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The Logan DRT Trial – Socio-demographic analysis of users

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Abstract

This paper outlines the results of a survey into socio-demographics of users of the Logan Demand Responsive Transit Trial in Queensland, Australia. Users of the service were surveyed to develop greater knowledge on the impacts of on-demand services on residents in low density environments. The survey was deployed prior to Covid-19, and collected responses from 400 individuals who had registered to use the service. Results indicate that most users lacked personal automobility and access to traditional fixed route public transit. These same users found accessing the on demand service easy, and experienced increased access to basic goods and services. The Logan DRT Trial provides serves as a usual model to study when deploying on-demand services in low population density environments.

1. Introduction

The sprawl of many of our larger cities are contributes to transport challenges by increasing the distances between outer suburban and urban areas (Dodson et al., 2006). Since a high proportion of economic and social opportunities are found in the urban center, people living in outer suburban areas require effective transport to access many of these opportunities. The distance and the low population density in these areas make it challenging for the traditional public transit systems to provide efficient and effective service (Yim et al., 2004). This increases the car dependency for people in these areas, where people with limited access to private vehicles experience mobility disadvantage (Church, 2000, Hine, 2011, Lucas, 2012, Mattioli, 2014). It becomes a landscape of "drive to survive".

Public transit services, when thoughtfully and diligently planned and delivered, can provide access across low density environments, but may benefit when supplemented by more flexible solutions (Wang et al., 2014). Demand Responsive Transport (DRT) is a flexible form of transit that adjusts scheduling and/or routing to accommodate changes in customer demand and is seen as an alternative way to offer public transit service in outer suburban areas (Enoch et al., 2004, Papanikolaou and Basbas, 2020, Alonso-González et al., 2018).

This paper presents the results of a socio-demographic survey of users of the Logan Demand Responsive Transit (DRT) Trial, contributing knowledge to aid on-demand service planning in similar locations around Australia (Queensland Government, 2017). Interest in DRT services is growing in popularity around the world, however there is limited understanding of who users are and why they use DRT (Currie and Fournier, 2020). Therefore, this paper explores

responses to a pre-covid survey of users (n=400) which looked at basic socio-demographics and rider experiences.

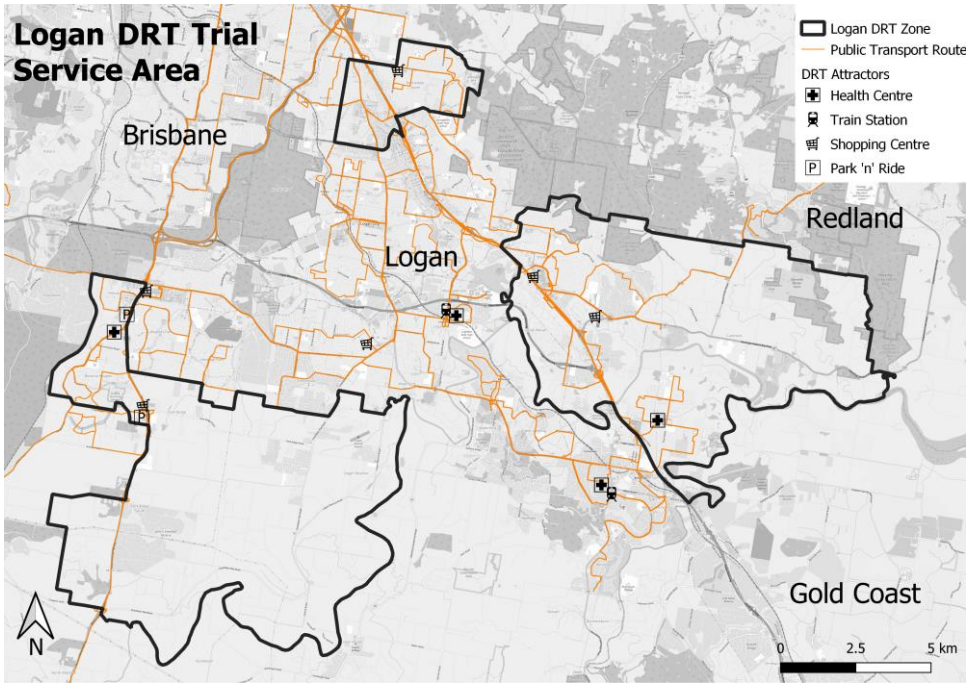
Brisbane, Australia, is Queensland's biggest city and hosts a dense urban core with sprawling suburban and exurban fringe that houses half of the population (Australian Bureau of Statistics, 2019). Logan City is located just south of Brisbane and home to 341,985 residents with a population density of 356 persons/km2 where 70 percent of the land is considered rural, semi-rural, or land for conservation (Logan City Council, 2021). Logan City, especially in the areas where the DRT trial is operating, is low density with pockets of medium density development. Zone A has the lowest density, with only 315 persons/km2. Zone B has nearly double, with 612 persons/km2, while Zone C is much more densely populated with 2,033 persons/km2. These are averages though and there are some small pockets of higher density, especially within Zone A.

