

# On-Demand Transit to Solve the Last Mile Problem

---

Derek Edwards, Zacharias Voulgaris

Georgia Tech, Atlanta, Georgia, USA

{dedwards, zvoulgaris}@gatech.edu

## I Introduction

Recent efforts to reduce pollution and cost associated with transportation has led to a movement away from personal automobiles to more sustainable transportation modes such as car sharing, commuter rail and bus rapid transit (BRT). However, each of these modalities is an incomplete solution due to its susceptibility to the last-mile problem. While driving a car on a freeway or riding on high speed rail or bus rapid transit is very efficient and fast, getting the riders to the transit stations or car sharing locations has proven difficult. The most prevalent current solution to the last mile problem is the bus, due to the bus's ability to travel on almost any road. Busses provide quasi door-to-door service between people's homes, offices, train stations and car sharing locations. However, the static nature of the bus route leads to inefficient routes and long wait times for passengers, which ultimately leads to customers opting for personal vehicles instead of public transit, especially when non-central locations are involved. The following introduces and discusses the advantages of on-demand transportation and flexible bus routes to alleviate some of the dominant problems with the conventional bus systems.

## II State of the Art

Previous work in the field of on-demand transportation has sought to create a door-to-door transportation option aimed at elderly or disabled riders. The system, generically known as Dial-a-Ride, works by having the customer call a central dispatching center and scheduling a pickup-up time and drop-off location. Usually this scheduling occurs several hours or even a day in advance to allow the dispatching center time to determine the most effective routes and accommodate as many customers as possible while minimizing the number of vehicles required to handle the customers' transportation needs. This, although helpful for a minority of the citizens, renders the whole process cumbersome and impractical for the everyday transit user.

21<sup>st</sup> century technology, including the proliferation of GPS devices, mobile phone technology, and increases in computational power has enabled a possible shift from the slow Dial-a-Ride system to a quick-response system that can rival the practicality and convenience of personal automobiles. The new flexible transit system will no longer have the customer interfacing with an operator via telephone. Instead, the customer will use any internet-ready device to quickly schedule a pickup and drop-off and receive near-instant feedback on when to expect service. The route selection will be automated by a central processing server using the GPS information from a fleet of busses and vans and will assign routes to drivers in real time. The bus's routes will be sent via a mobile network to an on-board GPS

device and turn-by-turn directions will be read to the driver. The expectation is that a customer can expect pickup in a matter of minutes instead of hours, while the number of employees that are needed to man the system will be minimal.

### III Target Areas and Impact

The areas that stand to gain the most from this technology are suburban areas and medium density urban areas which currently have bus systems. These areas face particular challenges in public transit due to their low population density. In these areas bus routes tend to be scarce with a large headway between busses. For instance, Atlanta busses, a mere one mile from the city center run at 40 minute headways. Even at this headway the busses often operate at low capacity rendering the whole system inefficient and relatively expensive. An on-demand transit solution would allow the bus system to select routes in real time, thus providing quick pickup and drop-off of passengers while maximizing the efficiency of resource usage by not sending busses down paths with little or no customer-demand. The routes will be further optimized by considering traffic conditions to allow busses to alter their routes to avoid congestion. All these characteristics will have positive consequences not only for the individual (customer) but also for the whole, helping tackle the traffic issue, and reduce overall cost, among other things. Table 1 illustrates the main advantages of utilizing flexible bus routes.

**Table 1 Flexible versus Static Bus Routes**

<b>Flexible Routes</b>	<b>Conventional Static Routes</b>
Alter route to avoid traffic congestion.	Unable to avoid traffic congestion.
Select bus/van size based on demand.	Always take the largest bus for worst case scenario.
Adjust bus frequency based on current demand.	Rely on schedules as guesses to current demand based on prior observation.
Respond to individual customer needs quickly.	Customer must alter his/her schedule to accommodate bus pickup.
Select optimum routes to minimize the number of busses in the system based on current demand.	Always cover the entire service area with busses regardless of current demand.
Good fuel efficiency, a “greener” alternative	Fuel efficiency mediocre to inadequate. Not so ecologically friendly an alternative.
Relatively low cost (after implementation)	Economically inefficient

### IV Conclusion

The vision of this project is to work within the current transportation framework of roads, commuter rail, and BRT to reduce dependence on privately owned automobiles. The system will provide efficient transportation to customers at a much lower cost than owning a vehicle while reducing pollution and congestion by essentially automating the car-pooling process. All this is done without the need for expensive expansion of rail lines and a minimum of computational and communication technology to facilitate vast improvements in public transportation service. This benefits the customer while saving the public transportation operators money by reducing route inefficiencies and promoting a more environmentally friendly alternative to urban transportation.