

The Logan DRT Trial – Socio-demographic analysis of users

Benjamin Kaufman^{1,2}, Malin Backman², Matthew Burke¹, Abraham Leung¹

¹Griffith University Cities Research Institute

²Microtransit Consulting

Email for correspondence: benjamin.kaufman@griffithuni.edu.au

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

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

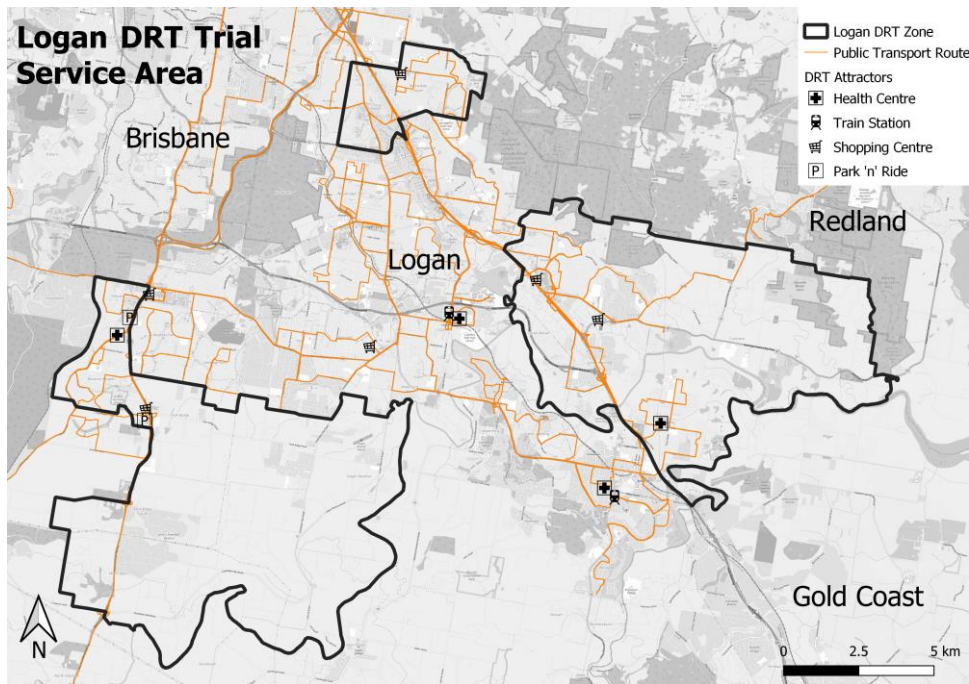
43 Brisbane, Australia, is Queensland’s biggest city and hosts a dense urban core with sprawling
 44 suburban and exurban fringe that houses half of the population (Australian Bureau of Statistics,
 45 2019). Logan City is located just south of Brisbane and home to 341,985 residents with a
 46 population density of 356 persons/km² where 70 percent of the land is considered rural, semi-
 47 rural, or land for conservation (Logan City Council, 2021). Logan City, especially in the areas
 48 where the DRT trial is operating, is low density with pockets of medium density development.
 49 Zone A has the lowest density, with only 315 persons/km². Zone B has nearly double, with
 50 612 persons/km², while Zone C is much more densely populated with 2,033 persons/km².
 51 These are averages though and there are some small pockets of higher density, especially within
 52 Zone A.

53
 54 The Logan DRT Trial commenced in October 2017, covering three service areas including 15
 55 suburbs, where residents can register and request rides to a set list of destinations. Figure 1
 56 shows the three service zones and the attractors that are included in the trial. Key attractors
 57 include health centers, public transit hubs and shopping centers. It can be noted that big parts
 58 of the service areas are not serviced by conventional public transport which displays the
 59 demand of a complementary transport service.