The Logan DRT Trial commenced in October 2017, covering three service areas including 15 suburbs, where residents can register and request rides to a set list of destinations. Figure 1 shows the three service zones and the attractors that are included in the trial. Key attractors include health centers, public transit hubs and shopping centers. It can be noted that big parts of the service areas are not serviced by conventional public transport which displays the demand of a complementary transport service.

Areas with low car ownership and higher incidence of socioeconomic disadvantage were chosen to be included in the DRT trail to maximise the social benefit from the service. The service has over 4,000 registered users and trip fares are $3.00 for full price or $1.50 for concession rides, comparable with rates for conventional public transport system. At this stage of the trial there are no smartcard operations, user can pay by cash, card or pre-paid voucher. At this stage in the trial, trips must be booked at least two hours in advance, however at inception this booking period required an 8-hour lead time. Drivers and riders are connected using software from *Routematch*, while operations are managed by the taxi company, *13Cabs* using their fleet of sedans and 13-seater vans. Drivers are engaged on a trip-by-trip basis, allowing them to operate as traditional taxis when not completing DRT trips.

The paper is structured as follows: the next section outlines the methodology used to survey riders. This is followed by the results of the study. The paper is concluded with a discussion outlining the current field of DRT operations. Finally, the key findings are presented in the conclusion.

Figure 1. Logan DRT Trial Zones, Attractors, and fixed route transit network.



2. Methods

This study used methods derived from the TRB Travel Survey Methods Manual (Zhang and Viswanathan, 2016) to survey users of the Logan DRT Trial and to obtain revealed preference information. The Queensland Department of Transport and Main Roads provided access to participants for this project through their internal *Transport Talk* team.

Quality survey response rates and results were ensured through "total survey design" (Dillman, 2014), recognizing that usefulness of a survey is limited by the weakest element of its design. Total survey design was implemented through rigorous survey design such as offering rewards, priming respondents for the survey delivery, and repeated survey completion requests. Respondents were offered the opportunity to enter into a prize draw (three $50 Myers gift cards) to increase response rates. The study design informed users of the DRT service and that surveying would be taking place prior to the beginning of data collection, priming potential respondents to increase response rates. Once collection commenced, all users who registered for the DRT service and expressed openness to contact receive a personalized email inviting them to participate in the survey. All non-respondents were then sent a second email invitation to increase response rate. Clear benefits from this design are shown in Figure 2, below, with a large spike in responses occurring after delivery of the reminder email.

Additional input from the Demand Responsive Transport team ensured that the survey was developed in easily accessible language consistent with other contact methods. Within the first day of survey launch over 200 responses were returned. A total response rate of 17% was achieved (n= 436, completed responses = 400). Figures 16 and 17 show responses by day and the first page of the survey. All respondents were asked how many times they had used the service and their age. Any respondent under the age of 18 had their survey ended to protect privacy (36 responses were removed). Respondents were only asked questions pertinent to their previous responses (non-licensed respondents were not asked about car-ownership for example). Opportunities for text-based responses were encouraged and some are included in this paper. The survey was distributed using *Qualtrics* software (Figure 3). While methods

were used to best generate responses, not all questions were required for survey completion, leaving different response rates for individual questions.

Figure 2: Survey responses by date with interventions.

