk (coded)	5 (1.2%)
Less Activities at Home *('no longer doing activities at home')*	4 (1%)

The remainder of the questions regarded the use of Journey Planners, which is explored in the section below.

6.4. Journey Planner-related questions

The primary focus of the survey was to ascertain how journey planners are used, such that their use supports an increase in utilisation of active and public transport modes. The following questions were asked of respondents in order to ascertain their usage and views of journey planners.

6.4.1. Frequency of journey planner use

The first Journey Planner-related question ascertained the frequency of use by respondents. As shown in Figure 6.6 below, the majority of respondents used journey planners at least 'occasionally' with only a small proportion never using journey planners.

Respondents were presented with a six-point scale describing how frequently they used journey planners, to help understand whether journey planners are a part of transport users' journey methodology.

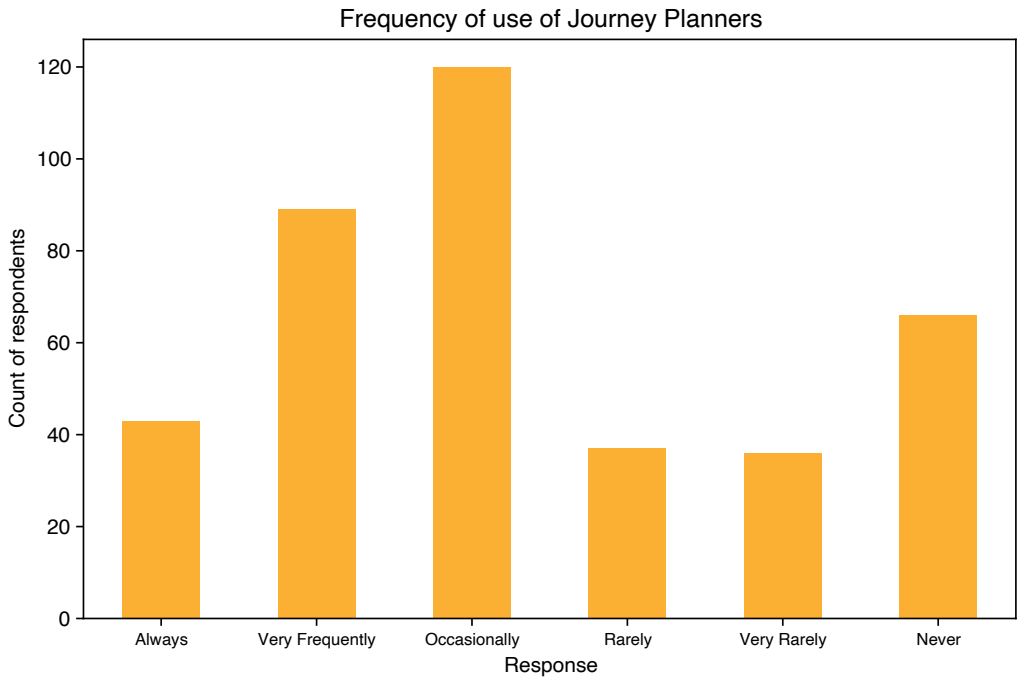

Figure 6.6 Frequency of use of Journey Planners (n = 391).

This is better illustrated through Table 6.7 below, which shows the exact number of respondents for each option.

Table 6.7 Responses to frequency of use of Journey Planners (n = 391)

Reason	**Responses**	**Grouped Responses**
Always	43 (11%)	252 (64.5%)
Very Frequently	89 (22.8%)	
Occasionally	120 (30.7%)	
Rarely	37 (9.5%)	139 (35.5%)
Very Rarely	36 (9.2%)	
Never	66 (16.9%)	

6.4.2. Journey planner use by device type and system

Next, for those 325 respondents who answered that they have indeed used a Journey Planner, the respondents were asked which particular one they used and on which platform – such as phone or website.

This was to ascertain which journey planners are commonly in use; third-party journey planners require information to function properly, and as such identifying if they are in common use will help inform recommendations on providing data to them.

While some of these options were read out, the ability for the respondents to specify other journey planners was provided, which yielded some additional journey planners being used. These were then coded into the device and system types, where possible. These are shown in Table 6.8 below.

Table 6.8 Matrix of Journey Planners and Platforms Used (n = 325).

Planner	Car	Phone	Printed	Unknown	Website	iPad
Android Auto	< 3	0	0	0	0	0
Apple Maps	0	50	0	0	5	0
Didi	0	0	0	4	0	0
Garmin	< 3	0	0	0	0	0
Google Maps	1	270	0	0	50	0
Hema	0	0	0	< 3	0	0
In-Built System	17	0	0	0	0	0
Maps.Me	0	< 3	0	< 3	0	0
Moovit	0	< 3	0	0	0	0
Navman	< 3	0	0	0	0	0
Ola	0	10	0	0	0	0
Road Directory	0	0	< 3	0	0	0
Road Warrior	0	< 3	0	0	0	0
Samsung Maps	0	< 3	0	0	0	0
Swan Taxis	0	0	0	< 3	0	0
TomTom	0	0	0	< 3	0	0
Transit	0	< 3	0	0	0	0
Transperth	0	81	0	0	27	< 3
TripGo	0	0	0	0	0	0
Uber	0	63	0	0	0	0
Waze	0	14	0	0	0	0
WhereIs	0	0	0	< 3	0	0
Your Move	0	0	0	0	< 3	0

Graphically, these results are shown in Figure 6.7 below, where they are grouped by the planner itself to see which planners overall are most popular.

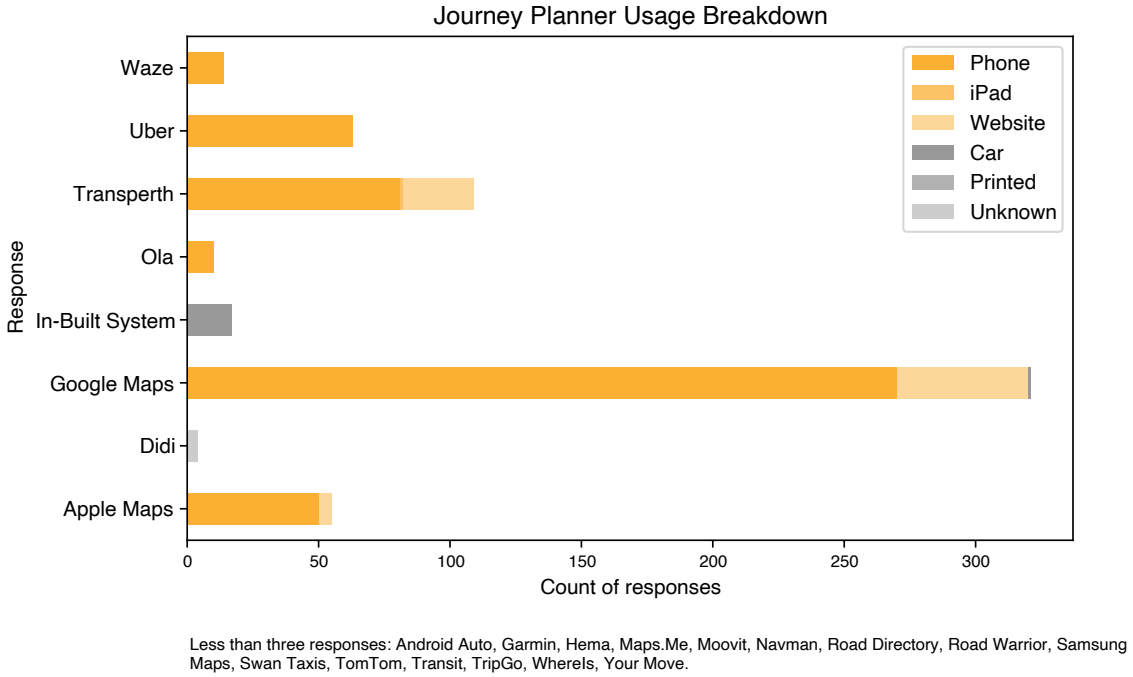

Figure 6.7 Journey Planners used by respondents (grouped, n = 325)

Of note is the popularity of Google Maps over Apple Maps – despite other research suggesting that a significant number of Australians use Apple devices, they are still using (or misidentifying) Google Maps as a primary source of journey planning information.

Waze and Uber were also popular, as was the Transperth app and online Transperth journey planner. Many other journey planners were identified but were used by a very small number of respondents.

Unfortunately, the question did not ask whether respondents tried one system before another system was used. However, 72.7% of respondents who used either a road directory or an in-car system also used Google Maps on a phone. There may be a cross-over of respondents who are limited by the in-car system and hence use Google Maps itself, however there also may be respondents who have ‘given up’ on an in-car system and stopped using it.

6.4.3. Journey planner use before COVID-19

The next question asked the same respondents whether they used journey planners before COVID-19 and if so, how frequently. This was asked to ascertain the level of journey planner use by the general community, again to understand whether it is worthwhile to focus efforts on journey planners and whether they may be affecting travel behaviour.

Respondents chose from a six-point scale as to how often they used Journey Planners, as detailed in Figure 6.8 below.

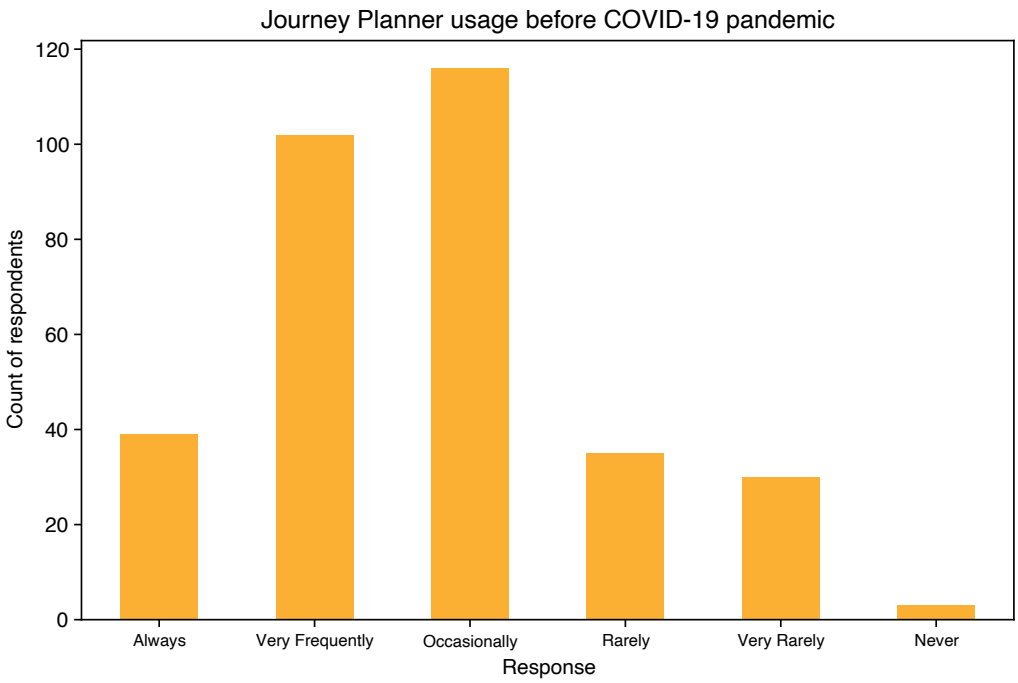

Figure 6.8 Journey planner usage before COVID-19 (n = 325).

Despite the fact only the 325 respondents had identified ever using journey planners were asked this question, a small number identified having never used journey planners before COVID-19.

There is a possibility that they used journey planners before the pandemic and do not do so now, having interpreted the first question regarding journey planner use frequency as being at this point in time and this question as being for only below COVID-19. Further details of the responses are presented in Table 6.9 below.

Table 6.9 Count of responses to question on journey planner usage before COVID-19 (n = 325).

Response	Count (Percentage)	Grouped Count (Percentage)
Always	39 (12%)	257 (79.1%)
Very Frequently	102 (31.4%)	
Occasionally	116 (35.7%)	
Rarely	35 (10.8%)	68 (20.9%)
Very Rarely	30 (9.2%)	
Never	3 (0.9%)	

Surprisingly, of those who had used journey planners, approximately four-fifths of respondents had used them at least 'occasionally', showing that those who use journey planners do indeed generally use them more frequently than as a once-off proposition.

6.4.4. Journey planner usage by travel mode

The applicable respondents were then asked which travel modes they used journey planners with. This was asked to better understand the types of travel modes used with journey planners, namely whether they are used only with private (car) transport, shared transport, or both.

Respondents were able to choose as many modes as they wished and were able to provide their own which were coded. The results of this are shown in Figure 6.9 below.