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

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

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



75

76 **2. Methods**

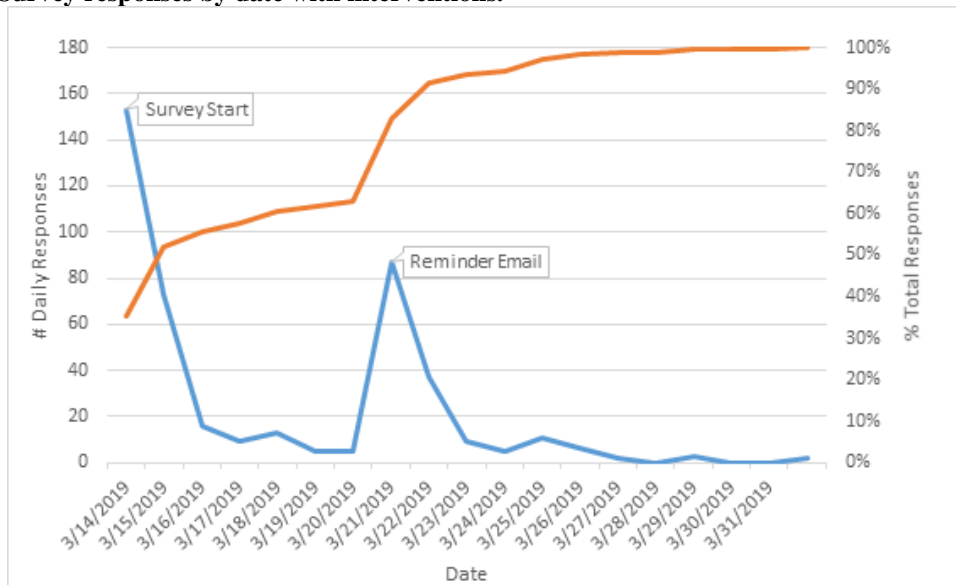
77 This study used methods derived from the TRB Travel Survey Methods Manual (Zhang and
 78 Viswanathan, 2016) to survey users of the Logan DRT Trial and to obtain revealed preference
 79 information. The Queensland Department of Transport and Main Roads provided access to
 80 participants for this project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

81
 82 Quality survey response rates and results were ensured through “total survey design” (Dillman,
 83 2014), recognizing that usefulness of a survey is limited by the weakest element of its design.
 84 Total survey design was implemented through rigorous survey design such as offering rewards,
 85 priming respondents for the survey delivery, and repeated survey completion requests.
 86 Respondents were offered the opportunity to enter into a prize draw (three \$50 Myers gift
 87 cards) to increase response rates. The study design informed users of the DRT service and that
 88 surveying would be taking place prior to the beginning of data collection, priming potential
 89 respondents to increase response rates. Once collection commenced, all users who registered
 90 for the DRT service and expressed openness to contact receive a personalized email inviting
 91 them to participate in the survey. All non-respondents were then sent a second email invitation
 92 to increase response rate. Clear benefits from this design are shown in Figure 2, below, with a
 93 large spike in responses occurring after delivery of the reminder email.