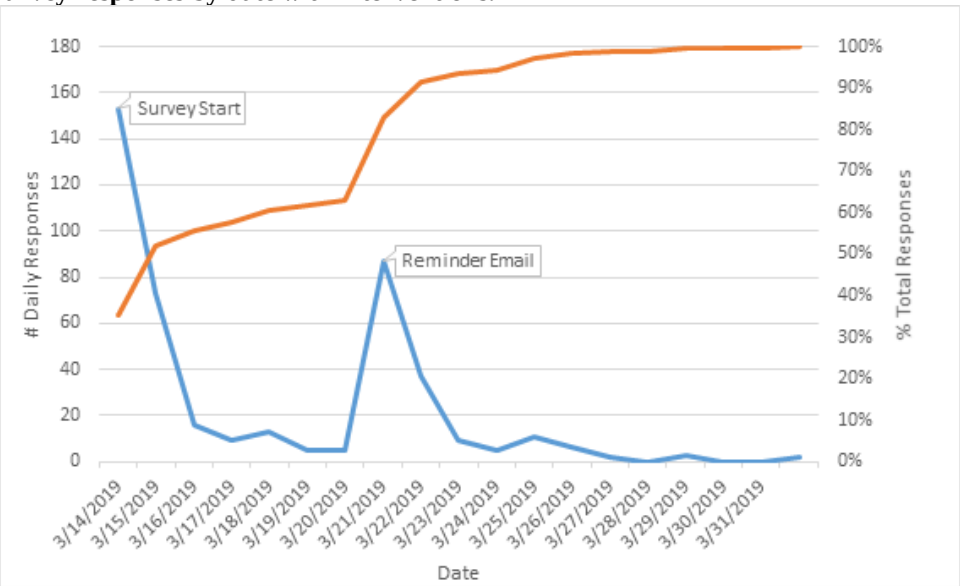
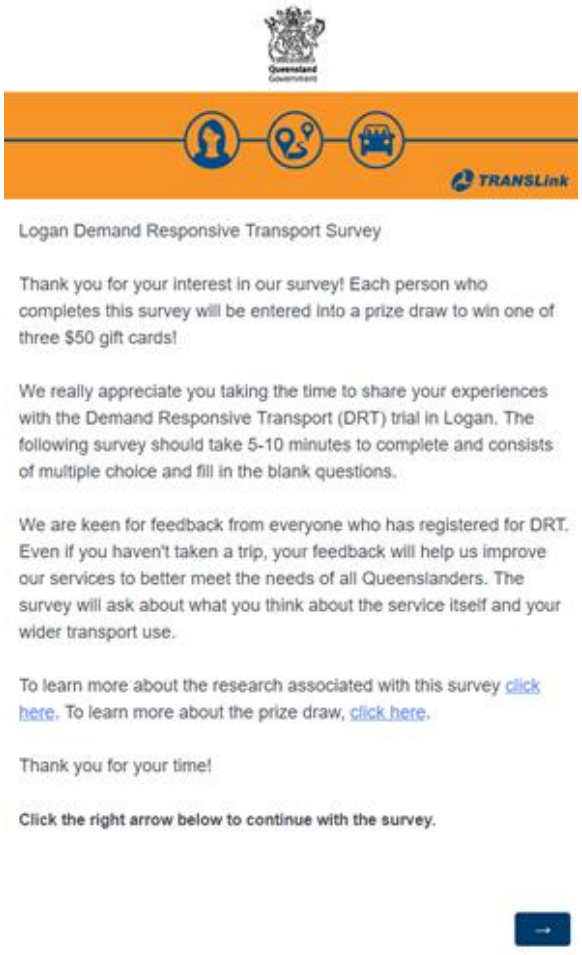


Figure 3: Screenshot of the initial survey page.

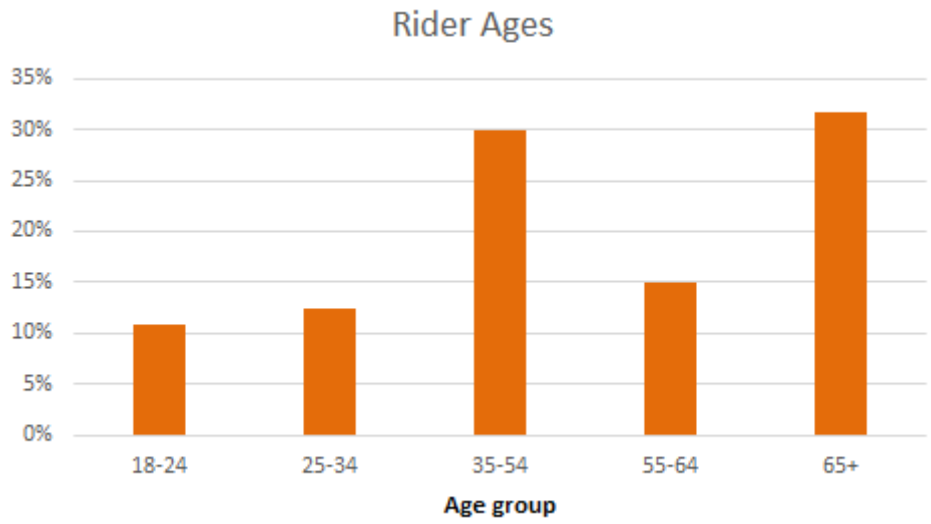


3. Results

The survey results primarily provide insight into rider socio-demographics and access to opportunities. The following sections explore user segmentation by age, trip purpose, income, level of automobility, ease of public transit access, use of common transport modes and modal substitution.

