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Users' preferences towards automated road public transport: results from European surveys

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Abstract

Collective automated road transport systems (ARTS) are the subject of current research in Europe. The paper reports on the results of the investigations about users' attitudes towards ARTS and conventional buses that have been carried out in twelve cities where the implementation of an ARTS service is being planned within the Citymobil2 project. A common stated preference questionnaire has been used. The econometric analysis has been based on the estimation of a logit model which has considered the choice for two alternatives: ARTS and minibus. The observed attributes are: waiting time, riding time and fare. Of particular interest, is the estimation of the alternative specific constant (ASC) of the ARTS, because this represents the mean of all the unobserved attributes of the automated system that affect the choice. With a common specification of the systematic utilities of ARTS and minibus, the observed attributes being the same, a positive value of the ASC is indicative of a relatively higher preference for the ARTS. The results show a relatively higher preference for ARTS across the cities where the ARTS is implemented inside a major facility. In other application contexts, commonalities in attitudes across cities are not found. The impacts on attitudes of the socio-economic attributes of the users are heterogeneous across cities.

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1. Introduction

Automation in collective public transport has been a reality for several years by now in the case of guided systems with fully segregated right-of-way. Examples include automated metro and automated people movers in airports. Research has been undertaken in Europe in recent years with the aim of implementing fully automated road

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collective transport systems (ARTS – Automated Road Transport Systems). The key advantage of ARTS is identified in the potential for offering a higher frequency of service in the off-peaks, provided the operating costs are lower than a conventional bus. Also, there is a potential for higher flexibility in adapting the supply to demand because of the lack of drivers' scheduling constraints. In this latter respect, it is worth mentioning that the on-demand functionality of collective vehicles is limited by vehicle size constraints (Personal Rapid Transit, PRT, have not been the subject of the research reported on here).

The technology is available and a few demonstrations of ARTS have taken place. The key barriers to implementation are legal. The Rivium in Rotterdam is the only system currently operated on a permanent basis. The system serves routes in peripheral areas of the city, with collective automated vehicles running along a dedicated lane with priority at intersections (<http://www.advancedtransit.org/advanced-transit/applications/rivium/>). Demonstrations of ARTS on routes in mixed traffic, low-speed, environments are currently being planned within the Citymobil2 project of the Seventh Framework Programme of the European Commission (<http://www.citymobil2.eu/en/>).

The attitudes of the users towards ARTS, i.e. collective automated road transport systems, are still largely unexplored. Most of the studies for which literature is available investigated the potential demand for ARTS services on specific routes (Bekhor and Zvirin, 2004; CyberMove Consortium, 2004; NETMOBIL Consortium, 2005). Only a few studies have tackled the research objective of assessing the relative preferences of the users towards ARTS vis-à-vis a conventional bus. One took place in Leeds (Shires and Ibañez, 2008), one in Rome (Delle Site et al., 2011). Both were based on stated preference (SP) survey methodology (Louviere et al., 2000; Hensher et al., 2005), which is nowadays common practice in transportation planning and economic studies. Other studies have considered personal rapid transit (among these: Minderhoud and van Zuylen, 2005; Shires and Ibañez, 2008; Cirillo and Hetrakul, 2010; Cirillo and Xu, 2010).

The Citymobil2 project gave the opportunity to investigate the attitudes of the users towards automation in collective road transport in a variety of application contexts. Technical and non-technical feasibility studies concerning the implementation of a small scale ARTS service have been conducted in twelve cities across Europe. The cities have selected the route for the proposed demonstration. The routes include a range of applications: within city centre, within a major facility (such as a technology park or a university), from public transport node to a major facility, and from public transport node to a residential area.

The paper reports on the investigation which has been carried out with the potential users of the ARTS service that has been planned in each city. A common SP questionnaire across the twelve cities has been used, with the aim of investigating the relative preferences towards ARTS and conventional systems. Questionnaire responses have been analysed using logit models (Ben-Akiva and Lerman, 1985).

2. Methodology

2.1. Stated preference questionnaire and surveys

An SP questionnaire common across cities has been used. First, the route of the public transport service under planning is described. A brief description of two vehicle options, a conventional minibus and an ARTS, is provided. It is specified that the two vehicles are equal in terms of propulsion, and of total and seating capacity. Both will run in mixed traffic. The difference is the presence/absence of the driver. A picture of both is shown.

In the second part of the questionnaire, respondents are asked to choose between a minibus and an ARTS in different supply scenarios for a trip of a given length; the supply scenarios are defined according to different levels of the waiting time, riding time and fare of the minibus and the ARTS. The third part relates to the personal characteristics of the respondents: gender, age, income, education, occupation, car availability in the household, ownership of a public transport monthly ticket.

The attributes and corresponding levels of the SP design are in Table 1. The number of combinations in the full factorial design (8 combinations) has been reduced to 4 combinations using a within-alternative orthogonal design technique.

Samples are composed by potential users of the ARTS services under planning in each city. Data collection activities took place in Spring 2013. The majority of surveys used face-to-face interviews, in a minority of cases on-

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