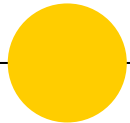
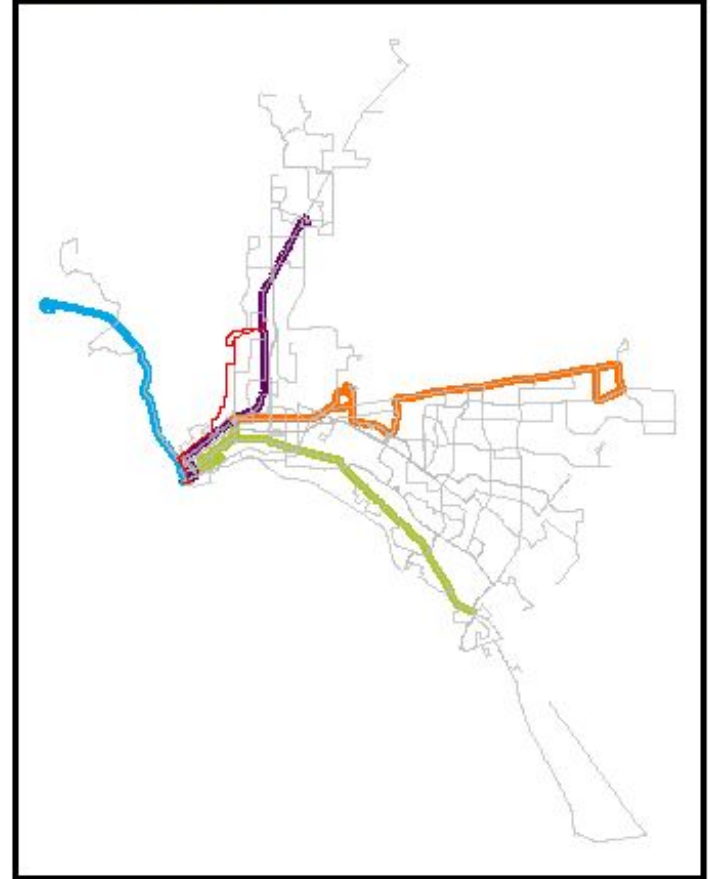


Planning & Forecasting Bus Transit Alternatives in El Paso, Texas



Client: El Paso Capital Improvements Department
Alex Hoffman, *AICP*, *CNU-A* & Adam Gorski

Sun Metro Local Bus Network
Beaumont Hospital/Highland



Practicum Team



Jack Rummler
Project Manager



Charlie Huemmler
R Markdown

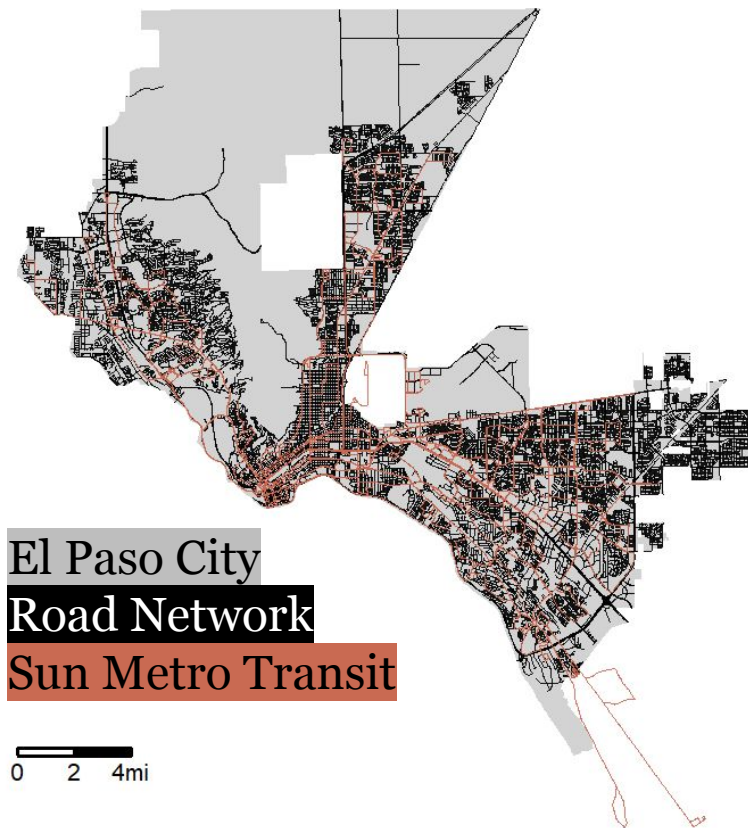


Yingxue Ou
App Development

● Problem Statement

Sun Metro is looking to redesign its bus network system while maximizing both equity and revenue