3.1. Rider Ages

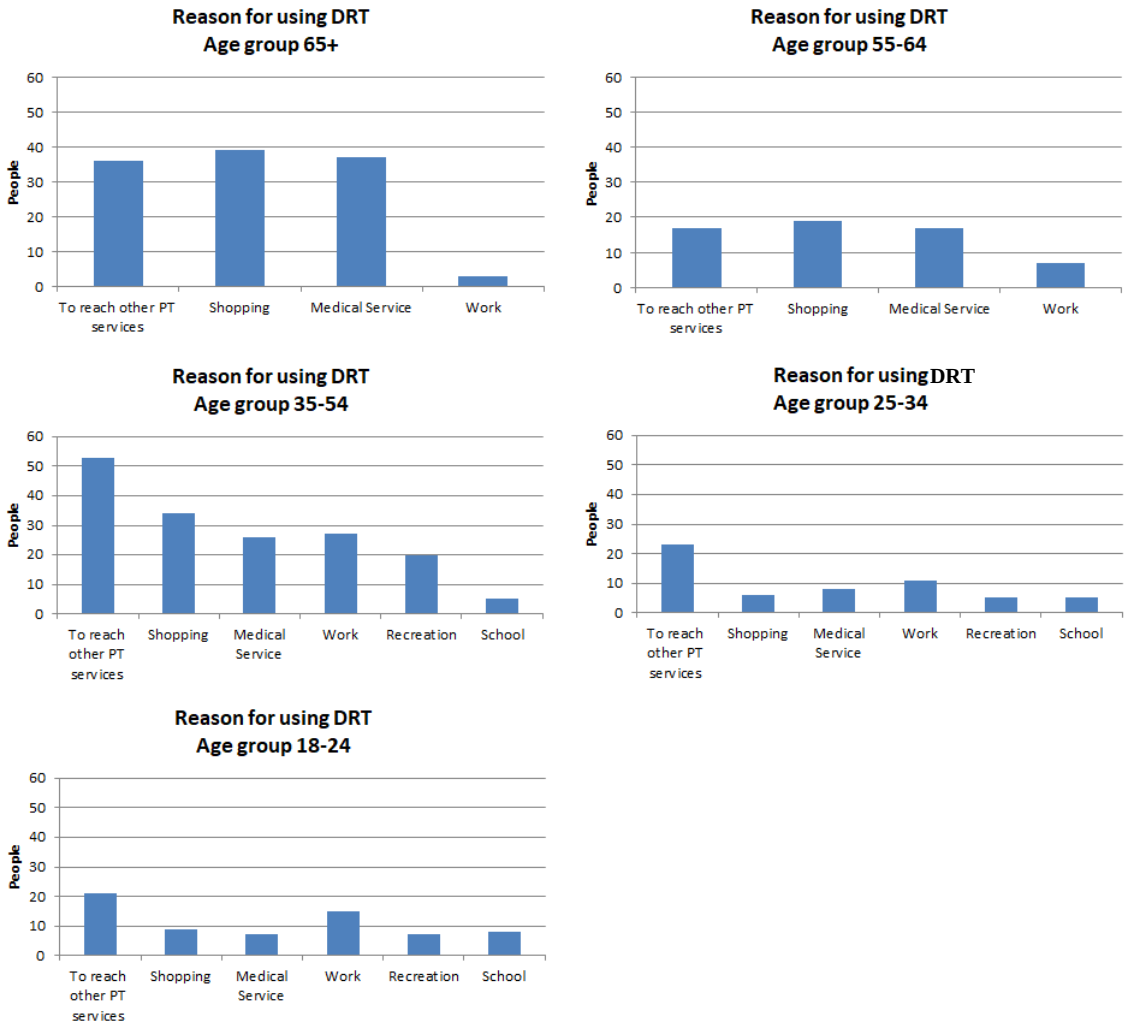
Figure 4: Rider age groups



The responses from the survey shows that people in all age brackets use the Logan DRT Trial (Figure 4). The two largest user groups are 35-54 (27%) and 65+ (29%) and make up more than half of the users. The remaining users were distributed, with age group 55-64 being slightly more represented (14%) and age group 18-24 being slightly less so (10%).

3.2. Rider trip purposes

Figure 5: Age and Reason for Using DRT

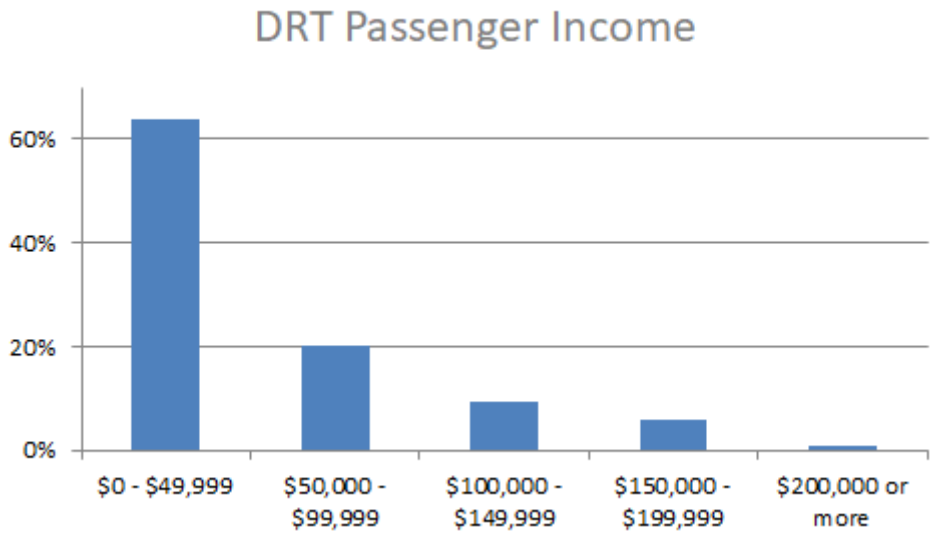


Respondents were asked to select primary trip purposes for their DRT trips, allowing for multiple selections for each response (Figure 5). The most common trip purpose by all age groups, except 55-64, was to use DRT to reach other public transit services. When users need access to destinations other than their home address and the designated attractors, the DRT service offers an alternative to access other public transport alternatives that service other areas. For the two oldest age groups, over the age 55, shopping followed by medical service was the second and third most common reasons. For the three younger age groups, between 18-54, work was as the second or third most common trip purpose. These trip purposes reflect the realised demand present in the trip data and potential appetite for public transit usage in the area.