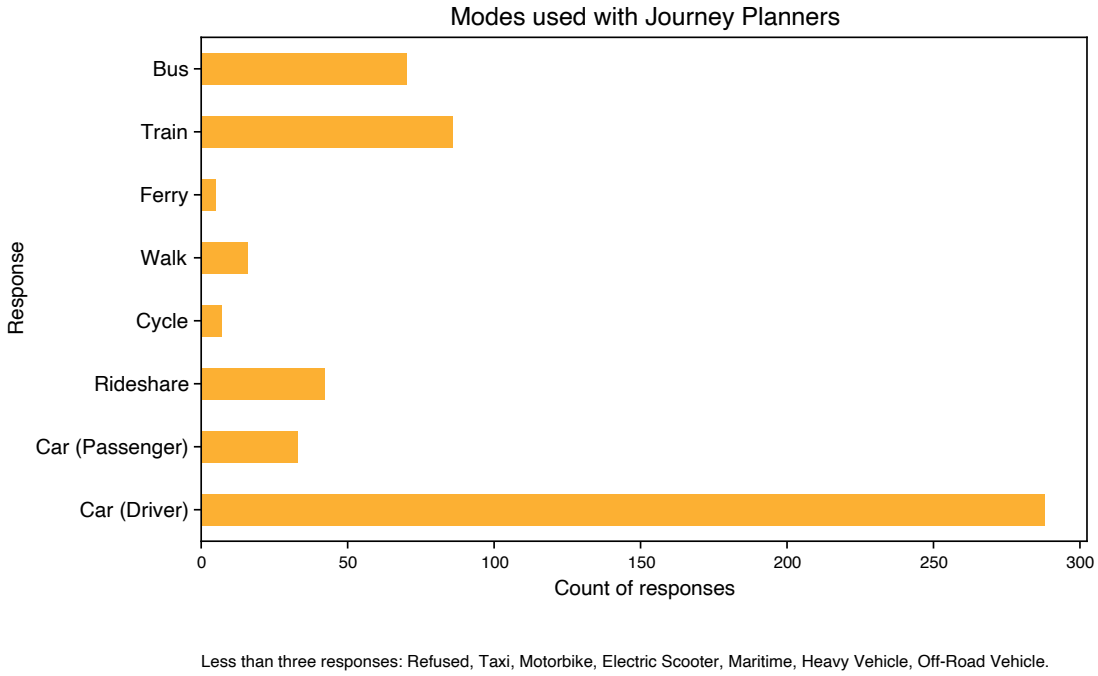

Figure 6.9 Graphic of journey planners by mode (n = 325).

As expected, much as the choices of modes utilised made by respondents, by far the largest mode selected was 'Car (Driver)', however there were still a reasonable set of respondents who identified that they used journey planners with public transport modes, seemingly higher than presented in the modes utilised. This is shown in detail in Table 6.10 below.

Table 6.10 Responses to use of journey planners by mode (n = 325).

Reason	**Responses (Percentage)**
Car (Driver)	288 (88.6%)
Train	86 (26.5%)
Bus	70 (21.5%)
Rideshare	42 (12.9%)
Car (Passenger)	33 (10.2%)
Walk	16 (4.9%)

Cycle	7 (2.2%)
Ferry	5 (1.5%)

A small (n = 6) number of respondents indicated that they used other modes than those stated above; none of these were indicated by three or more respondents but included things such as maritime vessels, motorbikes, off-road vehicles, heavy vehicles and electric scooters. The response to a later question (Section 6.4.9) indicates there are possibly more heavy vehicle users who have been interviewed.

6.4.5. Multi-modal journey planner usage

This was then further expanded on by investigating whether respondents had used journey planners for multi-modal journeys – excluding those which contained a combination of walking and public transport. Respondents could select from either a 'Yes' or 'No' response. This question was ascertained to better understand the use of multi-modal journey planners. Figure 6.10 below shows the results of this question, asked only of those who knew of journey planners (n = 325).

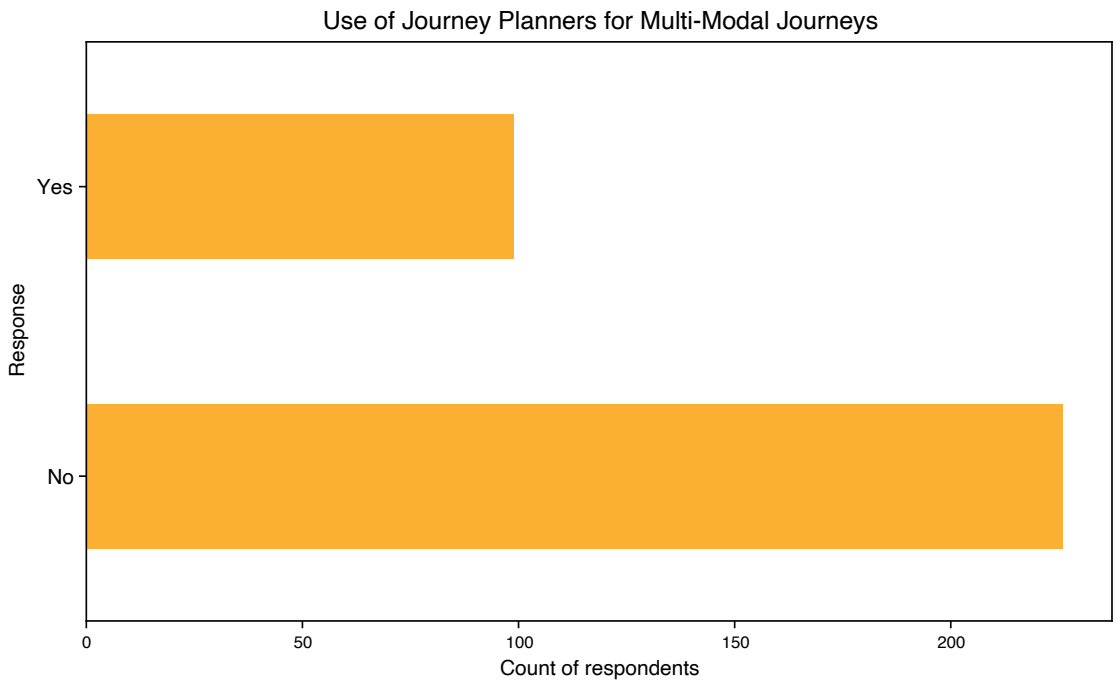

Figure 6.10 Use of Journey Planners for Multi-Modal Journeys (n = 325)

Table 6.11 below examines the data above in specific detail. 226 (69.5%) respondents identified that they had not used a journey planner for multi-modal journeys, whereas 99 (30.5%) respondents had identified that they had.

While the majority of respondents had not used multi-modal journey planners, the proportion that had was still reasonable; as such, there is a desire for these types of services which are not available in all journey planners.

Table 6.11 Counts of responses to use of journey planners for multi-modal journeys (n = 325).

Response	Count (Percentage)
Yes	226 (70.5%)
No	99 (29.5%)

6.4.6. Frequency of journey planner usage

The applicable respondents (those who were aware of journey planners) were then asked how frequently they used journey planners for particular types of journeys – new and recurring – rather than overall.

Namely, the respondents were asked how often they used journey planners for a new journey *("to somewhere you haven't been before")* and for a journey that they had done often *("such as travelling to work")*.

This was asked to understand whether journey planning was an integral part of each journey or something done only for new journeys – thereby inferring the importance of live information. The results of these questions are presented in Figure 6.11 below.

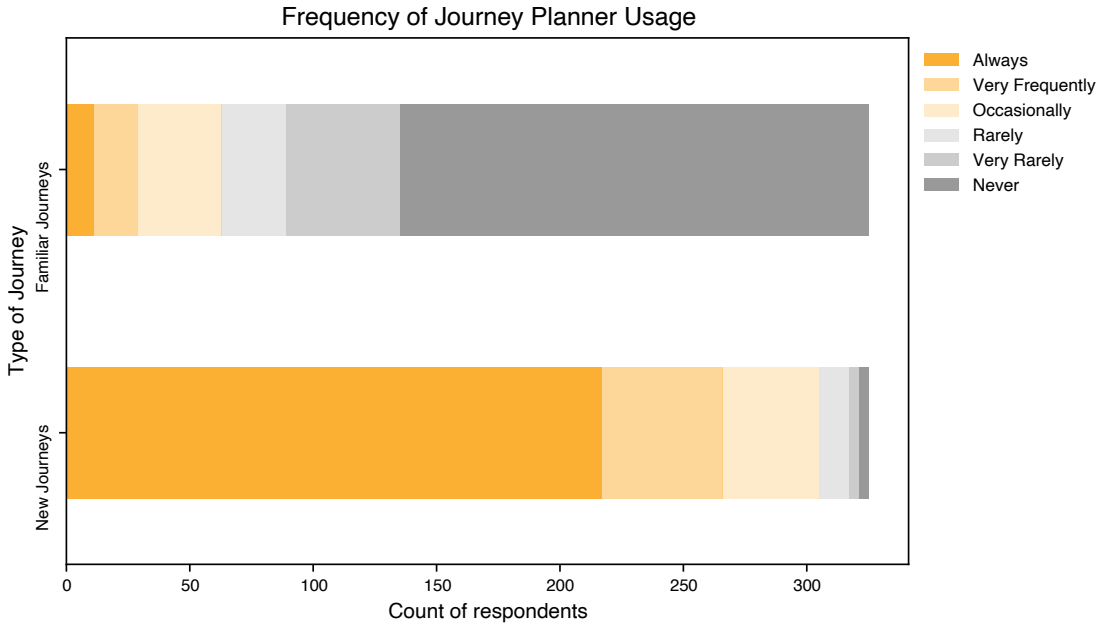

Figure 6.11 Frequency of journey planner usage by type of journey (n = 325).

It was hypothesized that respondents would be more likely to use journey planners for new journeys rather than recurring ones – instead relying on existing knowledge. The results above suggest that this assumption may be supported; a very large group do not use journey planners for familiar journeys while many always do so for new journeys.

This means, however, that respondents are not aware of the latest real-time information that may positively or negatively impact their journey, such as congestion on roads or delays and cancellations on PT services. This may be for a lack of interest, a lack of effort or other reasons.

This data is presented below in tabular format as Table 6.12, summarising the above results.

Table 6.12 Counts of responses to frequency of journey planner usage by type of journey (n = 325).

Frequency of Usage	New Journeys	Familiar Journeys
Always	217 (66.8%)	11 (3.4%)
Very Frequently	49 (15.1%)	18 (5.5%)
Occasionally	39 (12%)	34 (10.5%)
Rarely	12 (3.7%)	26 (8%)
Very Rarely	4 (1.2%)	46 (14.2%)
Never	4 (1.2%)	190 (58.5%)

6.4.7. Current journey planner features

The same respondents were then asked about the features currently existent in most journey planners and which features they valued. This ascertained which existing features are most worthwhile to focus effort upon maintaining and improving.

Respondents could select multiple options from a presented list or suggest their own, which were coded into one or more categories. Notably, there were 922 responses, so each respondent on average suggested 2.84 responses.

The responses shown in the graph and table are a combination of options presented to the respondent and coded responses to an 'Other' free response. The meaning of each of these options are as stated below:

- **Petrol Stations**: a coded response for respondents who indicated information regarding the location of petrol stations was of interest;

- **Alternate Instructions**: a coded response that covered 'advanced' routing techniques such as step by step instructions, voice directions, planning by arrival time, ability to avoid main roads and re-routing from accidents;

- **Police Locations**: a coded response that gathered responses that desired or used information regarding the location of police and/or speed cameras;

- **Traffic Information**: a coded response that gathered responses that found roadwork or road disruption information useful;
- **Travel Time (Estimated)**: a presented option '*travel time estimates*';
- **Routing/Navigation**: a presented option *'routing and navigation'*;
- **Travel Time (Live)**: a presented option *'live travel times'*;
- **Destination Finder**: a presented option '*finding a destination*';
- **Cost Estimate**: a presented option '*journey cost estimates*';
- **Speed Limits**: a presented option '*speed limits or similar information*';
- **Nothing**: a 'do not read out' option for when respondents did not think any features are useful.

Figure 6.12 below shows the results of this question.