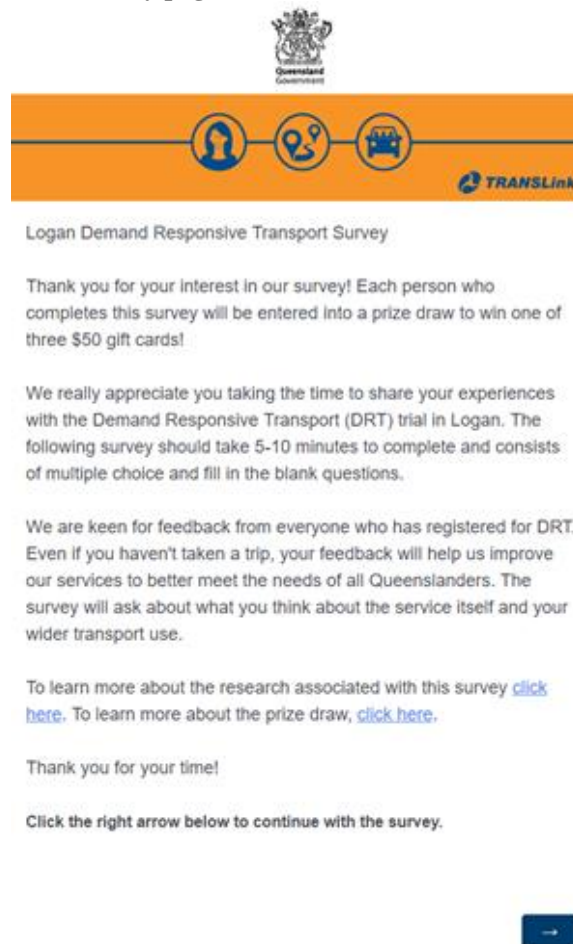
94
 95 Additional input from the Demand Responsive Transport team ensured that the survey was
 96 developed in easily accessible language consistent with other contact methods. Within the first
 97 day of survey launch over 200 responses were returned. A total response rate of 17% was
 98 achieved ($n= 436$, completed responses = 400). Figures 16 and 17 show responses by day and
 99 the first page of the survey. All respondents were asked how many times they had used the
 100 service and their age. Any respondent under the age of 18 had their survey ended to protect
 101 privacy (36 responses were removed). Respondents were only asked questions pertinent to their
 102 previous responses (non-licensed respondents were not asked about car-ownership for
 103 example). Opportunities for text-based responses were encouraged and some are included in
 104 this paper. The survey was distributed using *Qualtrics* software (Figure 3). While methods