Current Bus Network
Sun Metro Mass Transit - El Paso, TX



Sun Metro Context

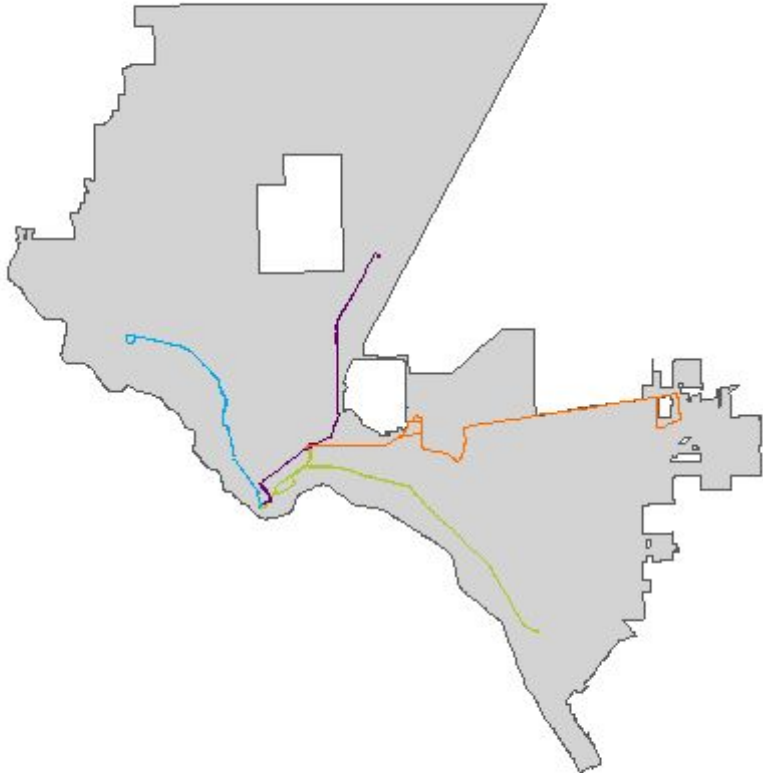
- Experienced declining ridership for the last several years with rapid decrease in ridership as the pandemic began
- New services helped increase ridership



Image: Sun Metro, State of the System Report (2022)

● **BRIO**

- Bus rapid transit lines
- Four routes since 2014
- Account for 40% of system ridership



“El Paso, often forgotten, is building a stronger transit network than most US cities.”

– Christof Spieler
(Trains, Buses, People)



“



Use Case

To develop an **evaluation framework** for Sun Metro transit planners to maximize the **social equity** and **fare revenue** outcomes of alternative bus route scenarios

