Fixed-guideway Transit and Social Justice in Austin

*Optimal Alignments and Station Siting Based on Need*

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Executive Summary

There exists a growing population of struggling working class families that must turn to transit for their commuting and transportation needs. Austin is currently planning a rail network that will become the city’s transit backbone for the next century. Economically disadvantaged folks have been forced to utilize bus transit systems, even with their burdens and inconveniences. As this new network is designed and built, it will be important to assure that these vulnerable populations are served by the new rail system. By looking at census and commuter trip data in addition to planned rail station and line locations, this project attempts to understand how well rail service address regional transit need.

The aggregate “Transit Need” ranking developed spatially identifies areas that are most deserving of rail transit projects based on a population’s likeliness to utilize transit. Although catering to neighborhoods ranked as high need is an exercise in social justice, it is also economically rational. Capital Metro can maximize its revenue and fare box recovery by locating rails and stations in areas where the most people are likely to utilize the service provided.

The following recommendations guide a smart approach to regional rail:

- The downtown circulator and university alignment should be the highest priority for the next rail buildout project
- An alignment along Riverside Drive, running to the ABIA airport is the second-highest priority
- Two station additions make sense along the Red Line, one close to 11th street, and the other at 45th Street and Airport Blvd.
Introduction

Economic inequality in the United States has reached levels not seen since the “Gilded Age” of the late nineteenth century. (Auerbach) In this current period of economic crisis, many working families are being faced with hard choices concerning budget. At the same time that incomes have failed to grow with inflation, transportation prices have been in a state of flux over the course of the last 24 months, shrinking families’ real income further. Figure 1 illustrates an average income family budget:

*Figure 1: Average Family Budget Breakdown by Expense*

![Bar Chart: Average Family Budget Breakdown by Expense](image)

All families feel the sting of high transportation costs, but impoverished individuals are more regrettively affected than average income individuals. (Blank) Figure 2 illustrates transportation spending by income group:

*Figure 2: Transportation Spending by Income Group*

![Bar Chart: Transportation Spending by Income Group](image)
Working families (defined as households with incomes between $20,000 and $50,000) are challenged by a simple trade-off between saving on housing and paying more for transportation. To find more affordable housing, families often have to “drive until you qualify,” and consider living in suburban or rural areas, where automobile dependency and commuting costs rapidly rise. Combined, the costs of transportation and housing, the two largest expenses in most working families’ budgets, account for 57% nationally, and according to 2003 Bureau of Labor Statistics data, for every dollar a working family saves on housing, it spends 77 cents more on increased transportation costs. (Surface Transportation Project)

For many of these families, owning and operating a single automobile is impossible given budget constraints. (Grusky) Figure 3 demonstrates the prohibitive cost of an automobile for the economically marginalized. Unfortunately, in most Western cities, the automobile is a dominant mode of transportation, forcing this vulnerable population to adapt to existing bus transit systems. At the same time, gentrification and the general desirability of proximity to the city center has led the poor to more affordable housing further from employment centers and transit. (Sanchez)

Figure 3: Transportation Costs Comparison

As Austin implements the Red Line of the Capital MetroRail this spring, it is important to ensure that vulnerable populations that benefit most from transit are being served. Of course, maximum ridership is in the best financial interest of Capital Metro, as well. The Red Line will be the first of several commuter lines, and as Austin designs and builds a rail network, the benefits of fixed-guideway transit over existing bus systems will become obvious to commuters of all income levels. Although transit must serve the entire community, serving vulnerable and historically underserved populations is a consideration of the rail planning process in Austin. The scope is regional, as the first transit service is a commuter rail. However, station areas will also be examined in detail to investigate barriers to transit access. During the course of this investigation, social justice will receive more than the traditional lip service by politicians.
Problem Statement

With the Capital Metro Red Line opening this spring, local stakeholders have an opportunity to ensure that rail alignment and station siting serve populations most likely to utilize public transit. Map 1 illustrates the build out and current station locations of the Capital Metro offering:

An analysis of the following data will allow a transit need ranking to be developed:

- Median Family Income
- Population Density
- Employment Density
- Poverty Levels
- Existing Bus Transit Availability
- Vehicle Ownership
- Public Transportation Utilization
- Average Commute Time
Research Questions

1. How well does rail transit serve the economically disadvantaged in Austin?
2. Which areas in town are most in need of fixed-guideway transit?
3. Which rail alignments should be prioritized for construction?
4. Where can additional stations be sited along the Red Line to further serve the economically disadvantaged?

