Lecture Notes in Mobility

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Transport Transitions: Advancing Sustainable and Inclusive Mobility

Proceedings of the 10th TRA Conference, 2024, Dublin, Ireland - Volume 2: Sustainable Transport Development

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Lecture Notes in Mobility

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Preface

We are pleased to publish the Conference Proceedings of the 10th Transport Research Arena (TRA 2024), held on April 15–18, 2024, in Dublin, Ireland. The conference brought together 4500 delegates from 57 countries who came together to discuss research findings, the latest innovations in policy, technology and practice, and the future directions of mobility and transport.

The conference tagline was *Transport Transitions: Advancing Sustainable and Inclusive Mobility*, and four primary conference themes were defined, namely

- Safe & Inclusive Transport.
- Sustainable Mobility of People and Goods.
- Efficient & Resilient Systems.
- Collaborative Digitalization.

TRA takes place every 2 years, and TRA2024 featured an array of plenary sessions, ministerial sessions, strategic sessions and special sessions which took place alongside the technical programme. A call for papers was issued in early 2023 which resulted in 1182 submissions. A double-blind peer review process was initiated, which ultimately resulted in 784 papers that were chosen for presentation at the conference (66% conversion rate). These papers were presented in a combination of oral or poster presentations over the course of the conference.

All accepted papers presented at TRA 2024 are published in a topical collection of the journal European Transport Research Review (ETRR) or within these proceedings. Both are published in a fully open-access format.

TRA is a multi-modal conference that draws on the support of key stakeholders. These include the European Commission, ACARE (Advisory Council for Aviation Research and Innovation in Europe), ALICE (Alliance for Logistics Innovation through Collaboration in Europe), CEDR (Conference of European Road Directorates), ECTP (European Construction Technology Platform), ERRAC (European Rail Research Advisory Council), ERTRAC (European Road Transport Research Advisory Council), ETRA (European Transport Research Alliance), and the Waterborne technology platform. Key Irish supporters of the event were Transport Infrastructure Ireland, Enterprise Ireland and the Irish Government's Department of Transport.

The editors would like to express their thanks to the presenters, authors, reviewers, session chairs, committee members and sponsors for helping deliver such a successful event. TRA 2026 will take place in Budapest, Hungary.

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Preferences of Rural Travelers Towards Demand Responsive Transport

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Abstract. Demand responsive transport (DRT) has received significant attention in recent years as a transport mode that can bridge the gap between personal motorized travel and public transport. It combines the best of individual cars and public transport: it can be more flexible, than traditional public transport, resembling the convenience of owning a car, but it does not come with the high cost of owning and maintaining a vehicle for the user. We conducted a stated preference (SP) survey about potential users' preferences towards demand responsive transport at a rural Eastern European town in Hungary, Kiskunhalas, Hungary, and modelled individuals' preferences towards DRT using a multinomial logit model. We had 6012 responses from a sample of 501 individuals, that was representative of the settlement with respect to age and gender. The results show that all else being equal, individuals find the DRT service the second most attractive mode of transport after cycling, meaning that a DRT service could have a potentially large uptake in the population. Our results could be used by decision makers and service providers for the design of a DRT service.

Keywords: rural transportation · demand responsive transport · choice modelling

1 Introduction

Demand responsive transport (DRT) has received significant attention in recent years as a transport mode that can bridge the gap between personal motorized travel and public transport. This type of transport service has no fixed schedule; instead, passengers have to signal their intention to travel to the service provider in advance, via either a phone call or a mobile app, otherwise the vehicle might not depart. DRT can have different configurations, some have fixed stops, others' departure and arrival points are flexible, some have predefined schedule, others operate without one.

DRT combines the best of individual cars and public transport: it can be more flexible than traditional public transport, resembling the convenience of owning a car, but it does not come with the high cost of owning and maintaining a vehicle for the user. Looking at it from a service provider point of view, providing services with a flexible

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schedule instead of a fixed one can result in significant cost reduction, making public transportation service more viable at more sparsely populated areas. Providing high quality public transportation in rural regions have been a challenge financially, and DRT can provide a solution.