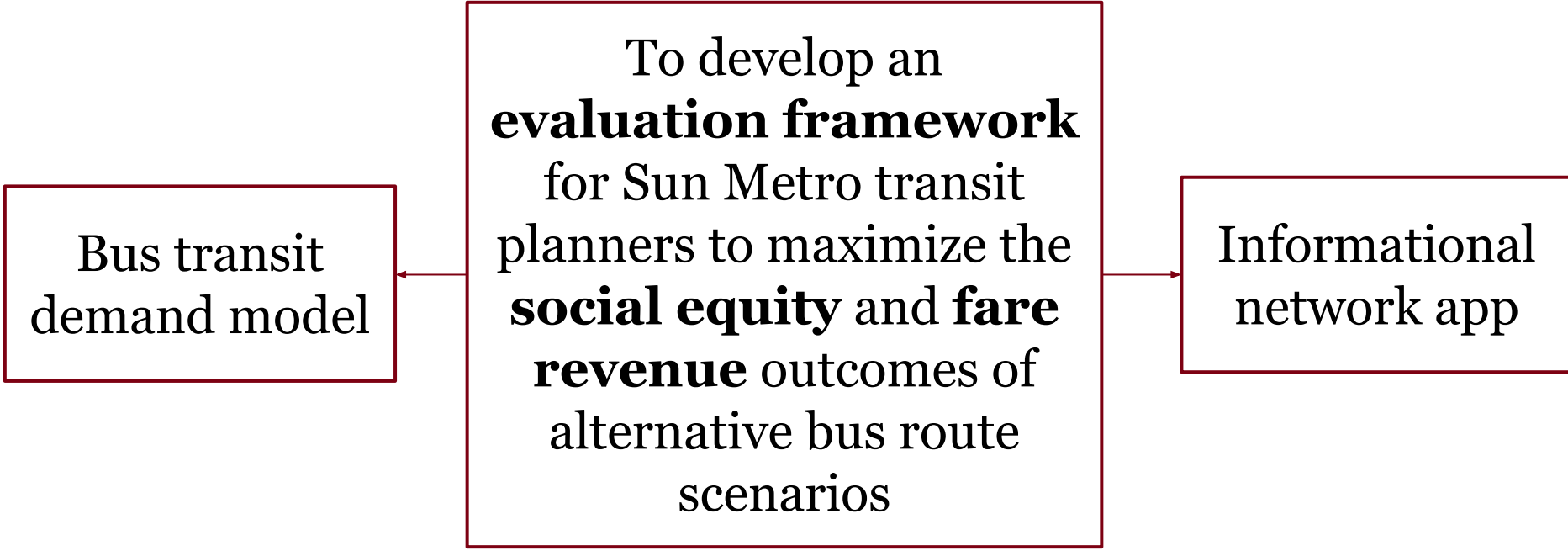


Use Case

Bus transit demand model

To develop an **evaluation framework** for Sun Metro transit planners to maximize the **social equity** and **fare revenue** outcomes of alternative bus route scenarios

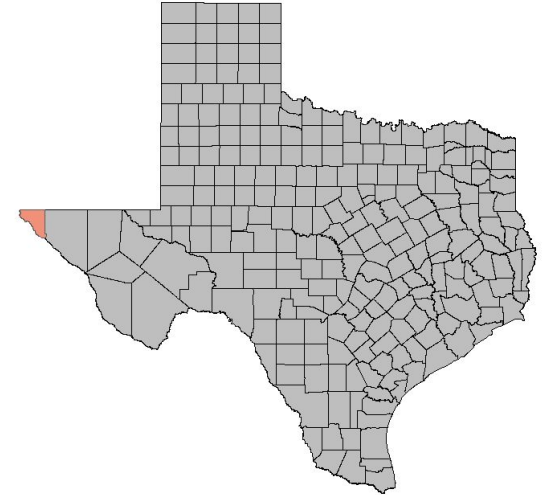
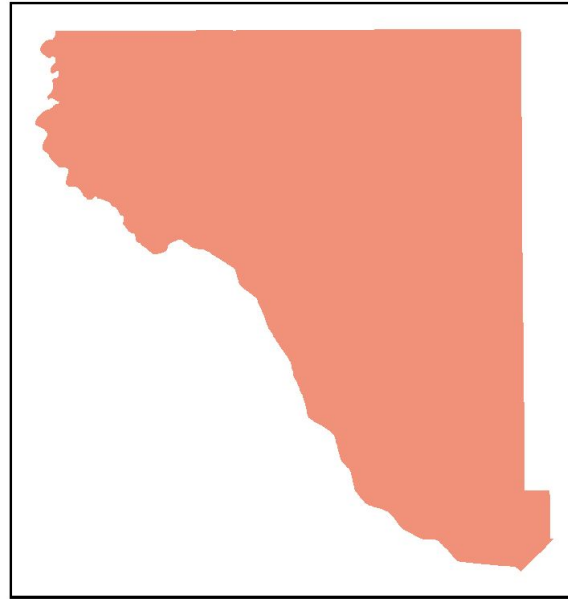
● Use Case





El Paso Context Map

El Paso (County)