"It has allowed me to engage in more social activities outside my normal bus service which only operates in AM/ PM won-fri "peak hour times"

3.3. Rider Income

Figure 6: Rider Income

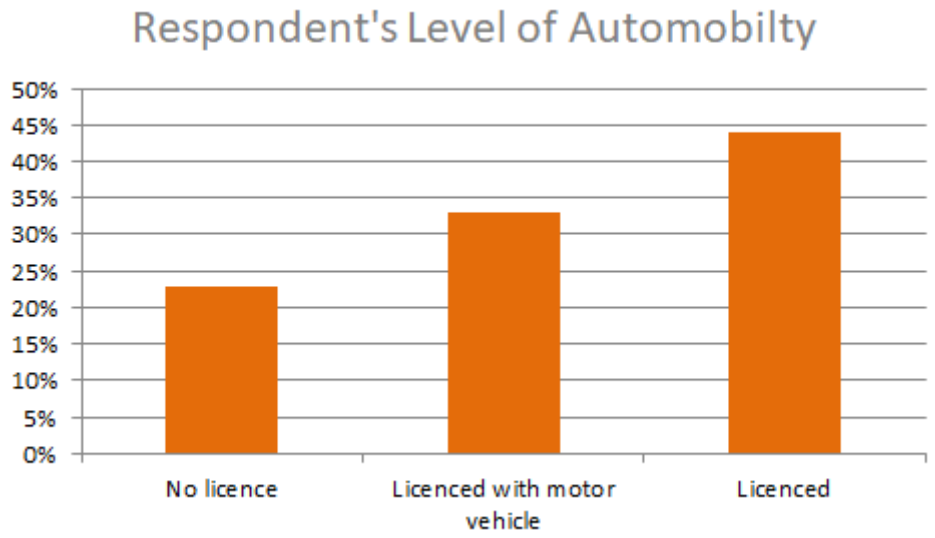


Respondents were asked to state their annual income (Figure 6), where 98 respondents chose to not respond to this question and is not displayed in the figure. The majority (67%) of the riders who responded have an annual income between $0-$49.999, and the second largest (20%) income group earned $50.000-$99.999. While a single DRT trip is slightly cheaper than the TransLink adult single zone fare of $3.00 (concession $1.50), there is no smartcard operations on the Logan DRT service at this time. The DRT offers an affordable transport alternative compared to private vehicle or private ride share services. The data indicates that the DRT service is most used by lower income groups.

"It would be excessively expensive to travel by normal-fare taxi which is the only alternative option at times/days when the bus in my area doesn't travel."

3.4. Levels of Automobility

Figure 7: Respondents' level of automobility.



Respondents were asked if they possess a driver's license or permit and if they have access to a private motor vehicle on a regular basis (Figure 6). The collected data showed that

respondents were primarily carless, with only 33% having access to a private motor vehicle. 23% did not have a license while 44% possessed a license but lacked regular access to a private motor vehicle. For many riders with no access to a private motor vehicle in the south-western and parts of the eastern zone, there is very limited public transit service. In these areas, the Logan DRT Trial provided the first basic means of autonomy in personal travel.

