Chapter 10
A Simulation Study to Derive the Optimal Cycle Length for Feeder Transit Services

Shailesh Chandra
Texas A&M University, USA

Chung-Wei Shen
Texas A&M University, USA

Luca Quadrifoglio
Texas A&M University, USA

ABSTRACT

This paper presents a simulation study to evaluate the capacity and the optimum service cycle time of a demand responsive transit "feeder" service within the colonia of El Cenizo, TX. Demand data are taken from a survey questionnaire conducted to evaluate the existing travel patterns and the potential demand for a feeder service. Results showed that a single shuttle would be able to comfortably serve 150 passengers per day and that a fleet of 7-8 vehicles would be needed to serve the residential area. The optimal cycle length between consecutive departures from the terminal should be between 11-13 minutes for best service quality. This exploratory study can serve as a first step towards improving transportation services within these growing underprivileged communities, but also other residential areas, especially those with demographics and geometry similar to our target area of El Cenizo.

INTRODUCTION

Colonias are unincorporated settlements outside city boundaries along the US – Mexico border. Texas not only has the largest number of colonias, but also the highest colonia population, more than 400,000 people. Colonias are underprivileged communities whose residents are facing many fundamental problems. For example, most of the housing is not built according to code standards and lack indoor bathrooms or plumbing; there is a lack of a potable water supply and a lack of proper health care services, such as access to hospitals and clinics which have further aggravated these

DOI: 10.4018/978-1-4666-2649-2.ch010

problems. The employment situation is also bad, ranging from 20% to 60%. Another major issue among the colonias is the level of education, since the dropout rate from schools is excessively high.

All the above problems are severely worsened, if not partially caused, by a general lack of acceptable transportation services and facilities. The existing unpaved roads are difficult for any vehicle to travel on. This problem becomes aggravated at times of heavy rainfall, since roads become muddy and it makes it very difficult to walk as well. Thus, school-bus operations, medical vans, transit vehicle and private cars/trucks cannot be used as desired. In addition, most residents do not own a private vehicle and the existing public transportation system is inadequate. The large distance and limited means of private transportation between the colonias and the closest city denies the colonia residents easy access to jobs, health care facilities and grocery stores for meeting their basic needs.

El Cenizo, adjacent to the Rio Grande River, is a colonia located in Webb County, TX, about 15 miles south of Laredo. There is some transportation services currently provided to El Cenizo's residents. El Aguilar, operated by the Laredo Webb County Community Action Agency, is one of the transportation services operating in this colonia. Medical transportation is provided by LeFleur Transportation and managed by TxDOT-MTP (Medical Transportation Program). There are a couple of other transportation services such as the vans provided by the Texas A&M University Center for Housing and Urban Development (CHUD) and school buses provided by the United Independent School District, a school district headquartered in Laredo. These transportation services can only pick up and drop off riders at designated bus stops outside or just at the entrance of El Cenizo (except for those meant for extreme medical emergencies). In addition, the schedule of fixed route bus service is limited to the morning and afternoon peaks. Furthermore, residents have little resources and most of them cannot afford to buy and maintain private vehicles. Consequently, most of them have no means of acceptable transportation.

There are two main objectives that govern the present research study. (1) The first is to analyze the travel demand patterns in El Cenizo and thereby perform a feasibility/design study for the possible implementation of a demand responsive "feeder" transit system in the El Cenizo area. (2) The second objective of this paper is to estimate by simulation analyses the best service time interval between consecutive departures from the terminal (cycle length) in order to maximize the service quality provided to customers, and minimize the disutility function expressed as a weighed sum of travel time and waiting time.

The primary data source used for this analysis is a travel survey conducted in El Cenizo, which has been selected as a representative colonia for this study as the area is easily accessible for collecting data and also it forms a very good representation of a colonia found along the US-Mexico border in terms of demographics.

The results from this study could improve the quality of life of colonias' residents by enhancing their mobility and efficiently responding to their present essential transportation needs. The results could be eventually used to incorporate an efficient transit system also in another area having similar geometry and demographics.

LITERATURE REVIEW

A general lack of a concrete transportation system in the colonias encouraged us to perform several literature reviews to identify the status quo of the transportation service in these areas. The Burke et al. (2005) analysis of the TAMU Colonias Van Project concluded that unscheduled, non-routine trips are a persistent and enduring need of families and individuals in the isolated colonias. Although the van program increases the access of colonia residents to many kinds of services available at