Methodology

Data Development

Data acquisition and geography selection was driven by the availability of social, economic, and transportation-related information. Unfortunately, such data is not 100 percent population census data, and for the 2000 U.S. Census was contained in the long form, which was received by approximately one in six households. However, the sample data is available at census tract level, which makes for a decent regional analysis of factors.

Poverty, transportation, and economic mobility research informed the selection of data variables that make up the Transit Need ranking. Median Family Income was one of the first considered due to its ability to discern general areas where the costs of a vehicle may be prohibitive. Population Density weighs need toward urban areas where rail is most feasible. Employment Density is useful for determining specific alignments and station siting, but was omitted from the Transit Need ranking due to differing geographies.

Poverty level data presented an interesting methodological challenge, as different measures of poverty would have varying impacts on the Transit Need ranking. Percent of individuals in poverty was chosen to represent areas where poverty exists beyond the household level, such as in the case of students. Existing bus transit availability was easily adapted from Capital Metro route and bus stop data.

Vehicle ownership and public transportation utilization are opposing ways of getting at the same data trends. Both were included to magnify the importance of areas where public transportation is already doing well and may be able to further improve, as well as areas where automobile transport is so dominant that transit could potentially struggle. Average commute time data identifies areas where transit can avoid highway bottlenecks and more positively affect an area’s productivity and congestion.
Data Analysis

For each of the indicators mentioned above (except employment density), data must be consistently distributed at the census tract level. All datasets are classified into 5 “natural breaks” in order to establish the most representative relative difference between tracts.

- Acquire transportation facility data (rail alignments, roads)
- Acquire census tracts shapefile
- Acquire, join, and classify (5 natural breaks) various Summary File 3 Census 2000 data
  - Median Family Income
  - Population Density
  - Poverty Levels
  - Vehicle Ownership
  - Public Transportation Utilization
  - Average Commute Times
- Acquire Capital Metro bus data
  - Bus Transit Availability
- Develop bus availability density raster from point file locations
- Apply bus availability density raster to census tracts and classify (5 natural breaks)
- Calculate Z scores for every parcel across each dataset
- Aggregate Z scores to develop and Transit Need relative index

- Utilize Transit Need ranking to make decisions regarding rail alignment prioritization and Red Line station location, incorporating additional data
  - Employment Density
  - Vacant Parcel location
  - Proposed Rail Alignments
  - Existing Rail Track
Findings

Map 2: Median Family Income by Census Tract

Median Family Income

MPI (in 1999 dollars):
- 7,420 - 28,300
- 28,400 - 43,600
- 43,700 - 64,500
- 64,800 - 97,200
- 97,300 - 165,000

Compiled by John T. Kennedy on December 15, 2008

Rail: Capital Metro
Base: hypsography: City of Austin
MPI: US Census 2000, SF3
Projection: Texas Central State Plane, NAD 83 (foot)
Map 3: Population Density by Census Tract
Map 4: Percent of Individuals in Poverty by Census Tract
Map 5: Vehicle Ownership Penetration by Census Tract
Map 6: Public Transportation Penetration by Census Tract

Public Transportation Utilization

Percent Per Tract:
- 0% - 2%
- 3% - 4%
- 5% - 7%
- 8% - 10%
- 11% - 20%

Compiled by John T. Kennedy on December 15, 2008
Rail: Capital Metro
Roads: hydrography, City of Austin
Transit: US Census 2000, SF3
Projection: Texas Central State Plane, NAD 83 (fwd)

Miles
Map 7: Average Commute Time by Census Tract
Map 8: Existing Bus Transit Availability by Census Tract
Map 9: Transit Need Ranking by Census Tract
Map 10: Regional Rail Situation

Rail Alignment Options

- Station
- Proposed
- Red Line
- Existing track
- Major Highway
- Arterial
- No Data

Compiled by John T. Kennedy on December 15, 2008
Rail: Capital Metro, Capital Area Council of Governments
Road, Hydrology: City of Austin
Projection: Texas Central State Plane, NAD 83 (Hem)

0 0.5 1 2 3 Miles
Map 11: Transit Need Study Area and Future Employment Density
Map 12: Red Line Station Expansion Proposal
Analysis and Conclusion

The aggregation of sampled census data into the Transit Need ranking proved to be rather useful, as the result identifies the University neighborhoods, in addition to the Eastern neighborhoods in general as most in need regarding transit. Of course, the statistics and variables chosen for aggregation have a great influence on the final ranking. In this case, the data chosen has proven to represent marginalized populations that would most likely experience great benefits from the availability of rail transit.