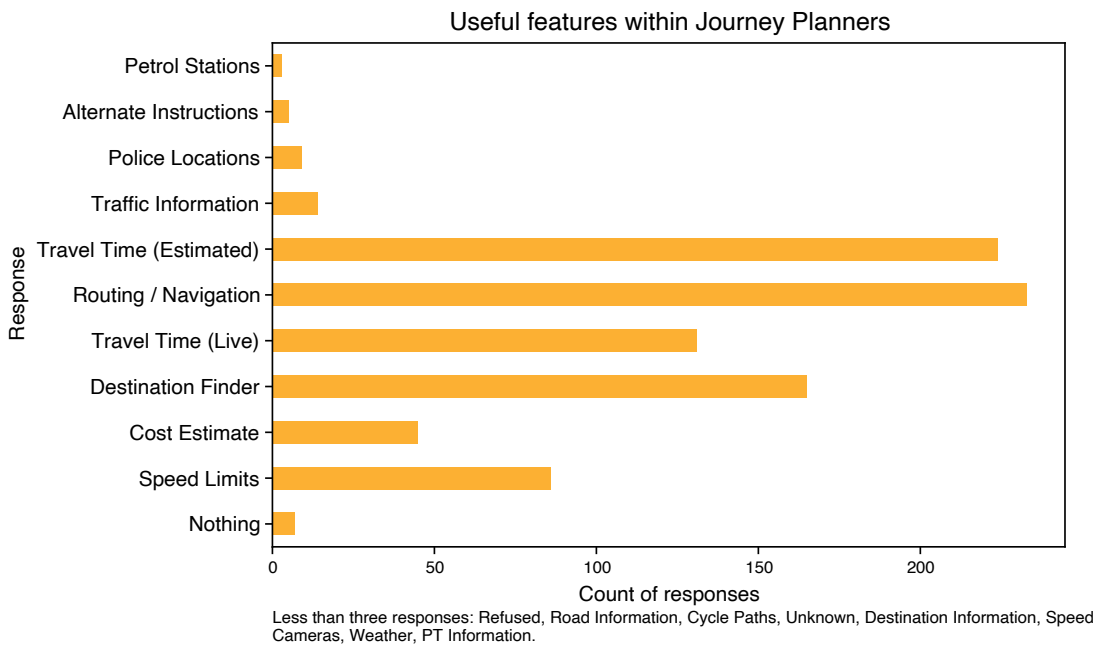

Figure 6.12 Useful features within journey planners (n = 325)

This is further examined for the above items with three or more responses, from most common to least common response, in Table 6.13. The percentage of respondents specifying each feature is also presented.

Table 6.13 Counts of responses to useful features within journey planners (n = 325).

Feature	**Count (Percentage of)**
Routing / Navigation *('routing and navigation')*	233 (71.7%)
Travel Time – Estimated *('travel time estimates')*	224 (68.9%)
Destination Finder *('finding a destination')*	165 (50.8%)
Travel Time – Live *('Live travel times')*	131 (40.3%)
Speed Limits *('speed limits or similar information')*	86 (26.5%)
Cost Estimate *('journey cost estimates')*	45 (13.8%)
Traffic Information (coded)	14 (4.3%)
Police Locations (coded)	9 (2.8%)
Nothing (no useful features)	7 (2.2%)
Alternate Instructions (coded)	5 (1.5%)
Petrol Stations (coded)	3 (0.9%)

Of note in the responses is that the 'traditional' journey planner features are well supported; estimated travel time and routing/navigation are the most common responses. 'Live' travel times were also well reported, with 40% of respondents identifying this as an important feature. As such, to ensure this group can continue to make use of Journey Planners, it is incumbent to continue and increase provision of 'live' travel time data (for all modes) to third-party journey planner developers.

Provision of information regarding the search and discovery of destinations is also highly valued; as such, the 'opening up' of data on destinations could assist in providing this to end users.

6.4.8. Desirable features for journey planners

The remaining questions, except for the final question, regarded the respondents' interest in new features that could be added to journey planners – these features gathered from an analysis of journey planners on the market that provide the features to other cities.

This is to ascertain whether effort should be placed into the development of said features or provision of data to enable their development, such that the effort may be rewarded with increased use of journey planners – both for car-based transit and shared transit.

For the six questions, respondents were asked to rate on a scale of 'usefulness' from 'Very Useful' to 'Not Useful' whether they found the specific feature useful to them.

Specifically, the scale consisted of 'Very Useful', 'Useful', 'Moderately Useful', 'Slightly Useful' (all of which were considered 'Useful' in the grouped category), 'Not Useful' and 'Don't Know'.

Four of the questions – information on the impact of the journey (1), ability to book and pay ahead (2), provision of information in alternative formats (5) and live information (6) – were provided to all who had heard of journey planners (n = 391). Two questions – regarding multi-modal journey planners (3) and crowding information of public transport (4) – were provided only to those refused the questions regarding mode use or had chosen an option in any of the questions that was not car-related (n = 130).

Specifically, the questions asked in the survey (as attached in the Appendix) are:

- **Live Information:** *How useful would you find extra 'live' information such as road congestion, road closures or bus delays?*

- **Alternative Formats**: *availability on different devices such as watches, digital assistants (e.g. Google Home or Alexa), integration with cars or using voice control?*

- **PT Crowding**: *How useful would you find information on crowding, such as capacity and occupancy of public transport?* (only asked of those who used non-car transport)

- **Multi-Modal**: *How useful would a journey planner be if it integrated transport modes, meaning it would show a journey that combined both public transport and driving or cycling?* (only asked of those who used non-car transport)

- **Book/Pay Ahead**: *How useful would you find the ability to book or pay ahead for a mixed mode journey, with details on the total cost and a discount applied?*

- **Journey Impact**: *How useful would you find a journey planner that also gave you information regarding the impact of your journeys, such as around carbon emissions or calories burnt?*

However, it has been noted that this can be considered a limitation, as multi-modal transport and crowding information may be desired by respondents who currently do not use public transport but may do so if said information is available. However, it is still noted that a majority in both cases still found this information at least slightly useful, and as such there is still a desire, at least from public transport users, for these features and as such their inclusion should be further investigated.

Figure 6.13 below shows the responses to each of the sets of features proposed.

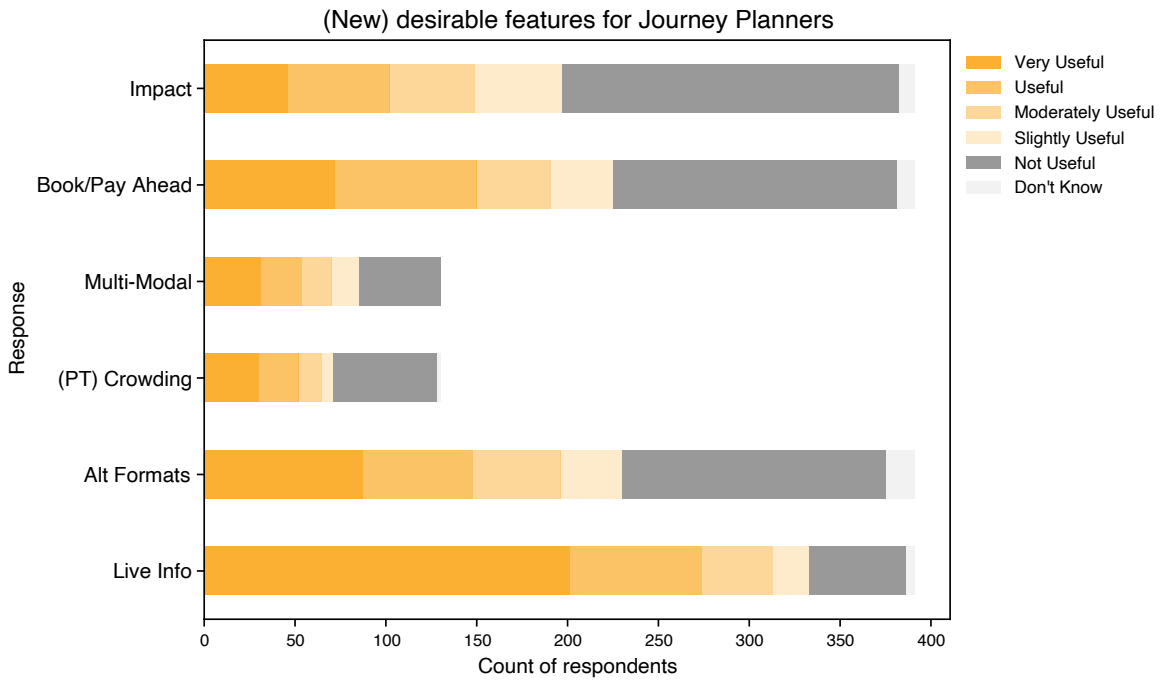

Figure 6.13 Responses to feature suggestions for journey planners ($n_{1,2,5,6}$ = 391, $n_{3,4}$ = 130).

It is noted that the multi-modal and PT crowding questions were only asked of applicable respondents.

The most desired feature of those asked was live information, contrasting with the results from the previous question. There was also great interest for the ability to book or pay ahead and lesser interest for alternative formats to access information with or for the impact of journeys, nothing there is still a large proportion of interest for the two feature groups.

For shared transport users, crowding information and multi-modal journey planning were found at least 'slightly useful' by the majority of respondents. The majority of all features were found to be somewhat useful, however only 'live information' was found 'very useful' by approximately half of respondents or more.

This is explained below in more detail within Table 6.14. Further detail is provided in Table 15 below that groups 'slightly useful' and above.

Table 6.14 Responses to questions regarding feature suggestions for journey planners ($n_{1,2,5,6}$ = 391, $n_{3,4}$ = 130).

	Very Useful	**Useful**	**Moderately Useful**	**Slightly Useful**	**Not Useful**	**Don't Know**
[1]Live Information	201 (51.4%)	73 (18.7%)	39 (10%)	20 (5.1%)	53 (13.6%)	5 (1.3%)
[2]Alternative Formats	87 (22.3%)	61 (15.6%)	48 (12.3%)	34 (8.7%)	145 (37.1%)	16 (4.1%)
[3]PT Crowding	30 (23.1%)	22 (16.9%)	13 (10%)	6 (4.6%)	57 (43.8%)	2 (1.5%)
[4]Multi-Modal	31 (23.8%)	23 (17.7%)	16 (12.3%)	15 (11.5%)	45 (34.6%)	0 (0%)
[5]Book/Pay Ahead	72 (18.4%)	78 (19.9%)	41 (10.5%)	34 (8.7%)	156 (39.9%)	10 (2.6%)
[6]Journey Impact	46 (11.8%)	56 (14.3%)	47 (12%)	48 (12.3%)	185 (47.3%)	9 (2.3%)

Table 6.15 Grouped responses to questions regarding feature suggestions for journey planners ($n_{1,2,5,6}$ = 391, $n_{3,4}$ = 130).

	Useful	**Not Useful**	**Don't Know**
[1]Live Information	333 (85.2%)	53 (13.6%)	5 (1.3%)
[2]Alternative Formats	230 (58.8%)	145 (37.1%)	16 (4.1%)
[3]PT Crowding	71 (54.6%)	57 (43.8%)	2 (1.5%)
[4]Multi-Modal	85 (65.4%)	45 (34.6%)	0 (0%)
[5]Book/Pay Ahead	225 (57.5%)	156 (39.9%)	10 (2.6%)
[6]Journey Impact	197 (50.4%)	185 (47.3%)	9 (2.3%)

As such, it can be seen that the vast majority of people find the provision of 'live' information for various modes important, and as such more investigation into the increased provision of this should be encouraged. The majority of respondents also found each of the other feature suggestions useful and as such their provision should also be encouraged.

When considering only the six respondents who increased their journey quantity during the COVID pandemic, an interesting picture is painted as seen in Table 6.16 below.

Table 6.16 Grouped responses to questions regarding feature suggestions for journey planners, only for those with increased travel ($n_{1,2,5,6}$ = 6, $n_{3,4}$ = 2).

	Very Useful	**Useful**	**Moderately Useful**	**Not Useful**
[1]Live Information	4 (66.7%)	< 3	< 3	< 3
[2]Alternative Formats	< 3	< 3	< 3	< 3
[3]PT Crowding	< 3	< 3	< 3	< 3
[4]Multi-Modal	< 3	< 3	< 3	< 3
[5]Book/Pay Ahead	< 3	< 3	< 3	< 3
[6]Journey Impact	< 3	3 (50.0%)	< 3	< 3

Unlike when considering all respondents, the views change when only considering this very small sample. While 'Live Information' is still very much of importance, 'Journey Impact' was also found to be 'Useful' to a larger proportion of respondents. The other questions are of too small a sample size to be reported to ensure privacy of respondents.

As such, this shows that the needs of those who actually have increased their journeys are roughly similar to the general sample however there is an over-representation for a view that 'Live Information' is 'Very Useful' and a much greater interest in 'Journey Impact'.

6.4.9. Rewards systems

The provision of rewards systems to encourage use of shared transport systems was also investigated and was provided as an open-ended question to yield the widest range of views possible. It was asked of all respondents (n = 391) who indicated they knew what a journey planner was.

Namely, the respondents were asked "*what type of reward system would encourage you to change your transport mode from using a car to walking, cycling or public transport*". This question was asked to ascertain whether a rewards system is a useful method to encourage take-up of shared transport services. Rewards systems have been suggested and used before to encourage behaviour change, such as for retail shopping, airlines and rideshare companies.

These views were coded (sometimes to more than one category; there were a total of 446 responses or 1.14 per respondent on average) and categorised to summarise the responses in Figure 6.14 and Table 6.17 below, which also shows the percentage of respondents identifying each response.