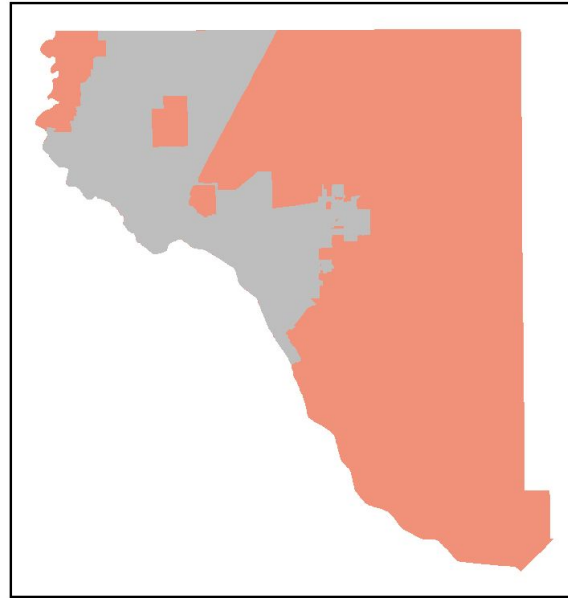
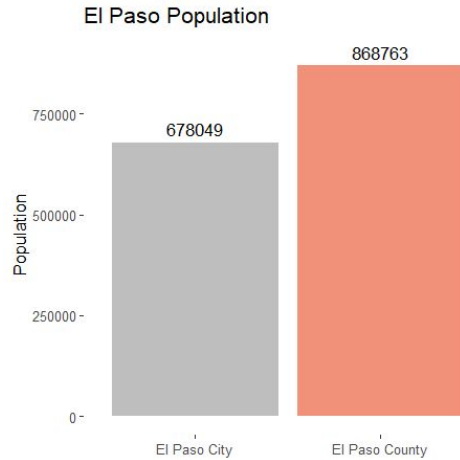




El Paso Context Map

El Paso (County)

El Paso (City)



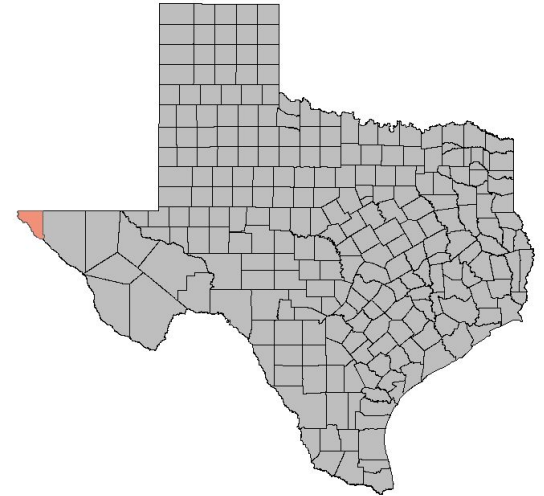
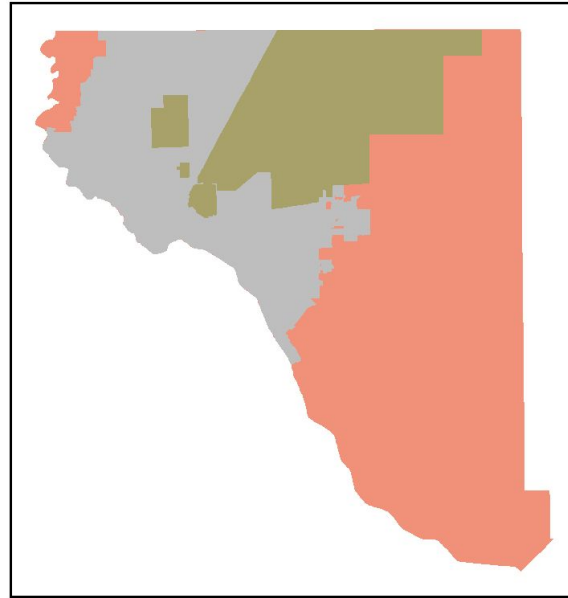


El Paso Context Map

El Paso (County)

El Paso (City)