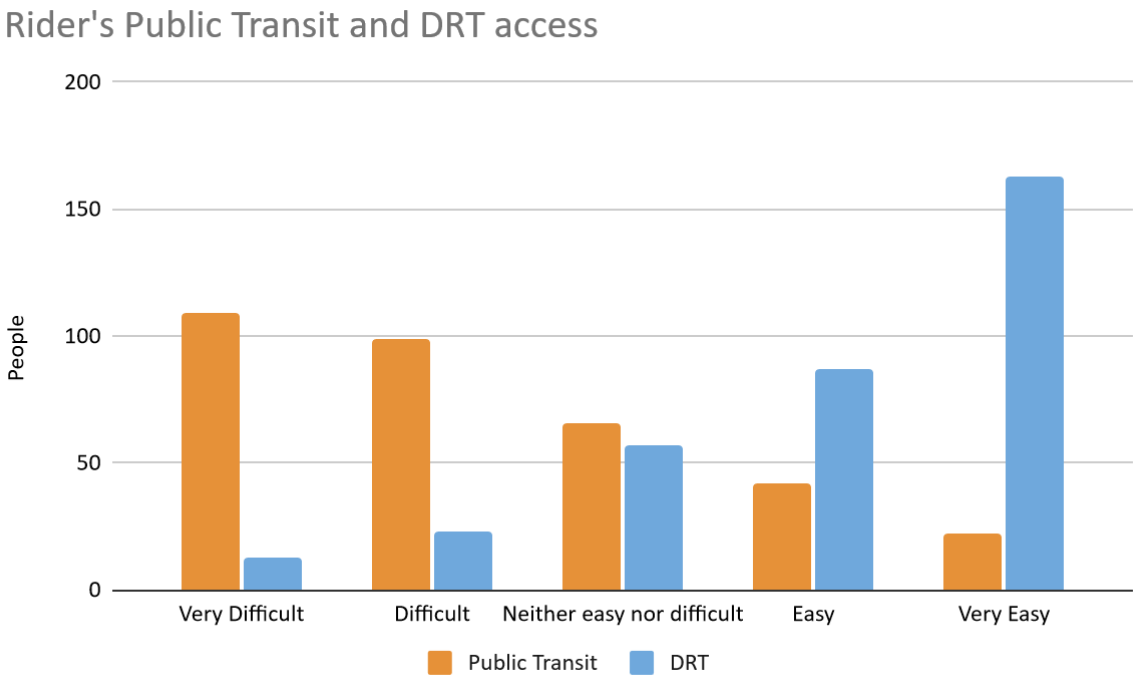
"I can't drive so I depend on my husband to drive me around. With DRT service, it gives me freedom :)"

"Provides transport for my vision impaired husband and allows independence. Great when my car is unavailable as we have no other public transport options"

"DRT has hile methods were used to best generate responses, not all questions were required *given me independence rather than rely on family to pick me up"*

3.5. Rider's Ease of Public Transit and DRT Access

Figure 8: Rider Access to DRT and traditional public transit



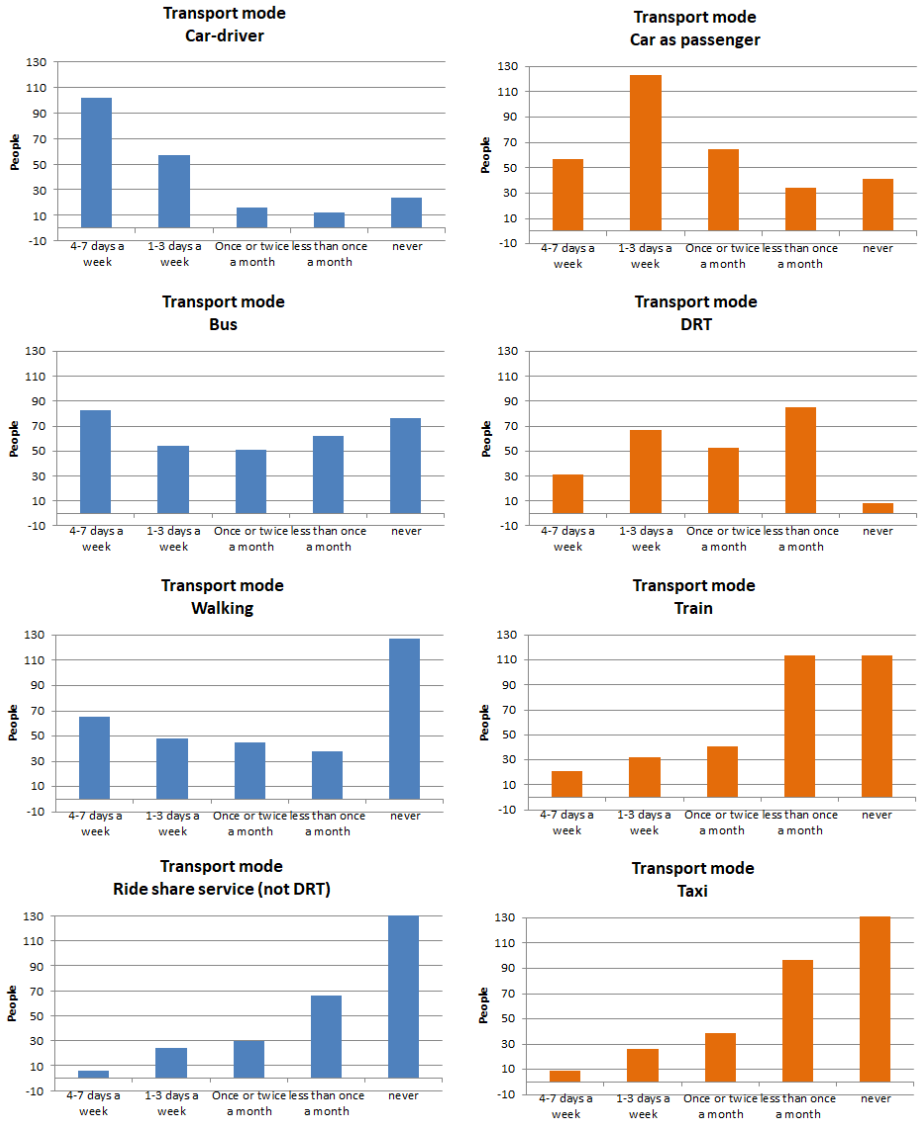
Respondents were asked how easy it is to access the DRT service as well as public transit in the area they live. The respondents expressed that compared with other more conventional public transit alternatives, the DRT service was perceived as a much more accessible. 63% of all respondents expressed that they perceive it as easy or very easy to access the Logan DRT Trial while 16% stated the same for public transit. Conversely 9% perceive that the access to the Logan DRT Trial is difficult or very difficult to access compared to 52% that answered the same for public transit.

