Comprehensive Analysis for Mission-Brownsville Commuter Rail Study

Geeth Sourabh Petla

Date: January 19, 2025

Contents

Introduction

The Mission-Brownsville commuter rail project aims to improve transportation infrastructure by connecting key areas within Hidalgo, Cameron, and Starr counties in South Texas. This study is focused on determining optimal station locations along three proposed routes: the upper and lower sections of the 365 Loop and an elevated route extendin (TXDOT, n.d.)g along Highway 83. The primary objective is to enhance accessibility and address regional socioeconomic challenges.

The 365 Loop, currently under construction by the Hidalgo County Regional Mobility Authority, serves as the backbone of this initiative. It stretches across Mission and McAllen and is envisioned to extend eastward into Brownsville. Highway 83, running through Mission and McAllen, plays a pivotal role as an elevated commuter route connecting these urban hubs. The study leverages the main high-speed rail terminal, highlighted in yellow on the project map, located in the southwest section of the 365 Loop in Mission, Texas.

To strategically identify station locations, the study employs regression analysis across eight critical factors:

1. Population density
2. Income levels
3. Traffic vehicle counts
4. Bus line routes and frequency
5. Location of medical facilities

6. Location of shopping centers
7. Educational facilities
8. Entertainment facilities and airports

By correlating these factors, the analysis seeks to maximize accessibility while addressing the needs of underprivileged communities. The integration of data-driven insights with infrastructural planning ensures that the proposed rail system supports economic growth, reduces congestion, and provides reliable transportation for residents in urban, suburban, and rural areas.

Goals

Identify Optimal Station Locations Using Data-Driven Methods

This task involves leveraging regression analysis and data correlation techniques to determine the most strategic station placements. By analyzing factors such as traffic flow, population density, and accessibility to essential services, the study identifies high-demand areas where stations will have the greatest impact. This method ensures efficiency and equity, aligning transportation services with community needs.

Address Socioeconomic Disparities, Focusing on Underserved Communities

The project prioritizes accessibility for low-income and underserved communities. By addressing disparities in transportation availability, the commuter rail system aims to reduce commuting costs, connect residents to employment opportunities, and enhance access to education and healthcare facilities. This approach contributes to reducing regional inequality while fostering economic development.

Enhance Connectivity to Economic and Social Hubs

Establishing efficient rail connections between urban centers, suburban areas, and key economic hubs ensures seamless mobility. The rail system integrates with existing bus routes and highways to provide comprehensive coverage. By connecting people to shopping centers, entertainment facilities, airports, and workplaces, the project supports both individual mobility and regional economic growth.

Correlate Multiple Datasets to Justify Station Placement

The study synthesizes data from diverse sources, including traffic counts, census demographics, and infrastructure maps, to provide a holistic view of regional needs. This multi-faceted analysis ensures that station locations are based on empirical evidence rather than assumptions. By correlating datasets, the project can prioritize stations that maximize public utility while aligning with long-term planning objectives.

Factors

Traffic Data

The traffic dataset, sourced from TXDOT, includes vehicle counts for key thru streets connecting Military Highway to US Business 83 and US 83. This dataset is vital for identifying high-traffic corridors, which serve as primary candidates for station locations. By analyzing traffic patterns, the study ensures that stations are placed in areas with the highest commuter activity, thereby optimizing usage and reducing congestion.

Population Demographics

The population dataset, derived from the US Census Bureau, provides ZIP code-specific information on population density across Hidalgo, Cameron, and Starr counties. This dataset helps identify densely populated areas where demand for public transportation is highest. It also supports equitable planning by highlighting underserved communities.

Income Levels

Data on median household income, obtained from census statistics, highlights economic disparities across ZIP codes. This dataset ensures that the commuter rail system addresses the needs of low-income communities by providing affordable and accessible transportation options.

Poverty Rates

The poverty dataset includes percentages of individuals living below the poverty line in each ZIP code. This information is crucial for targeting areas that would benefit most from improved access to transportation. By focusing on high-poverty regions, the project aligns with broader socioeconomic goals.

Housing Statistics

Housing data, which details the percentages of renters and homeowners, plays a significant role in station placement. Urban areas with high renter populations indicate a need for easily accessible stations, while suburban regions with higher homeownership rates may require park-and-ride facilities.