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

107
 108 **Figure 2: Survey responses by date with interventions.**



109
 110 **Figure 3: Screenshot of the initial survey page.**

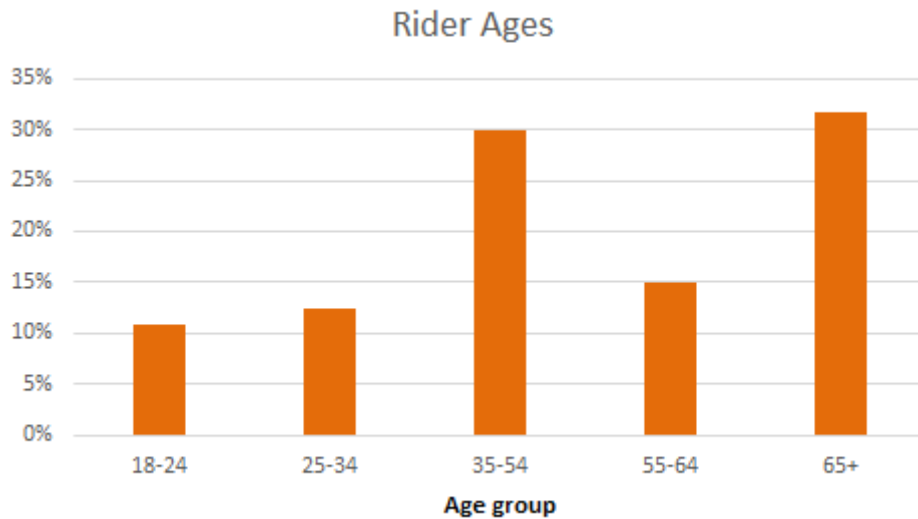


111
 112 **3. Results**

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

117 **3.1. Rider Ages**

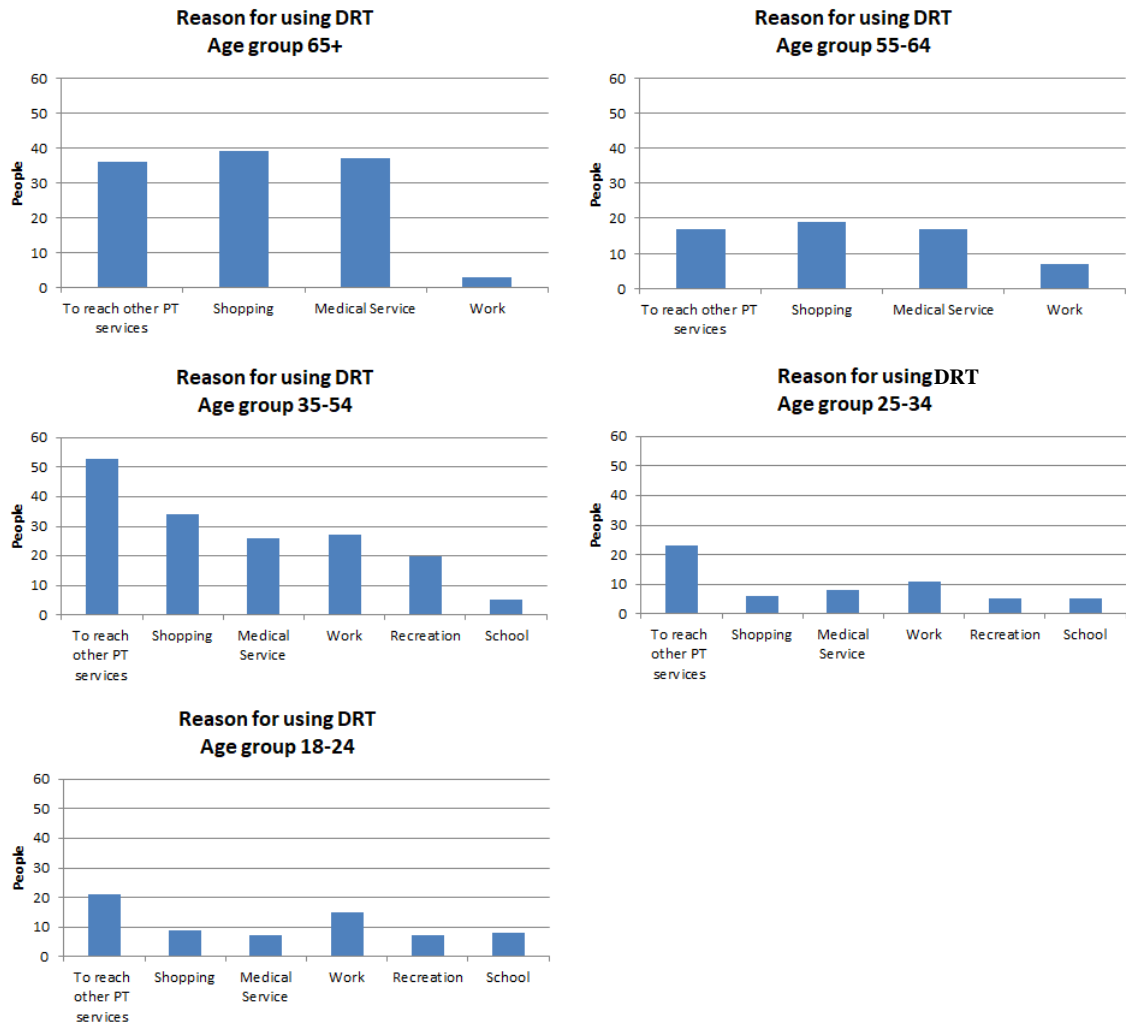
118 **Figure 4: Rider age groups**



119
 120 The responses from the survey shows that people in all age brackets use the Logan DRT Trial
 121 (Figure 4). The two largest user groups are 35-54 (27%) and 65+ (29%) and make up more
 122 than half of the users. The remaining users were distributed, with age group 55-64 being
 123 slightly more represented (14%) and age group 18-24 being slightly less so (10%).