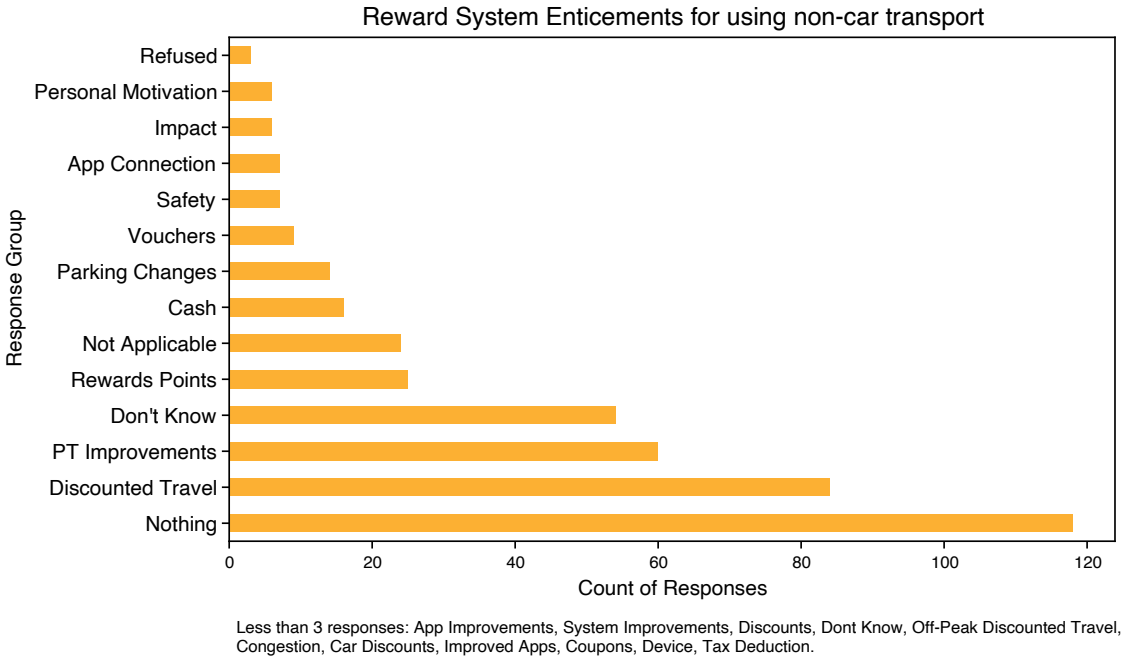

Figure 6.14 Reward system enticements for using non-car transport (n = 391).

Of note is that this question often yielded responses that were not directly relevant to the question asked; excluding the most common response of ‘Nothing’, the second most common response regarded improvements to the PT system itself outside the scope of rewards systems. Most other common responses were regarding some sort of monetary (or quasi-monetary) reward, such as rewards points, discounted travel, vouchers and cash.

Table 6.17 Counts of reward system enticements for using non-car transport (n = 391).

Response	**Count (Percentage)**
Nothing	118 (30.2%)
Discounted Travel	84 (21.5%)
PT Improvements	60 (15.3%)
Don't Know	54 (13.8%)
Rewards Points	25 (6.4%)
Not Applicable	24 (6.1%)
Cash	16 (4.1%)
Parking Changes	14 (3.6%)
Vouchers	9 (2.3%)
Safety	7 (1.8%)
App Connection	7 (1.8%)
Impact	6 (1.5%)
Personal Motivation	6 (1.5%)
Refused	3 (0.8%)

Some of the ‘easier’ suggestions were those to do with parking discounts and travel discounts on public transport for using said services or cycling. These did not require the direct provision of cash or cash equivalents and should be investigated further.

Suggestions around parking changes primarily focused on discounts for those at train stations (i.e. Park and Ride) however some comments were more general about reduced priced parking. Considering the context of the question – that is, what rewards will entice non-car transport – it is to be assumed that reduced price parking would be connected to the use of public transport.

Of note is that similar travel discount systems exist elsewhere such as weekly caps that make journeys after a certain point each week free or discounted; this is also achieved on a daily basis through the SmartRider system in Perth and the daily fare cap (DayRider) although this only applies for trips after 9AM on weekdays.

Some respondents did indicate that a game-style interface should be used to earn the reward points; however, the number of respondents suggesting 'gamification' were not large.

Of note is when examining only respondents who only use car (as either driver or passenger, n = 73), the most common response was 'nothing' indicating no change would be made. The next two responses, either improvements in PT services or discounted travel, were also popular responses when considering all respondents. This is show in Table 6.18.

Table 6.18 Counts of reward system enticements for using non-car transport for car-only respondents (n = 73).

Response	**Count (Percentage)**
Nothing	21 (28.8%)
Discounted Travel	14 (19.2%)
PT Improvements	13 (17.8%)
Vouchers	5 (6.8%)
Rewards Points	5 (6.8%)
Cash	4 (5.5%)

In rough terms, this is broadly similar to the responses for the general sample albeit with slight differences in percentages of respondents but with a similar magnitude for the larger categories – in this case, those with three or more responses.

Some insights providing more detail from the free-form text are described and paraphrased below:

- *I'm not paying more for public transport than I'd pay on fuel;*

- *PT would not take me to work as it is very scarce;*
- *No reward system would bribe me, unless PT is more accessible and convenient;*
- *The cost is about the same as driving, there would have to be a massive change in pricing to get me to change;*
- *I only use PT anyway;*
- *I am too lazy to ride the bike to work;*
- *I would not entertain other modes at all;*
- *I would like a discount for using both the bus and the train in a single journey;*
- *Discounts for frequent travellers would be good;*
- *As long as I get to my destination, I am happy;*
- *If I got a tax deduction at the end of the year, I would use PT more often.*
- *Just the reward of the apps being user-friendly and working properly;*
- *It's all about safety at the moment* (due to COVID);
- *Would like to have more parking at the train station*;
- *I have to use my car as I drop the kids off at school in the morning*;
- *Linked with an app that has fitness benefits*;
- *Having discounts for requesting an Uber regularly would be great* (Uber Rewards provides something similar to this);
- *It's far easier for me to drive and too inconvenient to change;*
- *I do shift work, so I would need to change my times to use PT;*

- *If there's too much traffic, I'll take the train instead;*
- *PT is pointless, it takes me two hours to get to work;*
- *Cannot change as I need to use my car for work, it carries my tools;*
- *No reward makes the wait worth it;*
- *Not viable as I am handicapped;*
- *Cost offset depending on distance travelled;*
- *Cheaper tickets and more frequent bus services;*
- *Not a well connected network;*
- *I would use it if my employer paid me to do so;*
- *A couple of free trips after five or ten;*
- *Planting trees every time someone uses the train;*
- *Nothing will make me use public transport, I hate it.*

The following responses gained less than three but greater than zero responses: Parking Changes, Don't Know, Personal Motivation, Not Applicable, Impact, App Connection, App Improvements.

6.4.10. Desirability of other new features

The last question on features within journey planners examined the desirability of other new features – on a 'yes or no' answer scale rather than a finer five-point 'usefulness' scale used for the previous questions. As per the above journey planner questions, it was asked of all respondents who knew what journey planners were.

This question was provided to ascertain if there were any other features worthy of investigation that were not covered in the previous question. To prevent respondent fatigue and ensure brevity of the telephone interview, these options were presented in this manner rather than the longer format of the previous questions.

Specifically, the respondents were provided with a list of "other new features of information within journey planners" that they "would be interested in" by the interviewer. The respondents could make multiple responses, with the 391 respondents eligible to answer this question making 594 responses, an average of 1.52 responses per person.

Respondents could also provide their own responses to this question if there were features not covered in the list; they were also free to make multiple responses. The free answers were coded to identify the primary themes (i.e. features) within them. Figure 6.15 below graphically shows the results of this question, which are described in detail in Table 6.19 below it.

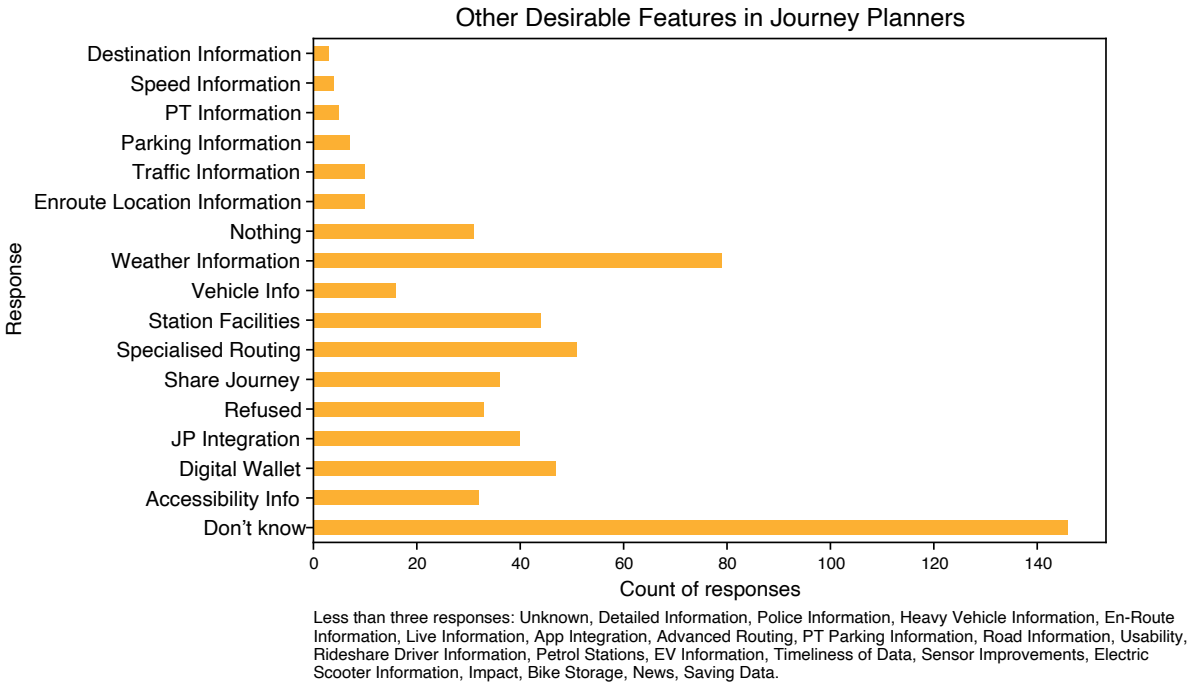

Figure 6.15 Other desirable features in journey planners (n = 391).

Responses which received less than three responses (less than 0.8%) are displayed at the bottom of the graph to enforce privacy. The responses are presented below in Table 6.19 from most common to least common for those features with three or more responses. For those responses that were not solely coded, the wording of the response is also presented in italics next to the abbreviated form of it.

Table 6.19 Counts of responses to other desirable features in journey planners (n = 391).

Response	**Count (Percentage)**
Don't know	146 (37.3%)
Weather Information *('weather information within the planner')*	79 (20.2%)
Specialised Routing *('specialised or fine-tuneable routing, e.g. avoid steep hills')*	51 (13%)
Digital Wallet *('ability to integrate payments with Apple Pay or Google Pay')*	47 (12%)
Station Facilities *(option presented as is)*	44 (11.3%)
Journey Planner Integration – with other mode apps *('better integration with rideshare e.g. Uber or bike share systems')*	40 (10.2%)
Share (your) Journey *('increased ability to share journey with other people, devices or Apps')*	36 (9.2%)
Refused	33 (8.4%)
Accessibility Information *('detailed accessibility information')*	32 (8.2%)
Nothing	31 (7.9%)
Vehicle Information *('detailed information on vehicle types')*	16 (4.1%)
En-route Information	10 (2.6%)
Traffic information	10 (2.6%)
Parking Information	7 (1.8%)
Public transport Information	5 (1.3%)
Speed Information	4 (1%)
Destination Information	3 (0.8%)

It is noted that many respondents either refused to answer the question (8.4%), provided an answer of 'nothing' (7.9%) or the similar and most popular answer of 'Don't

Know' (37.3%). Together, these responses represent approximately a third of respondents.

For those who did identify features, the most common response was that of weather. For users of shared transport modes, this is advantageous as the weather conditions may help influence travel decisions, with respondents less likely to walk or cycle if there is a possibility of poor weather such as rain.

With weather information already provided by groups such as the Australian Government's Bureau of Meteorology, this would be a relatively 'easy win' to include in Journey Planners. More advanced work could allow the weather to influence the choice of mode routing.

Specialised routing was a popular response and included areas such as identifying the slope and elevation for active transport users alongside complex journey provision (such as with multiple stops) for car users. A possible inclusion for public transport modes could be routing based on crowding; the COVID-19 views above support a desire for this and it would also help 'spread the load' over more services and provide the comfort of a seat to more patrons.