Unemployment Rates

Unemployment data, when available, highlights areas with limited access to job opportunities. By integrating this dataset, the study ensures that the commuter rail system connects these communities to economic hubs, thereby fostering job creation and economic growth.

Detailed Analysis of Factors

Traffic Trends

Dataset Description

The thru streets dataset includes data on traffic counts for streets connecting Military Highway to US Business 83 and US 83. This data was sourced from TXDOT's traffic count records and additional data from the Hidalgo County RMA map. The updated dataset covers more than 10 streets, including:

1. **FM 1732**
2. **FM 802**
3. **FM 1421**
4. **FM 2520**

5. **FM 3248**
6. **FM 506**
7. **FM 2556**
8. **FM 2220**
9. **FM 907**
10. **South Ware Road**
11. **FM 494**

Each street has four traffic points:

- **Highest Traffic Count:** Typically near US 83, reflecting major commuter activity.
- **Lowest Traffic Count:** Near Military Highway, capturing minimal traffic.
- **Two Additional Midpoints:** To observe traffic distribution along the street.

Expanded Exploratory Analysis

1. Streets with Highest Traffic Counts:

- **FM 2220 (South Ware Road):** 93,732 vehicles/day (highest traffic among all streets).
- **FM 2556:** 63,254 vehicles/day.

2. Streets with Lowest Traffic Counts:

- **FM 1421:** 2,565 vehicles/day (lowest traffic among all streets).

- **FM 2520:** 3,349 vehicles/day.

3. Traffic Distribution:

- Urban streets such as FM 2220 and FM 494 show significant peaks near Highway 83, indicating heavy commuter activity.
- Rural streets like FM 1421 and FM 2520 show consistently lower traffic counts, suggesting limited commuter flow.

Understanding the Dataset

The dataset reveals that urban streets have significantly higher traffic counts compared to rural ones, emphasizing the importance of locating stations strategically. High-traffic streets like FM 2220 are situated in densely populated and commercially active areas, aligning with the study's goal to maximize ridership. Conversely, low-traffic streets such as FM 1421 highlight areas where park-and-ride facilities could encourage greater rail usage, addressing underserved regions effectively.

Key Observations:

- Traffic trends directly correlate with population density and economic activity, demonstrating the importance of using empirical data to prioritize station placement.
- Understanding the disparities between high- and low-traffic streets provides actionable insights for designing complementary infrastructure that enhances overall rail accessibility.

Recommendations

1. Prioritize station placement along high-traffic streets like FM 2220 and FM 2556 to ensure maximum usage.
2. Integrate park-and-ride facilities near low-traffic streets to encourage greater rail usage.

3. Conduct additional studies to analyze seasonal variations in traffic patterns and adjust station placement strategies accordingly.

Population Demographics

Dataset Description

The population dataset includes ZIP code-specific data across Hidalgo, Cameron, and Starr counties. It highlights population densities and growth patterns in key urban and rural areas. This data was sourced from census statistics and cleaned datasets for analysis, reflecting population data for 2023.

Understanding the Dataset

1. **High-Density Areas:** Cities like McAllen (142,000), Mission (86,000), and Edinburg (102,000) exhibit the highest population densities, indicating significant demand for public transportation.

2. **Low-Density Areas:** Rural areas like Linn (4,500) and Los Ebanos (6,200) show sparse populations but may benefit from feeder services or park-and-ride options.

3. **Growth Patterns:** Suburban areas near urban hubs show increasing population trends, signaling future demand for transit connectivity.

Key Observations:

- Station placement should prioritize high-density urban areas to maximize ridership.

- Rural regions with smaller populations require cost-effective infrastructure like shuttle or park-and-ride services.

Recommendations

1. Establish stations in high-density cities such as McAllen and Mission.

2. Integrate rural regions with feeder bus services to rail stations.

Income Levels

Dataset Description

The income dataset contains median household income data across ZIP codes in Hidalgo, Cameron, and Starr counties for 2023. This data provides insights into economic disparities and highlights regions requiring affordable public transportation options.

Understanding the Dataset

1. **High-Income Areas:** Cities like McAllen ($62,500) and Edinburg ($58,200) show significantly higher median incomes compared to rural areas. These areas may require expanded commuter services to support the working population.