124 **3.2. Rider trip purposes**

125 **Figure 5: Age and Reason for Using DRT**



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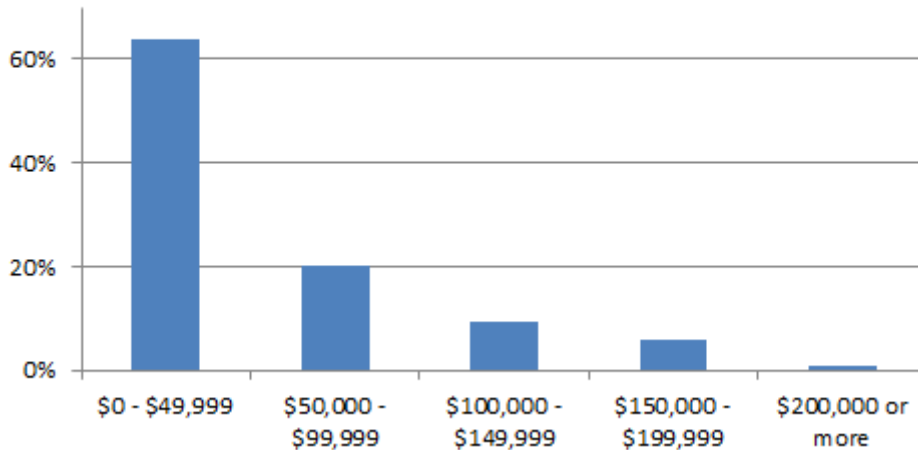
127 Respondents were asked to select primary trip purposes for their DRT trips, allowing
 128 for multiple selections for each response (Figure 5). The most common trip purpose by all age
 129 groups, except 55-64, was to use DRT to reach other public transit services. When users need
 130 access to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

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

139 **3.3. Rider Income**

140 **Figure 6: Rider Income**

DRT Passenger Income



141

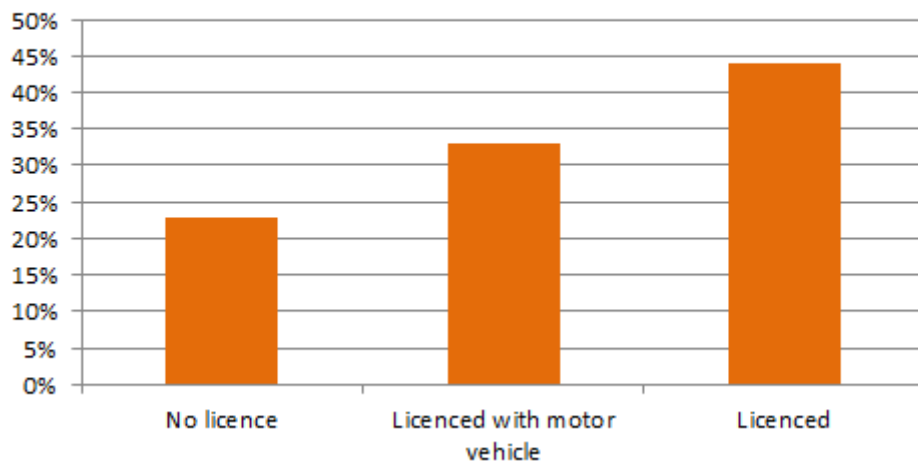
142 Respondents were asked to state their annual income (Figure 6), where 98 respondents
 143 chose to not respond to this question and is not displayed in the figure. The majority (67%) of
 144 the riders who responded have an annual income between \$0-\$49,999, and the second largest
 145 (20%) income group earned \$50,000-\$99,999. While a single DRT trip is slightly cheaper than
 146 the TransLink adult single zone fare of \$3.00 (concession \$1.50), there is no smartcard
 147 operations on the Logan DRT service at this time. The DRT offers an affordable transport
 148 alternative compared to private vehicle or private ride share services. The data indicates that
 149 the DRT service is most used by lower income groups.

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

152 3.4. Levels of Automobility

153 Figure 7: Respondents' level of automobility.

Respondent's Level of Automobility



154

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

157 respondents were primarily carless, with only 33% having access to a private motor vehicle.
 158 23% did not have a license while 44% possessed a license but lacked regular access to a private
 159 motor vehicle. For many riders with no access to a private motor vehicle in the south-western
 160 and parts of the eastern zone, there is very limited public transit service. In these areas, the
 161 Logan DRT Trial provided the first basic means of autonomy in personal travel.