Understanding potential users' taste is key for the design of a successful service, by helping to set the parameters of the service according to the users' needs. Over the last decade, a number of studies have looked at preferences of potential users towards DRT services, i.e. Alonso-González et al. [1], Choudhury et al. [2], or Frei et al. [3]. However, all of these studies investigate users' attitude in dense urban or sub-urban environments, where high quality public transport is already present, or could be provided in a financially sustainable way, and to our knowledge, no study has been conducted in rural area, where this type of service could be the most beneficial, and where transport demand has different characteristics. Bronsvoort et al. [4] estimate users' preferences in rural areas of the Netherlands, but due to the nature of that country, that can be still characterized as a relatively densely populated area comparted to other rural regions in the world. König & Grippenkoven, [5] analyzed a household survey conducted in rural Germany, but used different modelling techniques, and did not estimate utility functions. Schasché et al. [6] have done a review on the factors influencing user acceptance of rural demand responsive transport.

2 Data and Methods

We are conducted a stated preference (SP) survey about potential users preferences towards demand responsive transport at Kiskunhalas, Hungary. This town has about 26 000 inhabitants, and is located at the southern part of Hungary, one of the most sparsely populated areas of the country. Major cities are more than 50 km away, only smaller settlements can be found in its close neighborhood. The town is completely flat and has good cycling infrastructure along the main roads of the settlement, so it is very suitable for active travel modes. Local, and interurban transportation is provided by buses. The settlement has two railway lines, one of which is closed for years due to a major reconstruction, while the other only has a minor role in public transportation provision.

We conducted a household survey with 501 inhabitants of the town, a representative sample of its citizens in terms of age and gender, asking them to make decisions in mode choice scenarios. First, we asked the respondents about their most typical travel: what is the purpose of this travel, where is their destination, what transportation mode do they use, and how long does this trip usually take. Based on the responses to these questions, we asked the respondents to make decisions in hypothetical mode-choice scenarios with regard to their most typical travel. The available modes depended on the answers of the individuals: in case the most typical travel happens within the settlement the possible alternatives were passenger car, local bus, bicycle, and walking and demand responsive bus, in case the most typical travel was inter-urban, local bus option was replaced by coach, and walking was not an option. The alternatives had different attributes, as can be seen in Table 1. Each attribute had three levels, each chosen to be realistic to the reported typical travel.

Table 1. Alternatives and their attributes in the SP survey

Alternative	Attributes
car	travel time, cost
bus, demand responsive bus	travel time, cost, frequency, egress and excess time
walking, cycling	travel time

The demand responsive bus services was described to the respondents in details: it would run on a flexible route with predefined stops, and would depart only in case a passenger indicated her intent to travel in advance. In the SP experiment, demand responsive bus service had higher frequency, shorter travel time, and mostly shorter egress and excess walking time, but higher cost than the traditional bus service, to be able to capture the trade of between the two different type of bus services.

To estimate the potential users' preferences, we used a multinomial logit model. These preferences are represented by utility functions that can be written in the following forms for each mode:

$$U_{car} = asc_{car} + \beta_{travel\ time} * travel\ time + \beta_{cost} * cost \tag{1}$$

$$U_{bus} = asc_{bus} + \beta_{travel\ time} * travel\ time + \beta_{egr} * egress + \beta_{cost} * cost + \beta_{frequency} * frequency \tag{2}$$

$$U_{drtbus} = asc_{drtbus} + \beta_{travel\ time} * travel\ time + \beta_{egr} * egress + \beta_{cost} * cost + \beta_{frequency} * frequency \tag{3}$$

$$U_{bicycle} = asc_{bicycle} + \beta_{travel\ time} * travel\ time \tag{4}$$

$$U_{walk} = asc_{walk} + \beta_{travel\ time} * travel\ time \tag{5}$$

where *asc* stands for alternative specific constant, *travel time* is in vehicle travel time, *cost* is financial cost, *egress* is the time it takes to walk to and from the bus stops, and *frequency* shows how often the bus serves the given route.