"Because the bus service to where l live does not go on the weekend, during the week it runs only hourly"

"It (the Logan DRT Trial) is perfect. I love it. I am vision impaired so (transport) back to my door is fantastic."

3.6. Transport Mode Usage

Figure 9: Mode Use



Respondents were asked how often they use various transport modes, with multiple choices allowed. The most common mode used 4-7 days a week was car as a driver (26%). Conversely using a car as a passenger was more common for occasional trips during the week where 31% stated that they use it 1-2 days a week compared to more regular weekly usage which was only stated by 14%.

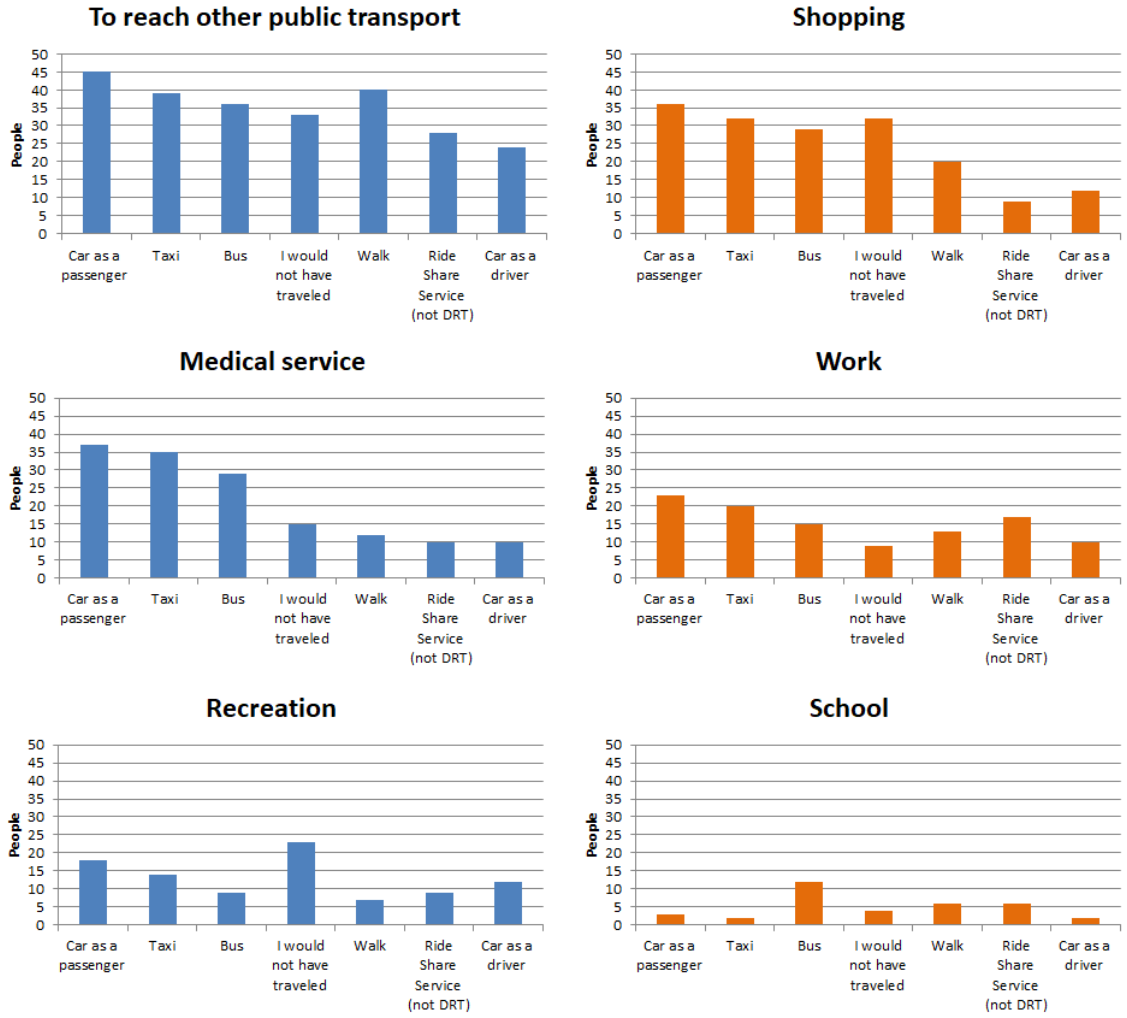
Bus was the second most commonly used transport mode with 21% using it regularly during the week. When it comes to the use of the Logan DRT Trial, 8% of all respondents stated that they use DRT weekly whereas 16% use it 1-3 days a week and 34% use it once or twice a

month or less. The use of more expensive shared modes, compared to DRT, such as taxi and non-DRT ride-share services was used regularly by 9% and 8% respectively. More occasional usage, once or twice a month or less, was more common with 34% for taxi and 24% for non-DRT ride-share services.