Fort Bliss



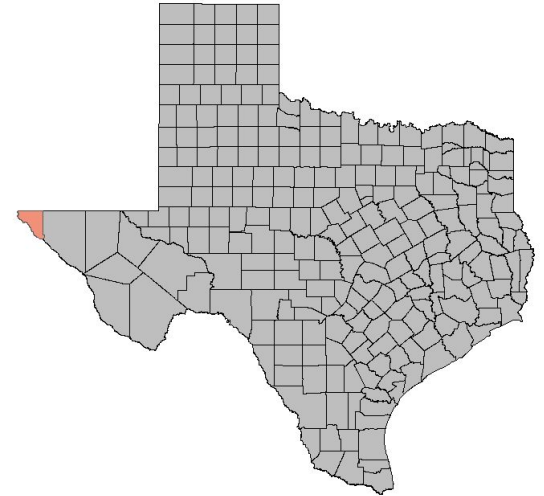
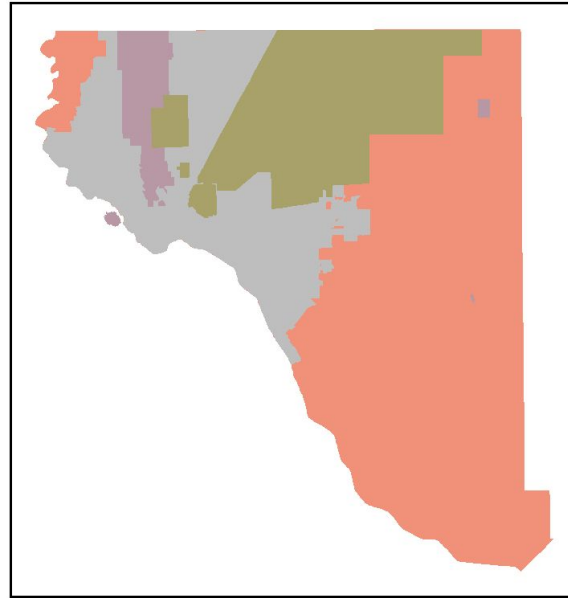
El Paso Context Map

El Paso (County)

El Paso (City)

Fort Bliss

Franklin Mountains



El Paso Context Map

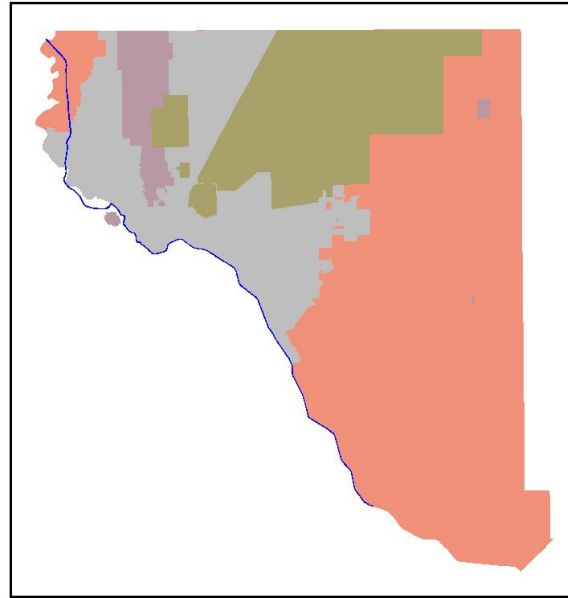
El Paso (County)

El Paso (City)

Fort Bliss

Franklin Mountains

Rio Grande River



El Paso Context Map

El Paso (County)

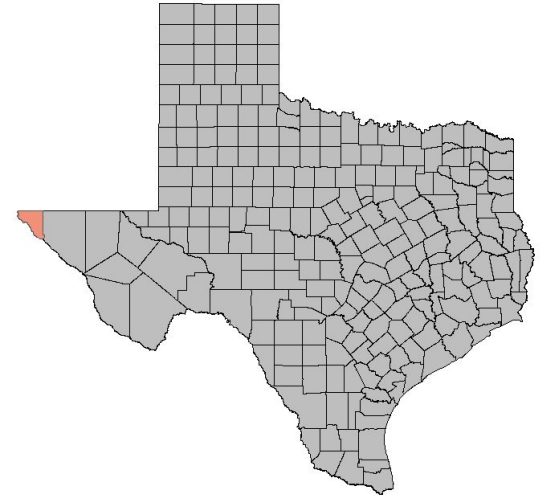
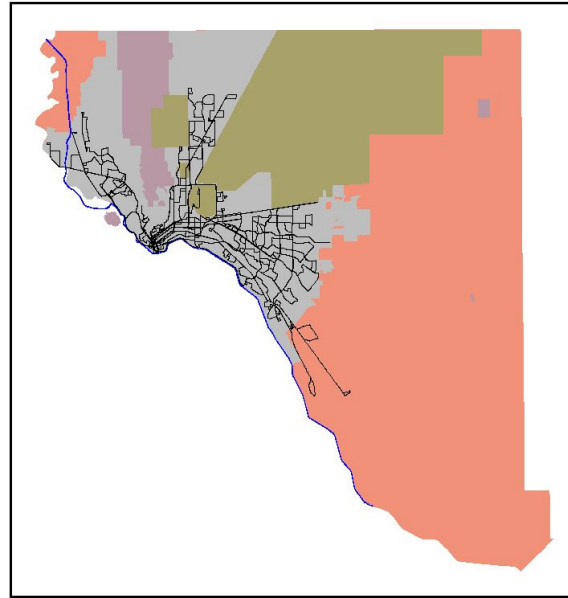
El Paso (City)