3 Results

Out of the 501 respondents, 471 stated that their most typical travel occurs within Kiskunhalas. Out of these 471 respondents, 174 had chosen the demand responsive at least once in the SP study. In the case of the intra urban travelers, it was 9 out of 30 how have chosen at least in one choice situation the on-demand bus service.

In terms of the modal split of the most typical travel, 222 respondents reported to use a car either as a driver or as a passenger. Notably, 226 people reported to use some form of active mobility for this most typical travel, such as cycling or scooter. Further 26 people walk, and 22 uses public transport. In terms of the goal of their travel, 293 respondents' most typical travel is work, while the second most populous category is shopping with 152 responses. School, healthcare, administration and the option 'other' were selected only in a few dozen cases.

The results of our choice model can be seen in Table 2:

Table 2. Results of the multinomial logit model

asccar	2.32***
	(0.155)
asc_{bus}	2.06***
	(0.208)
$asc_{drt\ bus}$	2.84***
	(0.161)
asc_{bike}	3.68***
	(0.146)
β_{cost}	0.0019***
	(0.000281)
$\beta_{travel\ time}$	−0.0625***
	(0.00397)
$\beta_{frequency}$	−0.0157***
	(0.00147)
β_{egr}	−0.0347***
	(0.0132)

Standard errors in parentheses.

The results show that everything being equal, residents prefer cycling the most out of the available modes, and that is followed by the hypothetical demand responsive bus service. This is a very encouraging result for the potential new service, showing that it could potentially be very competitive with other modes. The least preferred mode is walking (the alternative specific constant of which mode has been normalized to zero). This can be explained by the fact that the town is rather dispersed with relatively large distances within the settlement, so that mode is usually not competitive with the others.

Travel time, frequency and egress time have the expected negative sign. An interesting result is that the coefficient of egress time is way smaller than the coefficient of in vehicle travel time, which shows that individuals face a larger disutility while on a vehicle than on the way to/from the stop.

The coefficient of cost is positive. The reason behind this phenomenon has to be investigated further, but as a consequence, no meaningful value of travel time can be estimated.

4 Conclusions

In this contribution we have estimated user's preferences of potential rural travelers towards a hypothetical on-demand bus service by using a stated preference survey.

As most typical travels by this city's residents are done locally, within the settlement the local decision makers can have a large impact using traffic management tools. Introducing more attractive public transportation services can reduce car dependency and reduce traffic in the town.

Based on our results, a number of policy recommendations could potentially be formulated. It can be seen from the results that a relatively large portion of individuals did not find demand responsive transport attractive at a pricing level that resembled the price of the normal bus service. This might be due to the unfamiliarity of this type of service to the local community, which might make individuals overestimate the mental cost of indicating the will to travel to the service provider in advance. In case a DRT service would be introduced, a well targeted advertisement campaign could play a key role in informing individuals about the nature of a service like this. However, the large alternative specific constant of the DRT service shows that those who would use such a service would also prefer it compared to the traditional bus service.

On the one hand, the modal share of public transit is relatively low in this settlement, as it can be expected in an urban environment with low population density and regular, but not very frequent bus service, which means that there might be room for the demand responsive transit to take up potential users from that group that travels by car currently. However, the design of the service has to pay attention to the fact that 50% of the travelers reported to use some sort of active travel, either cycling or walking, which is already very environmentally friendly and cost effective on a societal level. Making them switch to DRT, a motorized and subsidized on-demand bus service would result a decrease of social welfare and would go against potential environmental goals. Designing a service that is attractive to current public transportation users and car users, but not for people walking or cycling is a challenge, but our research can help decision makers set up the service properly. For example, the fact that travelers show higher affection towards shorter egress and excess times than in other cities can mean that a high number of stops should be defined as part of the demand responsive service, so the service can be attractive to a larger audience.

Further research should work out the financial details of the service based on the demand that can be estimated from the results of this study and show the potential financial benefit for the service provider of converting the traditional bus services into a demand responsive one, as this question is out of the scope of this paper. Another research direction could be to use RP data in a rural town where on-demand bus service is already introduced and estimate users' preferences based on real-life mode choice data.

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