52% of all respondents stated that they never or very rarely use walking as their transportation mode, however 28% stated that they use walking as transportation mode one or more days a week. Walking as well as other of the suggested modes could be part of multi-modal transport usage where it is used as a means to access another mode.

3.7. Transport Mode Substitution

Figure 10: Mode Substitution



Respondents were asked how they would have completed certain trips if the DRT service was not available, allowing for multiple selections for each response. Using a car as a passenger was the most common response (43%) for all types of trips except recreational trips and to get to school. Only 18% would have completed the trip as the driver of a car, demonstrating the lack of automobility present in the surveyed group.

Use of a taxi was the second most (26%) stated substitution transport mode which provides a more flexible but also more expensive alternative. Using similar services such as Uber or Didi (Non-DRT ride-share services) was stated by 21%. 30% of all respondents answered that they

would not have travelled if the DRT service was not available which indicates that they experience a high level of transport disadvantage. Recreation, reaching other public transit, and shopping were the most common trips that they would not have pursued. Traveling by bus and walking were the most common substitution modes for students to get to school if the DRT service was not available. The most common trip type for all transport modes, except motor cycle/motor scooter, was to reach other public transport.

The data shows that the Logan DRT Trial increases the ease of trip-taking and allows for some trips that would not have been taken at all.

"Public transport unavailability and I have a restricted ability to walk and inability to drive. The cab cost is too high, so I would have waited until I got a lift from a friend"

4. Discussion

Large parts of the zones where the Logan DRT trial operates has low public transit service typically associated with low population densities. When surveyed, respondents were highly emotional about the service and responses came quickly. Written responses were filled with stories about how the Logan DRT Trial had changed the users' lives, a fact that cannot be clearly depicted through numbers and traditional numerical data analyses. While the graphs above attempt to portray this information, the quotes provide a better description of service impacts.

The data shows that a large number of the respondents do not have access to their own private vehicle and in the absence of the DRT service those people have to rely on others, be it a family member or using more expensive and less accessible transport alternatives which are often cost prohibitive. For people with neither the financial or the mobile capacity, or with poor social and family structures, the inability to partake in society is nearly insurmountable (Lucas, 2005). Without any transport alternative these people are not able to access social and economic opportunities and experience substantial disadvantage. This study did not make a direct cost comparison with provision of conventional fixed-route bus transit – with or without consideration of coverage. In terms of the cost per passenger, DRT is often more expensive; in terms of cost per head of population in a service area, DRT tends to be much less expensive. Recent studies of DRT success/failure (i.e. Currie and Fournier 2020) have not considered coverage in detail. The real value of DRT in such contexts, vis-a-vis conventional bus transit, requires further investigation. The collection of comparative data between on-demand, traditional public transport, and general population could further enhance this argument.

The benefits of this service to the users are greater due to the lower socio-economics of the area, large distances between destinations, and lack of other options than if the service was placed in a more affluent, denser, and better serviced area. The implementation of a similar survey applied to the general population in the catchments would allow for direct comparison between users and non-users. While transport is not the solution to all of the problems disadvantaged areas face, it does provide access to many solutions. The impacts of each service can be explored with greater spatial disaggregation, adoption rates, and impacts of rider demographics with larger survey datasets.

Currently, across Australia, there are countless ride-sharing services, each falling under different names or jurisdictions. Access to health care, buses for pensioners, RSL shuttles, the list goes on. There is clear opportunity to integrate services, reduce fleet redundancies, improve

service quality, and/or realise cost savings in comparison to providing similar service quality and similar coverage through fixed route services. This seems to be the next logical step for on-demand services and funding structures.

5. Conclusion

The survey result that this paper has looked at provided interesting insights on how a DRT service in a low density populated area with low conventional public transit service are used among different socio-economic groups.

Large part of the users of the Logan DRT Trial does not have access to a private vehicle for regular private usage and have to rely on family or more expensive or less accessible transport alternatives. People use the service to access essential, social and economic opportunities which shows that the service provides an important transport option for people to be able to be part of the society. Additionally the DRT service functions as a complement and feeder to the transport network which increases value of the overall network and promotes multmodal use.

It is clear that the Logan DRT Trial adds value to the people living in the service zones. The service offers an affordable and accesible transport alternative that enable people to access important destinations. It especially brings value to users that does not have any alternative due to low income or moblity issues. Being able to provide an inclusive transport alternative is important for transport equity in Logan and around Queensland.

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