Fort Bliss

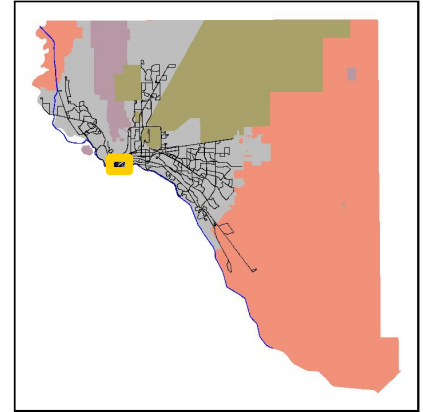
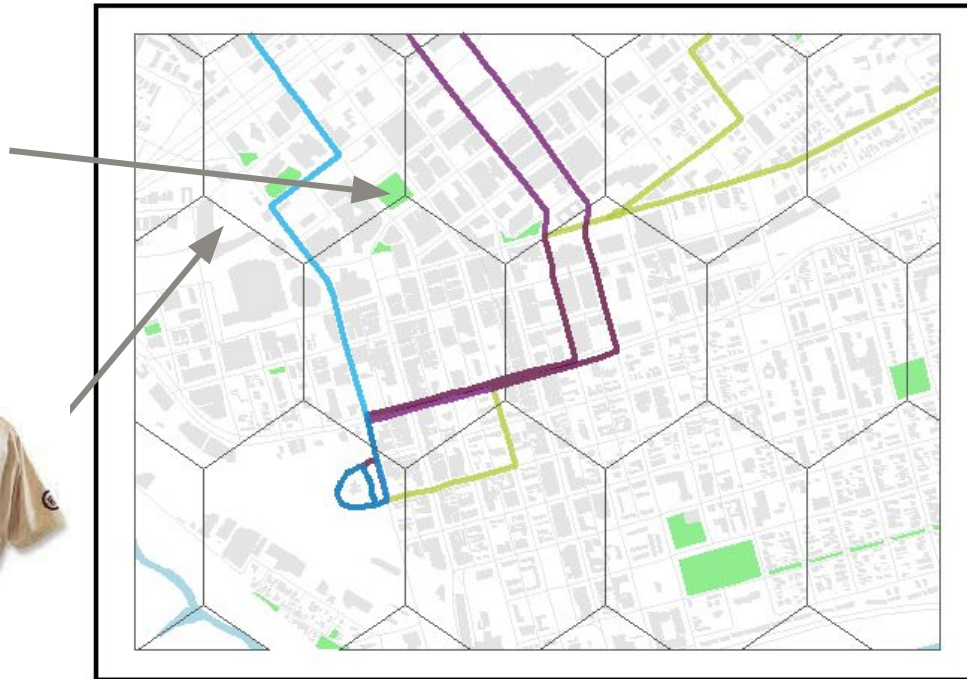
Franklin Mountains

Rio Grande River

Sun Metro Network



Downtown Spotlight



● Client-provided Data

- Ridership data for the year 2022
- Bus sensors collected how many people got on and off at every stop

Data Structure

Date	Route	Stop	On-board	Off-board	Geometry
------	-------	------	----------	-----------	----------