162 *“I can't drive so I depend on my husband to drive me around. With DRT service, it gives me
 163 freedom :)”*

164 *“Provides transport for my vision impaired husband and allows independence. Great when
 165 my car is unavailable as we have no other public transport options”*

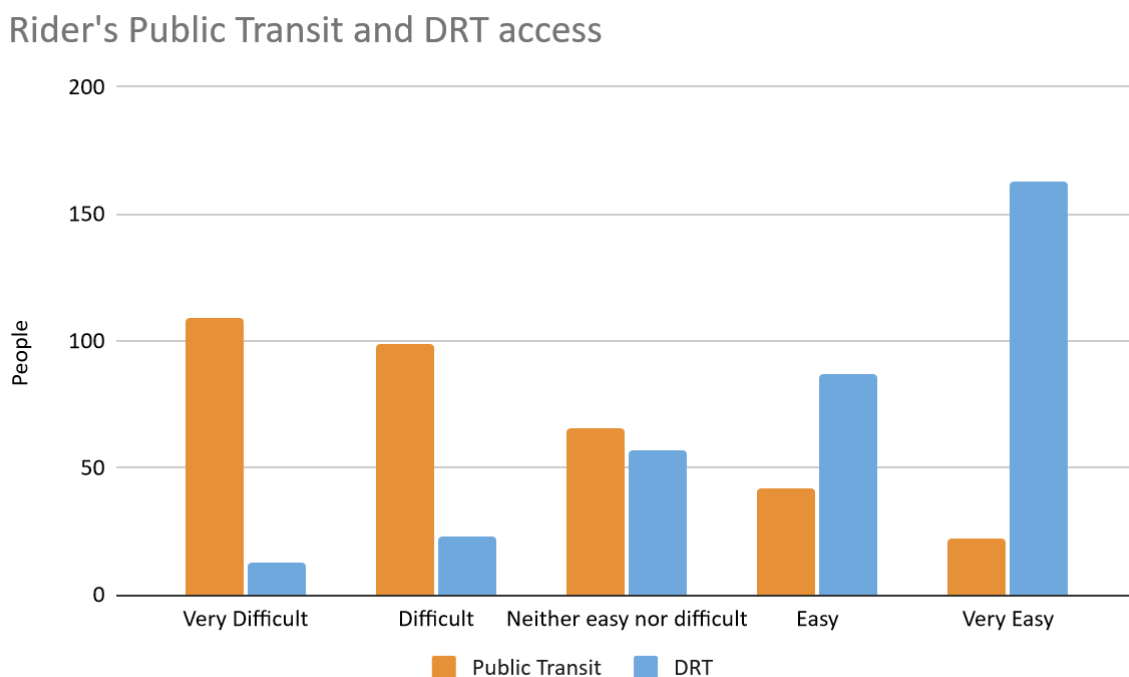
166 *“DRT has hile methods were used to best generate responses, not all questions were required
 167 given me independence rather than rely on family to pick me up”*