Other popular responses include integration with digital wallets such as Apple Pay and Google Pay for payment of transport services, alongside integration with other Apps. Some services already provide this, most notably rideshare services, however there is an arguable benefit for the ease of use by providing payment for shared transport services through mobile phones, as provided in some areas internationally and in Sydney indirectly through contactless payment.

Other desirable features primarily concerned the provision of more information regarding the trip such as accessibility and station facilities. Providing these would help transport consumers with difficulties accessing shared modes better utilise these modes by tailoring their journeys to use infrastructure more suited to their abilities. This could include wider bike paths for tricycles or railway stations with elevators compared to ramps.

Some insights that are paraphrased from the 'free answer' section that has been coded above is presented below:

- *Showing restaurants or things to do in new areas;*
- *Informing me of speed cameras as I approach them;*

- *Finding the nearest ATM while en-route;*
- *Dogs should be allowed on PT;*
- *Information on congestion and roadworks;*
- *Information about shops or good food;*
- *Speed limits and petrol station locations;*
- *More detailed information in general;*
- *Integration with Google and Apple Maps;*
- *Detours;*
- *Congestion;*
- *A service that alerts you when a bus is nearby;*
- *Knowing where to park in the city considering the flow of traffic as I drive a truck;*
- *Information on parking at train stations;*
- *Notification of relevant services in the area;*
- *Availability of car parking at the destination;*
- *Toilet facilities and EFTPOS machine;*
- *Bridge load limits;*
- *Location of coffee shops;*
- *Carbon footprints;*
- *Saving frequent or interesting drives.*

It is of note that most of these features are already available in certain existing journey planners, as identified previously. As such, this indicates that not all respondents are familiar with the 'state of the art' with journey planners already in existence within the market, or their preference is to use other journey planners without these features, or they are unaware of features within the journey planners they use.

6.4.11. Behaviour change toward shared transport modes

The final question explored whether any of these improvements would yield behaviour change towards shared transport modes.

The question was only asked of respondents who indicated that in the last week, they generally used a car (as driver or passenger) as part of their journeys for work or for social purposes and those who refused to answer that question, corresponding to 262 respondents. Specifically, the respondents were asked if "*any of these particular features… make you switch any of your journeys from using a Car… to a different mode*".

The purpose of asking this question was to ascertain that if greater resources were placed into improvement of the features identified above, would there be an improvement in the use of shared transport modes. The results are seen in Figure 6.16 below and further expanded in Table 6.20 below.

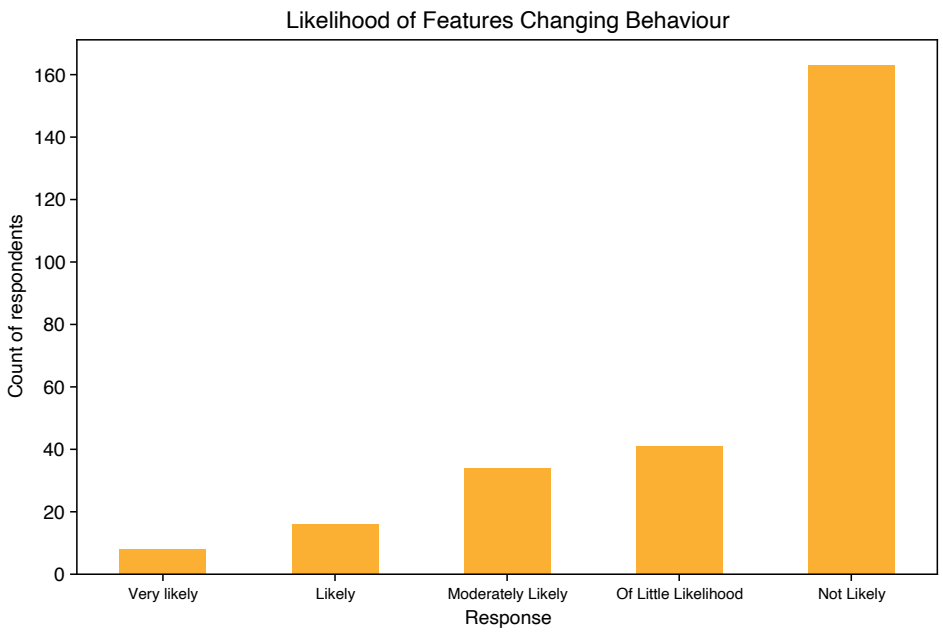

Figure 6.16 Likelihood of features changing behaviour (n = 262).

The above results are displayed in Table 6.19 below, with 'Moderately Likely' or more likely responses grouped to ascertain those who may change behaviour, as well as displayed individually, including the percentage chosen for each option.

Table 6.20 Counts and percentages of responses to likelihood of features changing behaviour (n = 262).

Response (Likelihood)	**Respondents (Percentage)**	**Grouped Respondents (Percentage)**
Very Likely	8 (3.1%)	58 (22.1%)
Likely	16 (6.1%)	
Moderately Likely	34 (13.0%)	
Of Little Likelihood	41 (15.7%)	41 (15.7%)
Not Likely	163 (62.2%)	163 (62.2%)

Unfortunately, most respondents (163, 62.2%) indicated that they would not change behaviour due to the provision of improved features within journey planners. It is noted however that some respondents already primarily used shared transport modes, and that others have factors which prevent them from doing so.

There were 140 (34.8%) respondents who indicated they did not use a car in any manner in the last week, hence the provision of expanded features within journey planners are to their benefit in improving their experience using shared transport modes (including enticing them not to switch to car-based modes) rather than pushing them towards said shared modes.

When examining only the subset of respondents from this subset who indicated they always use a car as either passenger or driver (n = 60), a similar pattern emerges as seen in Table 6.21 below.

Table 6.21 Counts and percentages of responses to likelihood of features changing behaviour for car-only respondents (n = 60).

Response (Likelihood)	**Respondents (Percentage)**
Very Likely	< 3
Likely	< 3
Moderately Likely	9 (15%)
Of Little Likelihood	10 (16.7%)
Not Likely	40 (66.6%)

However, it is of note that only approximately 15% of respondents would be at least moderately likely to change behaviour – which is still not a small number but smaller than the overall sample of respondents.

The next section of this report will examine the overall picture that these responses paint from both a travel behaviour standpoint during the COVID-19 pandemic alongside the overall picture of journey planner usage.

7. Overarching Discussion

Looking at the results as a whole, some interesting insights are gathered from the survey. As per the section above, this section will first discuss insights gained from the COVID-related questions before discussing the journey planner-related questions.

7.1. COVID question discussion

Anecdotally, it was expected that COVID-19 would yield a decrease in journeys due to restrictions being imposed alongside businesses and activities temporarily or permanently ceasing due to being uneconomical to operate. The results of the survey support this; of 402 respondents, 274 (68.2%) reported that they had reduced the number of journeys made compared to before COVID-19. Only 15 respondents (3.7%) increased their journeys.

This shows that the COVID-19 pandemic has greatly reduced travel demand, which likely yields a less congested network for all modes. This, however, could have the effect of reducing the occupancy of buses and trains and the viability of rideshare contractors by changing the economics of matching capacity to demand.

With fears of catching the disease from others, it was expected that use of shared transport modes would be lower during COVID-19 compared to before the pandemic. It was also expected that due to restrictions and risk management, the number of persons working from home would increase.

This was confirmed in the results of the survey, with the data supporting the number of respondents working from home approximately doubling during the pandemic compared to beforehand. The number of respondents using public transport (bus and train) to get to work markedly decreased by approximately two-thirds; interestingly, walking as a mode to travel to work slightly increased during the pandemic compared to before. Similar decreases to PT were shown in the use of cycling to travel to work.

This would likely be due to those now working from home rather than those who moved towards driving, which also experienced a smaller decrease during the pandemic. It is possible that this masked a combination of people who moved to using the car and as others using the car moved to working from home.

Similar results were seen in the mode choices made for social and recreational purposes. While not used by any large number of respondents to travel to work, there

was an approximately three-quarter reduction in the use of rideshare for social and recreational purposes. Again, this is to be expected due to restrictions in gathering sizes and closures of licenced venues.

The survey was conducted during the end of Phase 3 and the beginning of Phase 4. In both cases, restrictions to some degree applied to the activities undertaken by respondents.

As such, due to the marked changes in the use of shared transport modes due to COVID-19, it was desired to understand why these changes were made and what would need to be done to change behaviours back. As expected, the main reason for mode changes were due to reduction in activities due to COVID – be it for work, social/recreational purposes or other purposes. Other common responses were in the same field; namely that activities were now being held at home.

As restrictions start to ease, more activities will resume, however the 'economic shock' has meant that some organisations and groups have ceased operation and as such it may take longer for newcomers to take their place with these activities, or preferences may have changed and these journeys may not return – such as increased and consistent working-from-home.

The worry of catching COVID-19 also played into the change of modes, as such, it will need to be demonstrated that there is no or little risk in shared transport modes for respondents to use these services again. While it has been publicised that Transperth are going to great lengths to ensure cleanliness of services, this message is not being heeded by all, nor may this be enough to satisfy some respondents.

This is then supported in the responses to reasons as to what will be required to return to shared transport modes; most responses suggested a return of activities (either through returning to work, venues opening or the generic "activities increasing" response) or a reduction in the risk of catching COVID.

Overall, the respondents to this survey show that the COVID pandemic has created an environment where many less journeys are taken. The journeys that are taken have moved away from shared modes, due to changes in activities and worries of catching the virus. Once these return to normal, respondents suggest they will return to shared modes.

Of note below in Figure 7.1 is a graph showing Apple Mobility (2020) data for requests to Apple Maps by transport mode in Perth; while the relative number of walking

requests has return approximately to the average, the number of public transport requests far lags this and the number of driving requests exceeds this.

As such, to ensure the optimal use of existing infrastructure, encouragement may need to be made to move journeys back to public transport modes.

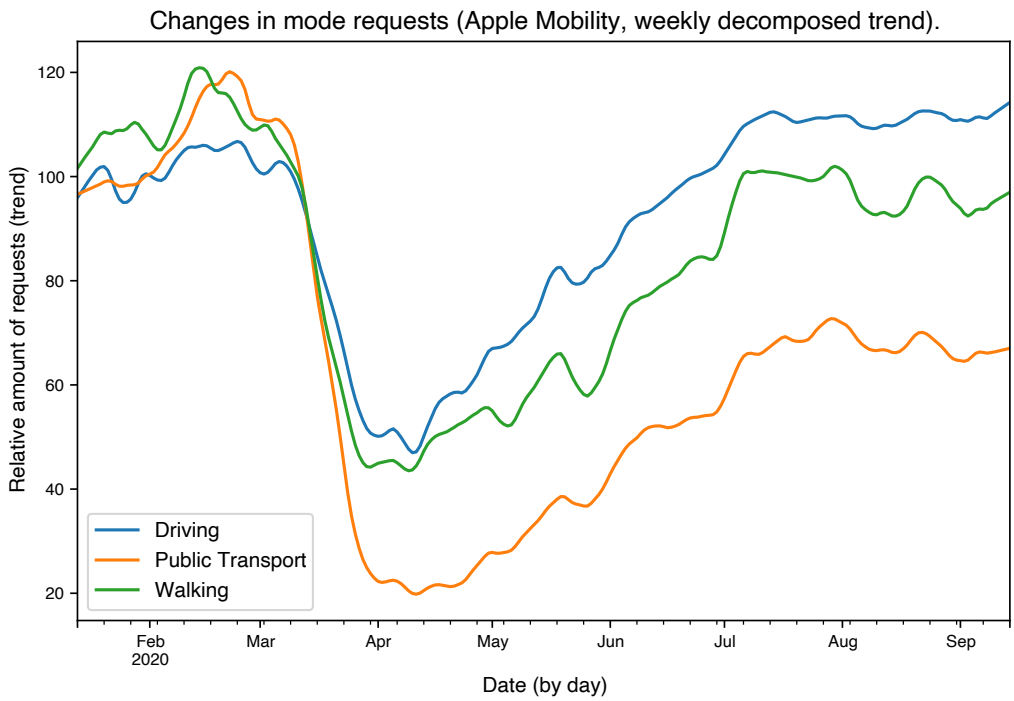

Figure 7.1 Apple Mobility requests in Perth by mode (STL decomposed trend)

7.2. Journey planner question discussion

The overarching purpose of conducting this research was to understand the use of journey planners throughout Perth, such that to ascertain whether their use influences mode choice and to understand what could be done with respect to improving journey planners and whether this would encourage changes towards shared transport modes.

This also had the side-effect of understand what would help improve journey planners for non-shared transport modes, as well as provide for ideas to help improve use of shared transport after COVID-19 by removing the ‘friction’ of shared transport modes, providing an advantage over private (car) transport modes.

Anecdotally, it was expected that journey planners were a relatively niche proposition – only used by a small proportion of transport users. However, the first question regarding how often people used journey planners proved this wrong. Approximately two-thirds of respondents identified using journey planners at least 'occasionally', showing that the provision of information through these services is an important service to many – as without accurate and timely information, these services lose their usefulness.