2. **Low-Income Areas:** Regions such as Donna ($32,800) and San Juan ($28,500) exhibit lower incomes, indicating an urgent need for affordable and accessible transit options.

3. **Economic Disparities:** Income disparities align with traffic and population trends, emphasizing the need to address transportation equity.

Key Observations:

- Low-income areas are often underserved by existing transportation networks, necessitating targeted infrastructure development.

- High-income areas show potential for higher ridership due to concentrated employment hubs.

Recommendations

1. Provide subsidized fare options in low-income areas to ensure affordability.
2. Focus on connecting high-income areas with employment hubs through direct rail services.

Poverty Rates

Dataset Description

The poverty dataset includes ZIP code-specific poverty rates for 2023 across Hidalgo, Cameron, and Starr counties. This data identifies regions with the highest percentages of individuals below the poverty line.

Understanding the Dataset

1. **High-Poverty Areas:** Cities like Donna (34%) and San Juan (38%) report the highest poverty rates, underscoring the need for accessible transit solutions.
2. **Impact of Poverty:** High-poverty areas often lack reliable transportation options, exacerbating socioeconomic challenges.
3. **Correlation with Other Factors:** High poverty rates correlate strongly with low income levels and limited traffic flow, emphasizing the importance of multimodal connectivity.

Key Observations:

- Addressing poverty through transportation can improve access to jobs, education, and healthcare.
- Infrastructure investments in high-poverty areas align with broader socioeconomic objectives.

Recommendations

1. Prioritize station placement in high-poverty ZIP codes to enhance accessibility.
2. Collaborate with local agencies to subsidize transportation costs for low-income residents.

Housing Statistics

Dataset Description

The housing dataset provides the percentages of renters and homeowners for 2023 across Hidalgo, Cameron, and Starr counties. This data offers insights into residential stability and transportation needs.

Understanding the Dataset

1. **High-Renter Areas:** Urban areas like McAllen (64%) and Pharr (62%) exhibit higher percentages of renters, necessitating accessible public transit systems.
2. **High-Ownership Areas:** Suburban and rural areas show higher rates of homeownership, with cities like Mission (72%) and Edinburg (70%) leading.

Key Observations:

- Renters rely heavily on accessible transit for daily commutes, emphasizing the importance of urban station placements.
- Homeowners in suburban areas benefit from park-and-ride infrastructure, facilitating first- and last-mile connectivity.

Recommendations

1. Develop transit hubs in high-renter areas to maximize usage.
2. Establish park-and-ride facilities in high-ownership regions to enhance connectivity.

Conclusion

This comprehensive analysis has reviewed the data gathered for factors including traffic patterns, population demographics, income levels, poverty rates, and housing statistics. High-traffic streets such as FM 2220 and population-dense areas like McAllen and Mission were identified as priority locations for station placement. Additionally, regions with high poverty and low income were highlighted as needing equitable access to transportation options.

While the findings are based on currently available data, further research is being conducted on other critical factors, such as bus line routes, locations of medical and educational facilities, and entertainment hubs. This ongoing analysis will use regression models to refine station placement strategies and ensure comprehensive coverage across Hidalgo, Cameron, and Starr counties.

References

(USPS), Z. C. (2024, October). *ZIP Code™*. Retrieved from https://tools.usps.com/zip-code-lookup.htm?_gl=1*1miaqz4*_gcl_au*MTk0MDg4NDU5Mi4xNzI2MTU4NTU2*_ga*NjAzODAzNzMyLjE3MjYxNTg1NTY.*_ga_3NXP3C8S9V*MTcyNjE1ODU1NS4xLjEuMTcyNjE1ODc1OS4wLjAuMA..

counts, T. D. (2024, December). *Traffic Count Maps*. Retrieved from https://txdot.ms2soft.com/TDMS.UI_Core/portal

Map, H. C. (n.d.). *"Web App Viewer." Hidalgo County Regional Mobility Authority*. Retrieved from https://hcrma.maps.arcgis.com/apps/webappviewer/index.html?id=a3027c8765134b9b8b7baf8688b48cd5

TXDOT. (n.d.). *Traffic Count Database System*. Retrieved from http://txdot.public.ms2soft.com