168

169

170 3.5. Rider’s Ease of Public Transit and DRT Access

171 **Figure 8: Rider Access to DRT and traditional public transit**



172

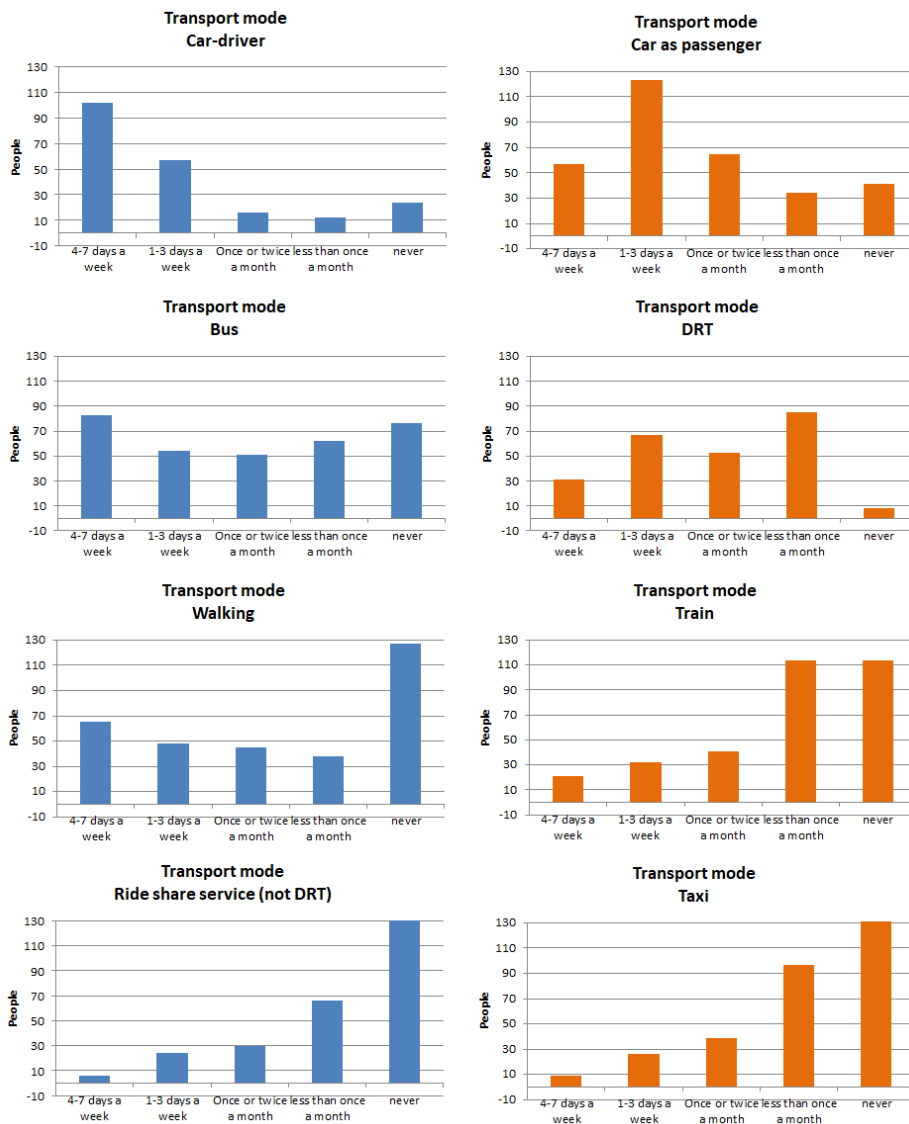
173 Respondents were asked how easy it is to access the DRT service as well as public
 174 transit in the area they live. The respondents expressed that compared with other more
 175 conventional public transit alternatives, the DRT service was perceived as a much more
 176 accessible. 63% of all respondents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

180 “Because the bus service to where I live does not go on the weekend, during the week it runs
 181 only hourly”