Transport users use a wide range of journey planners on a wide range of platforms. Most common is Google Maps, however the Transperth app and website alongside the Uber rideshare service and Apple Maps are also popular. Transport users use these services on a wide range of different devices, including traditional websites on traditional computers, smartphones, tablets (iPad's) and in-car systems. A small proportion of respondents still use paper maps and road directories! As such, it is important to target not only first-party apps made by the government such as the Transperth app but also third-party apps such as Google Maps. Ensuring that data can be provided to these services ensures that the most amount of transport users can be reached on the widest range of devices.

Journey planners are often considered only as tools of shared transport modes such as public transport and to a lesser extent rideshare, with some viewing modes such as cycling and walking also included. Respondents demonstrated that journey planners are certainly used by car drivers (88.2% of respondents) and car passengers (10.2% of respondents) alongside other modes – notably with bus (21.5% of respondents) and train (26.5% of respondents) over-represented compared to their usage as identified in the COVID-19 related questions by respondents. Notably, neither of these questions measure the frequency of use of these modes but only whether or not they are used.

Multi-modal journey planners enable transport users to design complex journeys utilising multiple modes to maximise time and cost efficiency. While in relatively infancy, approximately a third of respondents indicated that they have used multi-modal journey planners. These journey planners require vast amounts of information and integration to work successfully. As such, there is a continued appetite for the provision of data and services to enable their operation.

It is, however, to be noted that while over 90% of respondents who have used journey planners do use them at least occasionally for new journeys (with over two-thirds using them always for new journeys), most respondents (58.5%) did not use journey planners for familiar journeys. This reinforces the importance of accurate estimated

data, as most respondents are not using the 'live' data features. This is contrasted, however, to responses further within the survey, which suggests there is an unmet appetite for these services.

Of current features, the traditional travel time estimation and routing/navigation are deemed useful by the most respondents. However, many respondents (approximately 40%) identified that live travel times are also of usefulness. One relatively unmet need is regarding information regarding the destination within journey planners – either the search and discovery of the destination or detailed information about the selected destination.

Interestingly, live information was the most desirable new feature for journey planners as identified by respondents – when considering only the number who identified it as 'very useful' on a six-point scale alongside those rating it any level of useful. The ability to understand the environmental impact of journeys, booking and paying for journeys as well as provision of data in alternate formats is also of interest. Public transport users also suggested information regarding multi-modal journeys and crowding is also of interest; the latter prescient due to the COVID-19 pandemic. When identifying useful features from another perspective, weather information was a popular response which is relatively easy in its implementation. Integration with phone features, such as digital wallets and other apps, was also a popular response, as was further information regarding the accessibility and functionality of the infrastructure itself.

While respondents offered many suggestions for rewards systems, the most popular relevant suggestions were either monetary or equivalent or otherwise related to discounts on travel. Discounts on travel (such as a weekly cap on public transport) could be used as an incentive to use non-car transport modes.

Unfortunately, most respondents identified that provision of these features are unlikely to change their behaviour. However, some respondents already primarily use these modes and hence the behaviour cannot be changed towards them.

Overall, the questions surrounding the use of journey planners show that transport users are indeed users of journey planners and often frequent users at that, at least for new journeys. They use a wide range of planners on a wide range of devices. The provision of timely and accurate information in these services enables their success and provides usefulness to transport users. Progress towards multi-modal journey planners, a relatively new area but one that is of interest to respondents, is enabled by timely and accurate information. Multi-modal journey planners function as one

component of a mobility-as-a-service system, widely considered a pattern for future transport systems.

The results of the survey show that transport consumers are comfortable with the use of journey planners, even in the context of multi-modal journeys and that they have a desire for features such as pre-booking and enhanced information. These form an integral part of future mobility-as-a service system and as such the continued and enhanced provision of these features and data sources should be encouraged as a stepping stone to the wider rollout of MaaS.

8. Recommendations

Based upon the results gathered and interpreted from the survey, the following recommendations are made:

1. *Ensure the continued supply of accurate and timely transport data in an open format*: There is a desire for live and timely transport data from respondents, and the survey has shown that respondents use many different apps to access this data. As such, making 'live' information about the transport network – road, active and public transport – available to third-party apps will ensure that it is spread as widely as possible to end users of the system. This can encourage people to use shared or active transport modes and will enable the provision of multi-modal journey planners. There is also a desire for public transportation crowding data, especially relevant during the COVID-19 pandemic and its recovery and the provision of this information will help the return of patrons to public transport.

2. *Ensure the continued supply of accurate 'secondary' data in an open format*: The provision of information regarding the accessibility of infrastructure in a standardised format will also ensure maximum usability of shared transport modes by those with accessibility difficulties. For example, this would include the number of park and ride bays at railway stations, the number of disabled bays at railway stations, whether a railway station is fully accessible, the condition and slope of cycle and walking paths, detailed information regarding common destinations as well as entrances to stations by location and type. This will not only help accessibility to non-car transport modes, but also provide more accurate information for mobility-as-a-service systems that can be used to better estimate the nature of a journey, as well as for users' desire of more information on destinations and advanced routing systems.

3. *Continue development of the Transperth app*: While some jurisdictions (such as Adelaide) have moved away from first-party Applications, the Transperth app remains a popular choice of transport users within Perth. As such, its use should be continued to be encouraged and supported as to not alienate

existing users. Integration of weather information within journey planners was identified as a popular feature by respondents and could be implemented within the Transperth app and provides not only an enticement to public transport users but a comparatively novel innovation with most other journey planners. The integration of weather data could be useful in this regard and help inform the choices made by the journey planner to better suit the comfortability of patrons. As detailed in Recommendation 2 above, the provision of new information could enable many journey planners to offer advanced features such as multi-modal trips using Park and Ride availability. Such a feature would be ideal to be integrated within the Transperth app to meet the desires of the public and reduce friction in these types of public transport-containing journeys. Increased information regarding destinations and the discovery of them could also aid in the use of public transport by making it easier for patrons to plan their journey. These changes will not only improve the attractiveness and usage of the Transperth app through increased functionality but can also provide a base for mobility-as-a-service systems in the future.

4. *Investigate travel discounts for continued use of public and active transport modes*: There is a desire from respondents to be rewarded for continued 'good' use of transport systems. While monetary incentives are a common reward identified by respondents, providing travel discounts is a popular response that encourages further use of said desirable modes.

5. *Investigate provision of data in new and novel formats*: Many respondents identified the provision of transport data in alternate formats as a desirable feature within journey planners. While this could take many forms, one popular format that has been used by other transport operators – notably airlines including Virgin Australia and Qantas – is integration with 'smart speaker' assistant systems such as Amazon Alexa to provide information regarding transport services, or alternatively Google Assistant or Siri. As such, integrating data with third-party apps or providing this as a first-party service will enable an easier interaction with public transport or active transport

systems by transport users.

6. *Provision of pre-booking of public transport including integration with Apple Pay and Google Pay*: Also identified by respondents was a desire to integrate transport use with digital wallets such as Google Pay and Apple Pay. While this can include providing contactless payments through a phone, as seen in New South Wales and assumed to be a component of the 'SmartRider 2.0' system under development, this can be taken further to allow for the purchasing of tickets through a smartphone, providing further convenience for transport users. Pre-booking a service, while separate to this, can be integrated with such digital wallets to reduce the "friction" of public transport usage and also to provide one component of a mobility-as-a-service system.

9. Conclusion

This report has investigated the use of journey planners throughout the Perth metropolitan area. This was achieved primarily through a survey, whose design was informed by an analysis of the state of the market regarding journey planners and their features alongside a literature review on survey techniques for the use of transport-related phone applications, travel diaries and related technologies and systems.

The survey, which was undertaken at the end of June and beginning of July, examined not only journey planner use but also how transport use differed throughout the COVID-19 pandemic and whether journey planners could contribute to the recovery of journey volume on shared and active transport modes – those that are not private cars.

The survey found that journey planner use was quite widespread, with a diversity of apps being popular but primarily Google Maps and the Transperth app being used by the largest number of respondents. While the traditional routing and navigation features were most popular, there was also interest in live data and other new forms of information as detailed above. Unfortunately, while there was great interest in new and current features, most respondents that used journey planners only used them for new journeys and many respondents were not intending to change their behaviour despite new and improved features and information.

With respect to COVID-19 travel behaviour, the number of journeys taken dropped dramatically during the pandemic with a marked decrease in the use of shared and active transport modes. This is broadly consistent with research undertaken by Beck and Hensher (2020) throughout Australia, however differing methodologies mean that values cannot be directly compared. In both cases, there was a large level of concern regarding hygiene or cleanliness on public transport modes, however this research also showed that changes in activities and where they were conducted also played a large part.

This has led to conclusions being recommended which will help ensure the use of journey planners for years to come, by ensuring that whichever journey planner is used by a transport consumer, that the journey planner has the ability to use the most timely, detailed and accurate information available in the manner expected by users whilst also providing incentives to use shared and active transport modes. These recommendations will capitalise on the existing use of journey planners to also enable the wider rollout of mobility-as-a-service systems in the future.

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A. Journey Planner Analysis Table

This is also provided as a separate Excel file, due to the difficulties of displaying the table in this format.