Conveniently, the Red Line runs to the east side of town before heading downtown. The city should be applauded for choosing this alignment first, as it has many applications for marginalized Eastern neighborhoods. However, the Transit Need tract ranking can be utilized to discern priorities for future track alignments. When the primary need area is composited with employment density (Map 11), it becomes clear that the University and Downtown areas should be prioritized for the next rail build out. An additional line running along the Riverside corridor to the Airport would be the next priority, given the logic of Transit Need.

When looking specifically at the Red Line, potential exists for station expansion. The line runs along an East census tract that ranks highly for transit need. Accounting for other stops and the overall spacing of stops, in addition to the availability of vacant parcels, leads to the conclusion of a station proposal on a vacant parcel midway between the Saltillo and MLK stations.

The second station proposal is much more theoretical, but prospectively a game-changer for Capital Metro. The area bounded by Interstate 35, 45th Street, and Airport Blvd represents an excellent Red Line station possibility. Although there are no readily vacant parcels, this station would be of an equal interval in relation to the MLK and Highland stations, possibly provide park and ride access to Interstate 35 commuters, and serve the central Hyde Park neighborhood. Until an alignment is featured through the University and Downtown (at least 5 years away), this station would capture the large latent demand that exists in the University Area. Students from all around the campus area would travel to this station in order to travel downtown on the weekends, in addition to generally commuting.

In conclusion, identifying Transit Need is a compelling way to model fixed-guideway transportation facility alignment and station siting. More than just socially just, this approach ensures maximum revenue and fare box recovery for Capital Metro by providing populations with the most incentive to utilize transit with transit. As the City of Austin, Capital Metro, and CAMPO continue to work on the rail network, prioritizing projects based on Transit Need is socially, scientifically, and economically sound.
Further Study

The expansion of this methodology to investigate barriers to transit access on a more detailed geographic scale could provide valuable insight to the transportation planning process. Additional data more specific than the Census would be required, as well as indicators of accessibility, such as:

- Block length
- Sidewalk buildout
- Land use zoning
- TOD Plans
- Other walkability and accessibility data

With additional detail and a more intense scale, the issues investigated in this study could be applied to a neighborhood or tract level of analysis.
References


Surface transportation Policy Project. [http://www.transact.org](http://www.transact.org)
Appendix
Data Sources

U.S. Census/TIGER: www.census.gov

Socio-economic data and income/commuting data from the American Community Survey and Summary File 3 (Census 2000)

Capital Metro: www.capmetro.org (I have internal access to GIS data)

Current bus route line data, bus stop point data

Capital Area Metropolitan Planning Organization: www.campotexas.org

Trip data by traffic analysis zone, planned rail service line data, employment data

Methodology Expansion

• All data was downloaded and projected to the Central Texas State Plane (FIPS 4203)
• Census data was queried and downloaded in custom table form for the Travis County census tracts.
• Downloaded data was joined with census tract shapefile
• Once joined, data was symbolized into 5 “natural break” classes by tract
• This process was repeated for all census data
• In order to establish existing bus availability, several additional steps were taken:
  o Capital Metro route data and stop points were plotted
Bus stop density was determined by using the spatial analyst > zonal statistics to raster function.

The generated raster was applied to the census tract geography.

- In order to calculate z scores for each dataset, fields were added to the census tract shapefile.
- Created fields were calculated by arcGIS to assign each Travis County parcel a relative Z score ranking \[ Z \text{ score} = \frac{\text{sample} - \text{mean}}{\text{standard deviation}} \]
- Once Z scores were determined for each dataset, an aggregate z score was calculated by averaging with an eye towards transit need. For instance, high levels of public transportation utilization were ranked positively for need, while high levels of vehicle ownership were ranked negatively. For each data, a similar consideration was made. The following were applied to the aggregate Transit Need ranking: MFI low, public transit high, vehicle ownership low, bus access low, population density high, travel time high, poverty high.
- Aggregate Z scores were relatively ranked by tract to determine Transit Need.
- Rail alignment prioritization and Red Line station proposals were developed by adding appropriate data (employment, vacant parcels, rails) to the Transit Need ranking.
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**Z Score Calculation and Output**

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