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

184 **3.6. Transport Mode Usage**

185 **Figure 9: Mode Use**



186

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

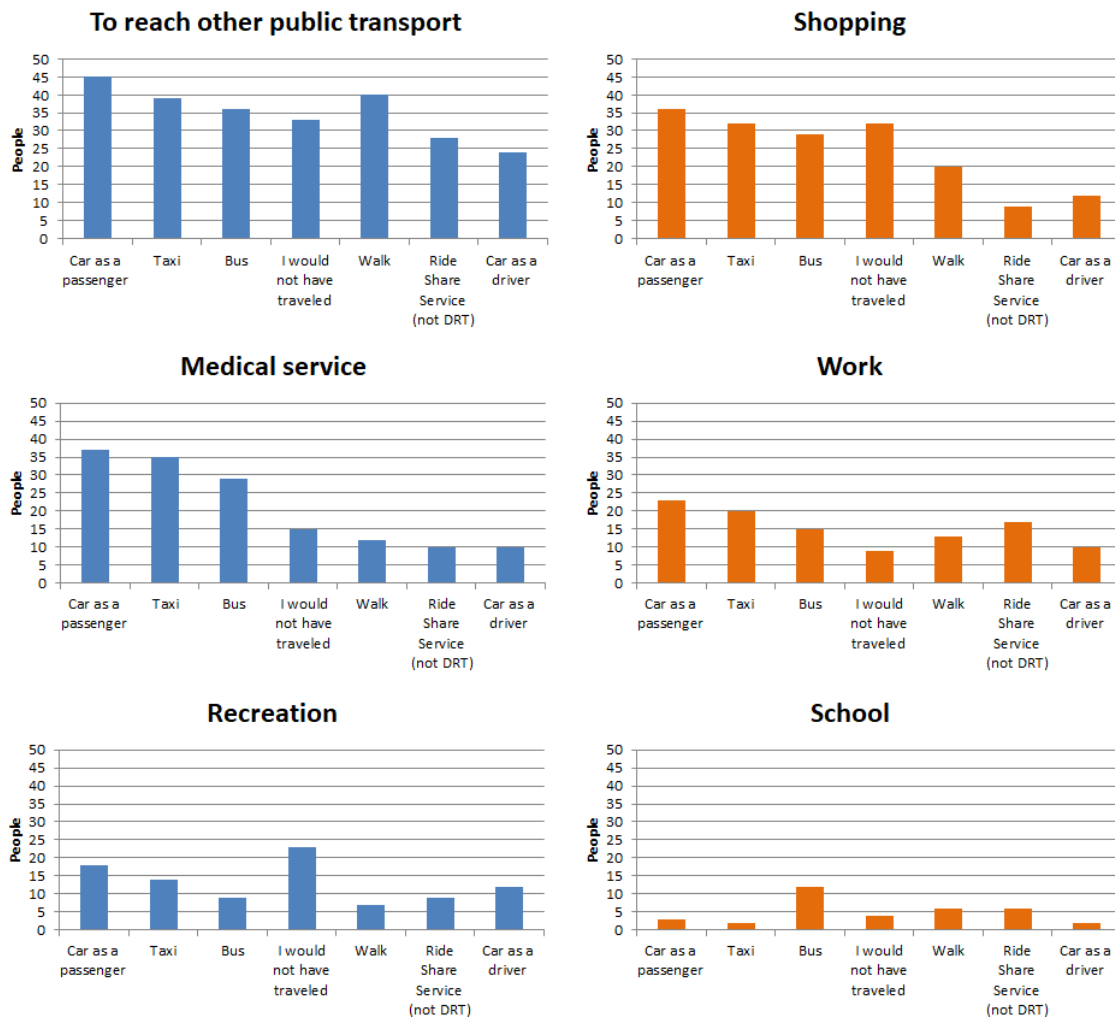
192 Bus was the second most commonly used transport mode with 21% using it regularly during
 193 the week. When it comes to the use of the Logan DRT Trial, 8% of all respondents stated that
 194 they use DRT weekly whereas 16% use it 1-3 days a week and 34% use it once or twice a

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

199 52% of all respondents stated that they never or very rarely use walking as their transportation
 200 mode, however 28% stated that they use walking as transportation mode one or more days a
 201 week. Walking as well as other of the suggested modes could be part of multi-modal transport
 202 usage where it is used as a means to access another mode.

203 3.7. Transport Mode Substitution

204 Figure 10: Mode Substitution



205 Respondents were asked how they would have completed certain trips if the DRT
 206 service was not available, allowing for multiple selections for each response. Using a car as a
 207 passenger was the most common response (43%) for all types of trips except recreational trips
 208 and to get to school. Only 18% would have completed the trip as the driver of a car,
 209 demonstrating the lack of automobility present in the surveyed group.
 210
 211

212 Use of a taxi was the second most (26%) stated substitution transport mode which provides a
 213 more flexible but also more expensive alternative. Using similar services such as Uber or Didi
 214 (Non-DRT ride-share services) was stated by 21%. 30% of all respondents answered that they
 215

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

222

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

225

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

228 4. Discussion

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

236

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

251

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

260

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

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

267 **5. Conclusion**

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

271
 272 Large part of the users of the Logan DRT Trial does not have access to a private vehicle for
 273 regular private usage and have to rely on family or more expensive or less accessible transport
 274 alternatives. People use the service to access essential, social and economic opportunities
 275 which shows that the service provides an important transport option for people to be able to be
 276 part of the society. Additionally the DRT service functions as a complement and feeder to the
 277 transport network which increases value of the overall network and promotes multimodal use.
 278

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

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