PARATRANSIT SYSTEMS OPERATIONS MODELS

FINAL REPORT

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INTRODUCTION

There is a significant and increasing number of disabled, elderly, very young or poor Americans that do not own or cannot use an automobile for personal transportation. According to the Community Transportation Association, "nearly 40 percent of the country's transit dependent population – primarily senior citizens, persons with disabilities and low-income individuals – resides in rural areas" (Community Transportation Association, 2002).

In most urban areas there is some sort of public transit system, usually conventional fixed route transportation such as buses, streetcars, subways etc. In addition, Federal law mandates equal access to public transportation for disabled individuals who are unable to use conventional, fixed route systems where such systems exist. Alternative, *demand responsive*, or *paratransit*, systems are provided for disabled individuals. In contrast, alternative transportation in non-urban communities is often limited to taxi services, if it exists at all.

More than one-third of America's population currently lives in suburban, small town and rural communities. With these communities aging faster than the general population, and increasing expectations for elderly and disabled independent living, demand for public transportation services can be expected to increase dramatically. Paratransit systems will likely play a major role in satisfying this demand.

PARATRANSIT BACKGROUND

In early 70's alternate transportation services started to get implemented for filling the gap left by the existing public transportation methods. Most of these systems were implemented through Federal funds mainly as demonstration programs. These forms of transportation came to be known as *paratransit*. The word *para* means "closely related to" and *transit* stands for "conventional transportation(Levinson-Weant, 1982). Paratransit systems can be loosely defined as a transportation services falling some where between a private automobile and fixed route systems. Paratransit has grown to include:

- Special service for the elderly and handicapped.
- Feeder services to line haul operations.
- Exploratory service in low-density suburbs to promote new ridership and to build the transit habit.
- Possible peak hour service to relieve pressure on often overtaxed vehicles and labor
- Possible late night service on certain routes where the capacity of conventional fixed route service is not required.

There are many forms of paratransit offering a wide range of service to different elements of society, but all can be broadly classified into two major categories. They are:

- Demand responsive paratransit – mainly includes Dial-a-ride or Dial-a-bus.
- Prearranged ride sharing – mainly includes Carpools, Vanpools, Subscription buses.

There are many organizations that provide paratransit services in many parts of the country and with differing objectives. According to Levinson (Levinson-Weant, 1982), these organizations are either public or private. There are two main types of public sector providers:

- Local governments.

- Regional transit authorities

Similarly, most private sector providers can be classified as:

- Non-profit social service agencies.
- Profit-making, nonsubsidized organizations.
- Profit-making transportation providers that have local government contracts and subsidies.
- Employers and employee organizations.

Whether public or private, all paratransit systems have similar management, routing and scheduling problems.

PARATRANSIT OPERATIONS MANAGEMENT AND VEHICLE ROUTING

Paratransit transportation system managers must assign *vehicles* and *drivers* to point-to-point *trips* corresponding to *ride requests* from elderly and disabled *passengers*. While operational details may vary, most small systems operate similar to the Galavan system documented in Appendix I.

Requests for rides must usually be made in advance by making a reservation. Some reservations can be made for a fixed *time window* while others are "will-call," meaning that the passenger will call for a return ride sometime after arriving at their destination. For example, a passenger may request a ride to a doctor appointment the next day, but must call when done for the return trip.

Hence, from a management point of view some vehicle trips can be planned at the beginning of the day while others are known but cannot be scheduled until a "will-call" event occurs. Paratransit vehicle routing thus involves three principle activities:

1. Reservation management.
2. Vehicle loading and routing (vehicle trip planning).
3. Real-time dispatching in response to will-call, breakdown, and other events.

This project focused on identifying computerized support opportunities for the second activity – vehicle trip planning – for small paratransit systems.

Figure 1 illustrates the architecture for a computerized decision support system for paratransit vehicle routing. The system will ultimately consist of two components:

- A database with map and trip reservation information
- Trip planning software including vehicle loading and routing and trip time estimation models.

While this project initially focused on routing software, it quickly became apparent that data issues would occupy most of the time. Planning algorithm development was therefore limited, while solutions to map and trip information acquisition and their integration and trip time estimation were devised.

A prototype database was designed and tested using Gallatin County Geographical Information System (GIS) map data and historical trip data from the Galavan reservation database. Data for developing trip time estimation models was collected by observing the Galavan vehicles.

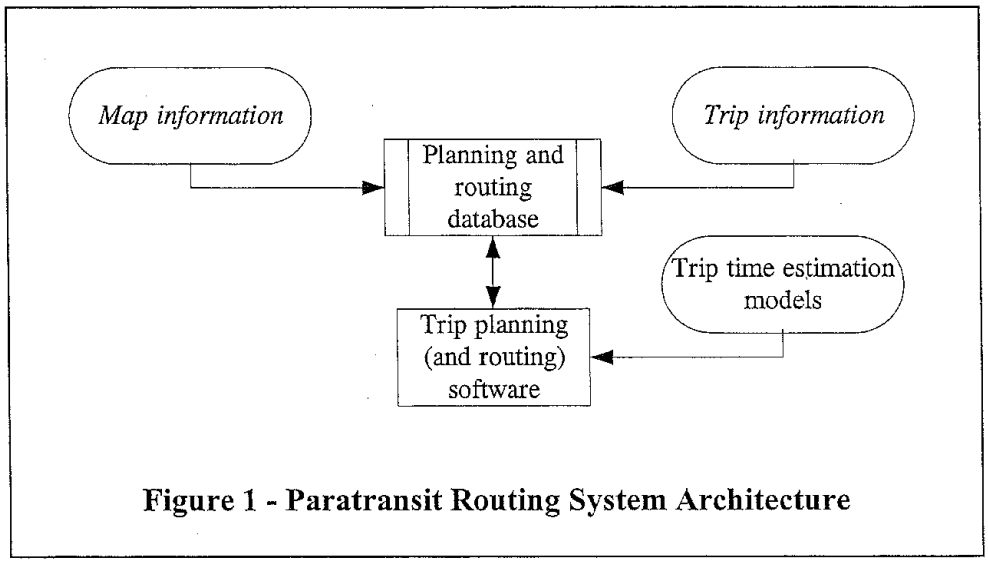

Figure 1 - Paratransit Routing System Architecture

This report is divided into two major sections, followed by conclusions and recommendations for future work. The first section summarizes the map and trip information database portion of the study and the time estimation models are described in the second section.