App Details		Platform							Transport Modes												Features																																												
App Name	App Maker	Android	Apple iPhone	Apple iPad	Apple Watch	CarPlay	Desktop App / Win10	Web Page	Private Vehicle	Active (Walking)	Active (Cycling)	Bus	Train	Ferry	Light Rail	Bike Share	Ride Share	Car Share	Car Pool	Other	See where transit vehicle is	Pre-book shared transit vehicle	Pre-book personal transit vehicle	Request shared transit vehicle	Request personal transit vehicle	Journey cost estimate	Pre-pay using App for journey	Estimated arrival time of vehicle	'Actual' arrival time of vehicle	Rewards system	Covers multiple modes (PT + Walk only)	Covers multiple modes	Covers multiple areas	See where personal vehicle is	Mapping	Navigation	Choice of Mapping	Vehicle Instruments	Route Planning (Estimated)	Route Planning (Actual)	Route Planning (Own Vehicle)	In-App Purchase	Suggest Destination	Weather	Waypoints	Logging/Saving	Equipment Integration	Price/Alternative Comparison	Third Party Booking	Apple Pay	Offline Mapping	Estimate consumables	Crowdsourced Data	Handoff between devices	Share Data with others	Non-Geographic Maps	Specialised Routing	Notifications	Android or Apple Wallet integration	Speed Limits	Points of Interest	Voice Navigation	Timetable	Ticketing Information	Operational Status Information
aFerry	AFerry	Y	Y	Y	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	N	N	N	Y	Y	N	Y	Y	N	N	Y	N	Y	Y	Y	N	N	N	N	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
Apple Maps	Apple, Inc.	N	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	Y	Y	N	Y	N	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y
Camp & RV	Allstays LLC	N	Y	Y	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	Y	Y	N	N	Y	Y	N	N	Y	Y	Y	N	N	N	Y	Y	N	Y	N	Y	Y	Y	N	N	N	N	N	Y	N	N	N	N
Careem	Careem	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	N	Y	N	Y	N	N	N	N	N	Y	Y	N	N	Y	N	N	Y	N	N	N	N
Carly	Carly Solutions GmbH & Co KG	Y	Y	Y	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	Y	N	N	N	N	N	Y	N	N	N	N	Y
Central Park NYC	Asteria	N	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N
Compass	gabenative	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
CycleMaps	motocode Ltd	N	Y	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	N	Y	Y	N	Y	Y	N	N	Y	Y	N	N	N
Fishing Points	Grega Cucnik	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	N	Y	N	Y
Fitbit	Fitbit, Inc.	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	N	Y	Y	N	N	N	Y	Y	Y	Y	Y	N	N	Y	N	N	N	N	N	N	N
Google Maps (inc. Go)	Google LLC	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	N	N	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	N	Y
iNavX	NavX Studios LLC	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N
Journey Planner	National Transport Authority (Ireland)	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	N	N	N	Y	N	N	Y	N	Y	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	Y	Y	Y
Komoot	komoot GmbH	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N
Map My Walk	MapMyFitness, Inc.	Y	Y	Y	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	N	N	Y	N	Y	Y	N	N	Y	N	N	N	Y	N	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N	Y	N	N	N	Y	N	N	N
MarineTraffic	MarineTraffic.com	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y	N	N	Y	N	N	Y	Y	N	N	N	Y
MyFerry	Fullers Group Ltd	Y	Y	Y	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y
MyTransLink	Dept. of Transport and Main Roads (QLD)	Y	Y	Y	N	N	N	Y	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	Y	N	N	N	N	Y	N	Y	Y	N	Y	N	Y	N	Y	N	N	N	Y	N	N	N	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	Y	N	Y	N	N	Y	Y	Y	Y	Y
National Rail Enquiries	National Rail Enquiries	Y	Y	Y	Y	N	Y	Y	N	Y	N	N	Y	N	Y	N	N	N	N	N	Y	Y	N	N	N	Y	Y	Y	Y	N	Y	N	Y	N	N	Y	N	N	Y	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	N	Y	N	N	N	Y	N	N	N	N	Y	Y	Y
Navigation Pro	SmartWatchStudios	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	N	N
Navmii GPS World	Navmii	Y	Y	Y	N	N	N	N	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	N	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	Y	N	N	N
NextThere	AppJourney Pty Ltd	N	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	N	Y	Y	N	Y	N	Y	N	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	Y	Y	Y	N	Y
NYC Ferry	Hornblower Cruises & Evenets	Y	Y	Y	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	Y	N	N	N	N	N	Y	N	N	N	Y	Y	N	Y	N	N	N	N	N	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	Y	Y	Y
NZ Topo50 South Island	Right Place Resources	Y	Y	Y	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N
Ola	ANI Technologies Pvt. Ltd.	Y	Y	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	N	Y	N	Y	N	Y	N	N	N	N	Y	N	N	Y	Y	N	Y	Y	N	N	Y
OS Maps	Ordnance Survey Ltd	Y	Y	Y	N	N	N	Y	N	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	N	N	N	N
PeakFinder	Fabio Soldati	Y	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N
PeakVisor	Routes Software SRL	Y	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	Y	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N	N
Probus	Probus Apps Mobile	Y	Y	Y	N	N	N	N	N	Y	N	Y	Y	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	Y	Y	N	Y	N	Y	N	Y	Y	N	N	Y	N	N	N	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	Y
Public Transport Victoria App	Public Transport Victoria	Y	Y	Y	N	N	N	Y	N	Y	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	N	Y	N	Y	N	Y	Y	N	N	Y	N	N	N	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	Y	Y	N	Y	N	Y	N	Y	Y	Y
Ride with GPS	Ride with GPS	Y	Y	Y	Y	N	N	Y	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	N	N	N	Y	N	Y	N	N	N	Y	Y	N	N	N
Ski Tracks	Core Coders Ltd	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	N	N	N	Y	N	Y	Y	Y	N	N	N	N	Y	N	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
Sydney Ferry	Gerard Murphy	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y
Sygic	Sygic a. s.	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	N	N	Y	N	N	Y	N	Y	Y	Y	N	N	N
Trainline	thetrainline	Y	Y	Y	Y	N	N	Y	N	N	N	Y	Y	N	N	N	N	N	N	Y	Y	Y	N	N	N	Y	Y	Y	Y	N	Y	N	Y	N	N	Y	N	N	Y	N	N	Y	Y	N	Y	Y	N	Y	Y	Y	N	N	N	Y	N	Y	N	Y	Y	N	N	N	Y	Y	Y
Transit	Transit App, Inc.	Y	Y	Y	Y	N	N	N	N	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	N	Y	Y	N	N	Y	N	Y	Y	N	Y	N	Y	N	N	N	Y	Y	Y	N	Y	N	Y	Y	Y
Transperth (inc. JourneyPlanner)	Public Transport Authority	Y	Y	Y	N	N	N	Y	N	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	Y	N	Y	Y	N	Y	N	N	N	Y	Y	N	N	Y	N	N	N	Y	N	N	Y	N	Y	N	N	N	N	N	N	Y	Y	N	Y	N	N	Y	N	Y	Y	Y
TripGo	SkedGo	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	Y	N	Y	N	Y	N	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	Y	Y	N
TripView (inc. Lite)	TripView Pty Ltd	Y	Y	Y	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	N	N	N	Y	Y	N	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	N	N	Y	N	N	N	N	Y	N	Y	N	N	N	N	Y	Y	Y
Tube Map - London Underground	Mapway Limited	Y	Y	Y	Y	N	N	N	N	Y	N	N	Y	N	Y	N	Y	N	N	N	N	N	N	N	Y	N	N	Y	Y	N	Y	N	N	N	Y	Y	Y	N	Y	Y	N	Y	N	N	Y	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	N	Y	Y	Y
Uber (inc. Driver)	Uber Technologies, Inc.	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	N	N	Y	N	Y	Y	Y	N	N	Y	N	Y	N	Y	N	N	Y	N	Y	N	Y	Y	N	Y	Y	Y	N	N	Y
Waze	Waze, Inc.	Y	Y	Y	N	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	N	Y	N	N	Y	N	N	N	N	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	N	Y
WikiCamps	WikiCamps Pty Ltd	Y	Y	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	N	Y	N	Y	N	N	Y	Y	N	Y	Y	Y	N	N	N	N	N	N	N	Y	N	N	N	Y
Your Move	Department of Transport (WA)	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	N	N	N	Y	N	N	Y	Y	Y	N	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	Y	N

B. Survey Questions (Instrument)

Following on from determining the survey objectives and the brainstorming and iterating upon them to fine-tune final objectives, the survey questions were drafted in order to be able conduct a survey of the Perth population regarding their views on journey planners and their impact, within the context of post-COVID-19.

Details italicised or bolded below would be spoken. Sections that are highlighted are explanations that are not to be scripted on screen. The questions are as follows.

B.1. Questionnaire Content

Preamble: the Preamble will state the purpose of the survey alongside the relevant Human Research Ethics Committee (HREC) approval and gain consent from the respondent. It may also be used to ascertain a particular household member to be the respondent to fill the required quotas. It will be stated as:

INTRO. Good (morning/afternoon/evening – automatic). My name is (interviewer name – automatic). I'm calling from the Survey Research Centre at Edith Cowan University to carry out an important survey on how Journey Planners for all types of travel are used and could be improved throughout Perth, including in the context of COVID-19. This survey is being undertaken by Sharon Biermann and Tristan Reed at the Planning and Transport Research Centre of the University of WA. We are inviting you to help by answering a few questions and would really appreciate about 10 minutes of your time that the survey will take.

All answers will remain strictly confidential, no names will be asked for and you can refuse to be involved at any time.

PHONE. Could we speak to the youngest male aged over 18 at home? (then, if not, to the youngest female aged over 18).

[IF THE PHONE IS PASSED TO SOMEONE ELSE – REPEAT THE INTRO]

PREAMBLE. Edith Cowan University Survey Research Centre abides by the Australian Privacy Principles, so before we begin, I want to assure you of confidentiality for any answers you may give, and let you know that parts of this survey may be listened to for training and quality control purposes. Data will only be recorded

in a non-identifiable format, reported in aggregate and you may ask questions at any point. As the data is recorded anonymously, withdrawal is only possible before the end of the survey.

This research has received approval by the ***University of WA Human Ethics Office****. Would you like to know more about this?*

[IF YES] *Approval to conduct this research has been provided by the University of Western Australia, in accordance with its ethics review and approval procedures. Any person considering participation in this research project, or agreeing to participate, may raise any questions or issues with the researchers at any time.*

In addition, any person not satisfied with the response of researchers may raise ethics issues or concerns, and may make any complaints about this research project by contacting the Human Ethics Office at the University of Western Australia on (08) 6488 3703 or by emailing to humanethics@uwa.edu.au. A copy of this questionnaire can be obtained by contacting the office.

PREAMBLE PT 2 There are no foreseen risks in undertaking this survey, with the benefit to you being that of contributing to the understanding of Journey Planner use within the context of COVID-19 throughout Perth. You can track the research and view the results when available at patrec.org/jp.

Your responses to this survey will be stored in an encrypted format within UWA for a minimum of seven years, and for longer if still of use to the research team. For more information, you can contact the researchers on 6488 2767 or by visiting patrec.org/jp.

CONSENT Do you agree to participate in this research project, knowing that participation is voluntary, incomplete interviews will be discarded, you may refuse to answer any question and you may withdraw at any time without reason or prejudice?

1 **Yes**
2 **No (thank and close)**

Demographic Information: any questions to ascertain which demographic the respondent belongs to will be asked here.

AGE_EXACT. *Can you please tell me your age in years?* (If under 18, thank and close).

(Under 18 = 997 Don't know = 998 Refused = 999)

AGE_RANGE. [IF AGE IS UNKNOWN OR REFUSED] *Are you?*

1 **17 years or younger (thank and close)**
2 **18-34**
3 **35-54**
4 **55-65**
5 **66+**
6 **[DO NOT READ OUT] Refused (thank and close)**

QUOTA_AGE (this question does NOT appear to interviewers. It automatically works out respondent age group based on combined answers to AGE_EXACT and AGE_RANGE.)

2 **18-34**
3 **35-54**
4 **55-65**
5 **66+**

Q_GENDER Which gender do you identify as?

1 **Male**
2 **Female**
3 **Other**
4 **(DO NOT READ OUT) Refused**

Q_POSTC *What is your residential postcode?*

(RECORD POSTCODE)

(ALLOWABLE RANGE: 6000 through 6999)

(Don't know = 9998)

(Refused = 9999 – and thank and close)

Q_SUB *Could we know your suburb instead please?*

1 **(SPECIFY SUBURB)**
2 **(DON'T READ OUT) Don't know/Can't say (thank and close)**
3 **(DON'T READ OUT) Refused (thank and close)**

FINAL_LOC Auto-populated (does not appear to interviewers) based on postcode answer IF they provide a postcode. If only provides a suburb, this will be populated manually. Postcode ranges per location defined at end of this document.

1 **Mandurah**
2 **Perth – Inner**
3 **Perth – North East**
4 **Perth – North West**
5 **Perth – South East**
6 **Perth – South West**

(DO NOT READ OUT) Refused (thank and close)

The intention is to capture metro (Perth and Mandurah) per SA4 that the postcode most belongs to by area – see list at the end of the document as well as the soft quotas.

WORK_STATUS Approximately how many hours do you work in an average week?

(Numeric Answer)
(If Refused = 999, do continue)

Q3. Have you made any changes to how many times you travel between places within the Perth area since the beginning of the COVID-19 pandemic in early March?

(READ OUT)

1 **A lot more**
2 **A few more**
3 **About the same (go to Q9)**

4 **A few less**

5 **A lot less**

6 **(DO NOT READ OUT) Don't know (go to Q9)**

7 **(DO NOT READ OUT) Refused**

Q4. REMOVED, BUT KEPT IN DOCUMENT TO ENSURE LOGIC MAKES SENSE.

Q5. [IF WORK_STATUS > 0] *In an average week,* ***before*** *the COVID-19 pandemic started,* ***generally*** *how did you get to* ***work****?*

(READ OUT) (MULTIPLE RESPONSE)

0 **Worked from Home**

1 **Bus**

2 **Train**

3 **Ferry**

4 **Walk**

5 **Cycle**

6 **Rideshare (Uber etc.)**

7 **Taxi**

8 **Car as Passenger (not rideshare or taxi)**

9 **Car as Driver**

10 **Other transport mode**

11 **(DO NOT READ OUT) I did not work / did not take work trips in that time period**

12 **(DO NOT READ OUT) Refused**

Q6. [IF WORK_STATUS > 0] *Last week, how did you* ***generally*** *get to* ***work?***

(READ OUT – IF NEEDED) (MULTIPLE RESPONSE)

0 **Worked from Home**

1 **Bus**

2 **Train**

3 **Ferry**

4 Walk
5 Cycle
6 Rideshare (Uber etc.)
7 Taxi
8 Car as Passenger (not rideshare or taxi)
9 Car as Driver
10 Other transport mode
11 (DO NOT READ OUT) I did not work / did not take work trips in that time period
12 (DO NOT READ OUT) Refused

*Q7. In an average week, **before** the COVID-19 pandemic started, how did you usually travel for **social** or **recreational** purposes?*

(READ OUT – IF NEEDED) (MULTIPLE RESPONSE)

1 Bus
2 Train
3 Ferry
4 Walk
5 Cycle
6 Rideshare (Uber etc.)
7 Taxi
8 Car as Passenger (not rideshare or taxi)
9 Car as Driver
10 Other transport mode
11 (DO NOT READ OUT) Did not travel for social / recreational purposes in this time period
12 (DO NOT READ OUT) Refused

*Q8. Last week, how did you **generally** travel for **social** or **recreational** purposes?*

(READ OUT – IF NEEDED) (MULTIPLE RESPONSE)

1 Bus

2 Train
3 Ferry
4 Walk
5 Cycle
6 Rideshare (Uber etc.)
7 Taxi
8 Car as Passenger (not rideshare or taxi)
9 Car as Driver
10 Other transport mode
11 (DO NOT READ OUT) Did not travel for social / recreational purposes in this time period
12 (DO NOT READ OUT) Refused

Q9. [IF ANSWERS DIFFER FOR Q5 AND Q6 AND/OR Q7 AND Q8, OR IF ANY OF Q5 to Q8 REFUSED] *What are the **two** main reasons why you changed the way you travelled?*

(READ OUT – IF NEEDED) (MULTIPLE RESPONSE)

1 Timing of previous mode has changed – such as longer journey time, less services, changed timetabling;
2 Doing activities at home rather than in-person;
3 Reduction of activities due to COVID-19;
4 Reduction of activities not due to COVID-19;
5 Looking after children during COVID-19;
6 Change in financial situation;
7 Worry about catching COVID-19;
8 Prefer to do activities locally;
9 Have not changed time spent on each mode;
10 Other (specify).
11 (DO NOT READ OUT) Refused

Q10. [IF ANY NON-CAR TRANSPORT CODES (ANY CODE FROM 1 TO 7 OR 10) SELECTED IN Q5, BUT NONE OF THESE CODES SELECTED IN Q6, OR ANY NON-CAR TRANSPORT (1-7, 10) SELECTED IN Q7, BUT NONE OF THESE

SELECTED IN Q8, OR IF ANY OF Q5-Q8 REFUSED] *What will make you go back to using public transport, rideshare, taxi, cycling and/or walking to the same extent as before COVID-19?*

(READ OUT – IF NEEDED) (MULTIPLE RESPONSE)

0 Returning to work away from home;
1 Improved timing of old mode has changed back – such as more bus services or shorter journey times;
2 No longer doing activities at home;
3 Increase of the number of activities;
4 Children returning to school/daycare;
5 Return of financial situation to before COVID-19;
6 Re-opening of venues after COVID-19;
7 No longer worry about catching COVID-19;
8 No longer prefer to do activities locally;
9 Other (specify).
10 (DO NOT READ OUT) None / nothing will make me return to non-car transport
11 (DO NOT READ OUT) Refused

Q11. How often do you consult a Journey Planner to make travel decisions? Keep in mind this includes things such as Apple or Google Maps, the Transperth app, rideshare booking systems like Uber and web-based planners for cycling.

(READ OUT)

(IF NEEDED: These are mobile apps or computer systems that provide information to help you plan or undertake a journey).

1 Always
2 Very Frequently
3 Occasionally
4 Rarely
5 Very Rarely
6 Never (skip to Q19)

7 **Unaware of Journey Planners** (thanks and close – keep interview but end here)

8 **(DO NOT READ OUT) Refused**

Q12. *Which Journey Planners have you used and on which device? This may be on a mobile phone, a smartwatch, a tablet, a car infotainment system or a computer. They could be websites or Apps, such as the ones above.*

(READ OUT – IF NEEDED) (MULTIPLE RESPONSE)

1 **Google Maps – Phone**
2 **Google Maps – computer/website**
3 **Apple Maps – Phone**
4 **Apple Maps – computer/website**
5 **Transperth – Phone**
6 **Transperth – computer/website**
7 **TripGo – Phone**
8 **Transit – Phone**
9 **Uber – Phone**
10 **Ola – Phone**
11 **Your Move – Website**
12 **Others? (as many as required** – will be coded by PATREC**)**
13 **Don't Know**
14 **(DO NOT READ OUT) Refused**

Q13. *How often did you use a journey planner before the COVID-19 pandemic?*

(READ OUT)

1 **Always;**
2 **Very Frequently;**
3 **Occasionally;**
4 **Rarely;**
5 **Very Rarely;**
6 **Never.**

7 (DO NOT READ OUT) Refused

Q14. *For what type of travel do you use a Journey Planner, including before the COVID-19 pandemic and now?*

(READ OUT – IF NEEDED) (MULTIPLE RESPONSE)

1 Bus;
2 Train;
3 Ferry;
4 Walk;
5 Cycle;
6 Car as Passenger;
7 Car as Driver;
8 Rideshare;
9 Taxi;
10 Other (specify).

(DO NOT READ OUT) Refused

Q15. *Do you ever use a Journey Planner when you are travelling to a destination using a number of different transport types? For example, a car and public transport or cycling and public transport, but* ***not*** *walking to a bus stop or the station.*

1 Yes
2 No
3 (DO NOT READ OUT) Refused

Q16. *When making a new journey – say to somewhere you haven't been before – how often would you use a Journey Planner?*

(READ OUT)

1 Always
2 Very Frequently
3 Occasionally

4 Rarely
5 Very Rarely
6 Never
7 (DO NOT READ OUT) Refused

Q17. *For a journey that you are familiar with and do often – such as travelling to work – how often do you use a Journey Planner?*

(READ OUT – IF NEEDED)

1 Always
2 Very Frequently
3 Occasionally
4 Rarely
5 Very Rarely
6 Never
7 (DO NOT READ OUT) Refused

Q18. *What features or information within the Journey Planner specifically are or would be useful to you?*

(READ OUT – IF NEEDED) (MULTIPLE RESPONSE)

1 Travel time estimates;
2 Routing and navigation;
3 'Live' travel times;
4 Finding a destination;
5 Journey cost estimates;
6 Speed limits or similar information;
7 Other (can be multiple – please state)
8 (DO NOT READ OUT) None / No useful features
9 (DO NOT READ OUT) Refused

Q19. *Now considering extra/additional features or information within Journey Planners. How useful would you find extra 'live' information such as road congestion, road closures or bus delays?*

(READ OUT)

1 **Very Useful**
2 **Useful**
3 **Moderately Useful**
4 **Slightly Useful**
5 **Not Useful**
6 **(DO NOT READ OUT) Don't know**
7 **(DO NOT READ OUT) Refused**

Q20. How useful would you find alternative formats of journey planners, including easier-to-use Apps, availability on different devices such as watches, digital assistants (e.g. Google Home or Alexa), integration with cars or using voice control?

(READ OUT – IF NEEDED)

1 **Very Useful**
2 **Useful**
3 **Moderately Useful**
4 **Slightly Useful**
5 **Not Useful**
6 **(DO NOT READ OUT) Don't know**
7 **(DO NOT READ OUT) Refused**

Q21. [IF ANY NON-CAR TRANPORT CODES (1-7, 10) SELECTED IN ANY QUESTION Q5-8, OR REFUSED SELECTED IN ANY OF Q5-Q8] *How useful would you find information on crowding, such as capacity and occupancy of public transport?*

(READ OUT – IF NEEDED)

1 **Very Useful**
2 **Useful**
3 **Moderately Useful**
4 **Slightly Useful**
5 **Not Useful**
6 **(DO NOT READ OUT) Don't know**

7 (DO NOT READ OUT) Refused

Q22. [IF ANY NON-CAR TRANPORT CODES (1-7, 10) SELECTED IN ANY QUESTION Q5-8, OR REFUSED SELECTED IN ANY OF Q5-Q8] *How useful would a Journey Planner be if it integrated transport modes, meaning it would show a journey that combined both public transport and driving or cycling?*

(READ OUT – IF NEEDED)

1 Very Useful
2 Useful
3 Moderately Useful
4 Slightly Useful
5 Not Useful
6 (DO NOT READ OUT) Don't know
7 (DO NOT READ OUT) Refused

Q23. What type of reward system would encourage you to change your transport mode from using a car to walking, cycling or public transport? For example, this could be a game with points to compete with friends, cash back or discounts on public transport/bike sharing.

(Free answer – probe fully)

(If refused – type 'Refused')

Q24. How useful would you find the ability to book or pay ahead for a mixed mode journey, with details on the total cost and a discount applied?

(READ OUT – IF NEEDED)

1 Very Useful
2 Useful
3 Moderately Useful
4 Slightly Useful
5 Not Useful
6 (DO NOT READ OUT) Don't know

7 (DO NOT READ OUT) Refused

Q25. How useful would you find a Journey Planner that also gave you information regarding the impact of your journeys, such as around carbon emissions or calories burnt?

(READ OUT – IF NEEDED)

1 Very Useful
2 Useful
3 Moderately Useful
4 Slightly Useful
5 Not Useful
6 (DO NOT READ OUT) Don't know
7 (DO NOT READ OUT) Refused

Q26 Are there any other new features or information within Journey Planners that you would be interested in?

(READ OUT – IF NEEDED) (MULTIPLE CHOICE)

1 Detailed accessibility information;
2 Station facilities;
3 Detailed information on vehicle types;
4 Better integration with rideshare (e.g. Uber) or bike share systems;
5 Specialised or fine-tuneable routing (e.g. avoid steep hills);
6 Weather information within the planner;
7 Ability to integrate payments with Apple Pay or Google Pay;
8 Increased ability to share journey with other people, devices or Apps;
9 Other (can be multiple)
10 (DO NOT READ OUT) Don't know
11 (DO NOT READ OUT) Refused

Q27. [IF CAR TRANSPORT CODES (8-9) SELECTED IN Q6 OR Q8, OR REFUSED Q6 OR Q8] *Would any of these particular features we have just talked about (within*

Journey Planners) make you switch any of your journeys from using a Car (either as passenger or driver) to a different mode?

(READ OUT)

1 **Very likely**
2 **Likely**
3 **Moderately Likely**
4 **Of Little Likelihood**
5 **Not Likely**
6 **(DO NOT READ OUT) Don't know**
7 **(DO NOT READ OUT) Refused**

THANK *That was my last question. Thank you for your time and just to remind you, my name is (interviewer name – automatic) from the Survey Research Centre at Edith Cowan University.*

If you have any questions about this research, you can telephone our office. Would you like the number? (give if requested). *Alternatively, you can telephone the researcher from the Planning and Transport Research Centre on 6488 2767 or learn more about this project and Journey Planners at patrec.org/jp.*

B.2. Region definitions by Postcode

Postcode	Region (SA4)
6000	Perth – Inner
6003	Perth – Inner
6004	Perth – Inner
6005	Perth – Inner
6006	Perth – Inner
6007	Perth – Inner
6008	Perth – Inner
6009	Perth – Inner
6010	Perth – Inner
6011	Perth – Inner

6012	Perth – Inner
6014	Perth – Inner
6015	Perth – Inner
6016	Perth – Inner
6017	Perth – North West
6018	Perth – North West
6019	Perth – North West
6020	Perth – North West
6021	Perth – North West
6022	Perth – North West
6023	Perth – North West
6024	Perth – North West
6025	Perth – North West
6026	Perth – North West
6027	Perth – North West
6028	Perth – North West
6029	Perth – North West
6030	Perth – North West
6031	Perth – North West
6032	Perth – North West
6033	Perth – North West
6034	Perth – North West
6035	Perth – North West
6036	Perth – North West
6037	Perth – North West
6038	Perth – North West
6050	Perth – Inner
6051	Perth – North East
6052	Perth – Inner
6053	Perth – North East
6054	Perth – North East
6055	Perth – North East

6056	Perth – North East
6057	Perth – South East
6058	Perth – South East
6059	Perth – North West
6060	Perth – North West
6061	Perth – North West
6062	Perth – North East
6063	Perth – North East
6064	Perth – North West
6065	Perth – North West
6066	Perth – North East
6067	Perth – North East
6068	Perth – North East
6069	Perth – North East
6070	Perth – North East
6071	Perth – North East
6072	Perth – North East
6073	Perth – North East
6074	Perth – North East
6076	Perth – South East
6077	Perth – North West
6078	Perth – North West
6079	Perth – North East
6081	Perth – North East
6082	Perth – North East
6083	Perth – North East
6084	Perth – North East
6090	Perth – North East
6100	Perth – South East
6101	Perth – South East
6102	Perth – South East
6103	Perth – South East

6104	Perth – South East
6105	Perth – South East
6106	Perth – South East
6107	Perth – South East
6108	Perth – South East
6109	Perth – South East
6110	Perth – South East
6111	Perth – South East
6112	Perth – South East
6121	Perth – South East
6122	Perth – South East
6123	Perth – South East
6124	Perth – South East
6125	Perth – South East
6126	Perth – South East
6147	Perth – South East
6148	Perth – South East
6149	Perth – South West
6150	Perth – South West
6151	Perth – South East
6152	Perth – South East
6153	Perth – South West
6154	Perth – South West
6155	Perth – South East
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6169	Perth – South West
6170	Perth – South West
6171	Perth – South West
6172	Perth – South West
6173	Perth – South West
6174	Perth – South West
6175	Perth – South West
6176	Perth – South West
6180	Mandurah
6181	Mandurah
6182	Perth – South West
6207	Mandurah
6208	Mandurah
6209	Mandurah
6210	Mandurah
6211	Mandurah
6214	Mandurah
6556	Perth – North East
6558	Perth – North East

B.3. Soft Quotas

With at least 385 total interviews, as close as possible to:

Age

18-34	33% ± 10%
35-54	35% ± 10%

55-65	15% ± 10%
66+	17% ± 10%
Total	**100%**

Gender

Male	49% ± 10%
Female	51% ± 10%
Other	**Up to 10%**
Total	**100%**

Region

Mandurah	10% ± 10%
Perth – Inner	10% ± 10%
Perth – North East	10% ± 10%
Perth – North West	25% ± 10%
Perth – South East	25% ± 10%
Perth – South West	20% ± 10%
Total	**100%**