System-Wide Transit

56 total routes

4 BRIO routes

3 circulator routes

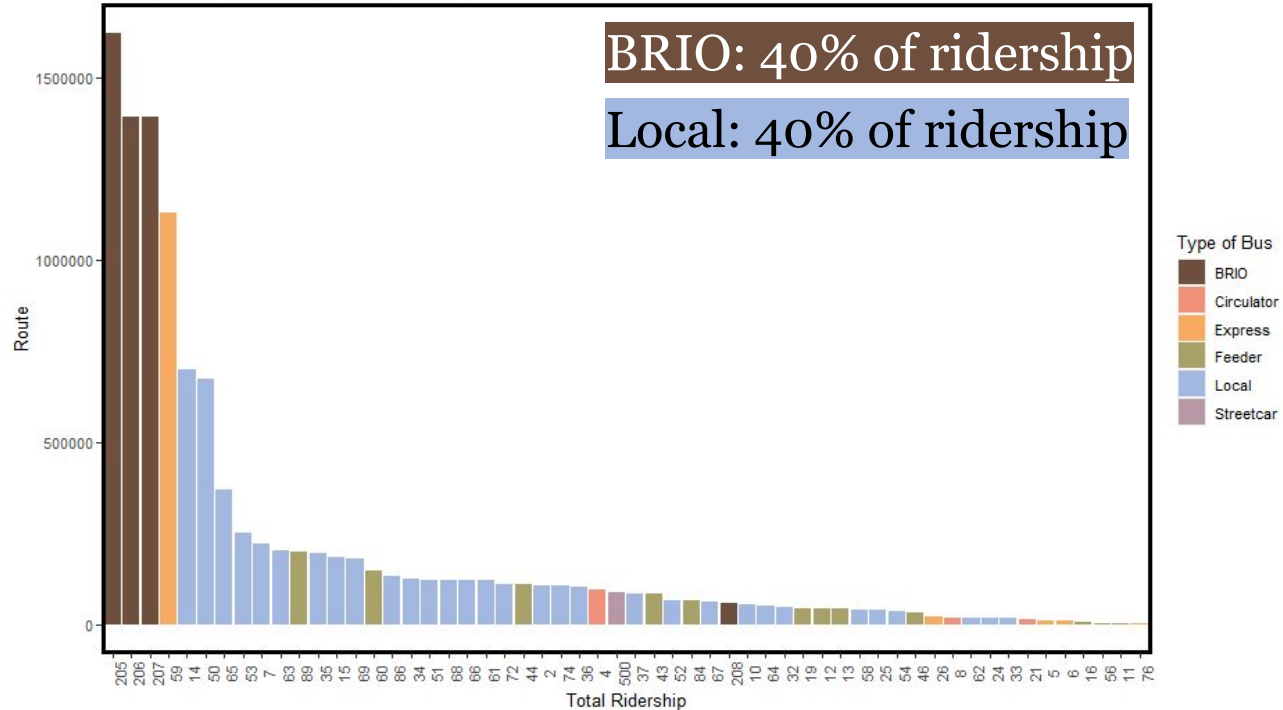
5 express routes

12 feeder routes

31 local routes

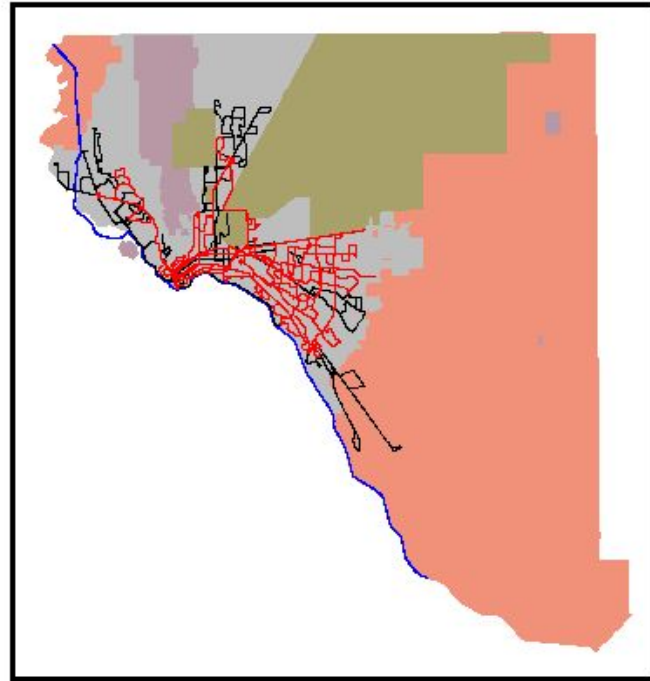
1 streetcar

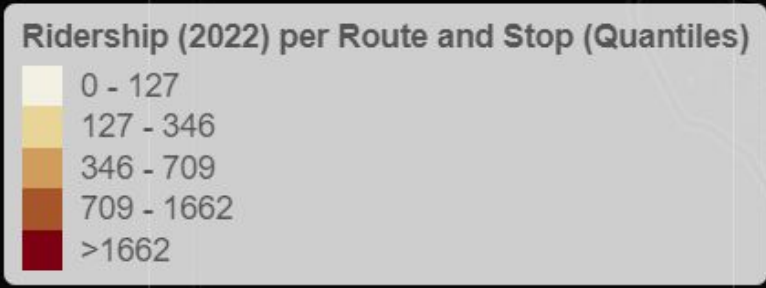
Total Ridership by Route and Type



El Paso Context Map

El Paso (County)
El Paso (City)
Rio Grande River
Franklin Mountains
Fort Bliss
Sun Metro Transit
Local Bus Routes

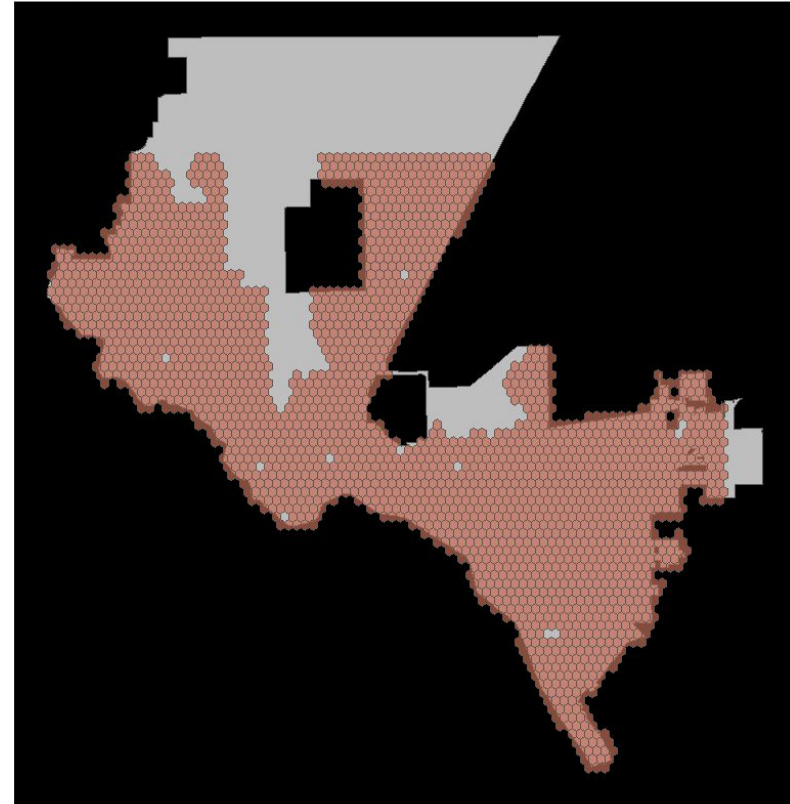




Spatial Aggregation

- Spatial Unit: Hexbins
- Equal spatial structure

Hex Bin Grid
El Paso, Texas





Feature Selection

AMERICAN COMMUNITY SURVEY (2019)

- Race
- Income
- Ability
- Education

NATIONAL WALKABILITY INDEX (2019)

- Vehicle ownership
- Regional, destination, and job accessibility
- Intersection density

LONGITUDINAL EMPLOYER- HOUSEHOLD DATA (2019)

- Age of employees
- Education of employees
- Income of employees
- Sector of jobs

OPEN DATA EL PASO

- Schools
- Parks
- Major roadways

OPEN STREET MAP

- Health facilities
- Entertainment
- Shopping centers
- Food establishments

OTHER SPATIAL FEATURES

- Stop density



Feature Selection

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OPEN DATA EL PASO

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OPEN STREET MAP

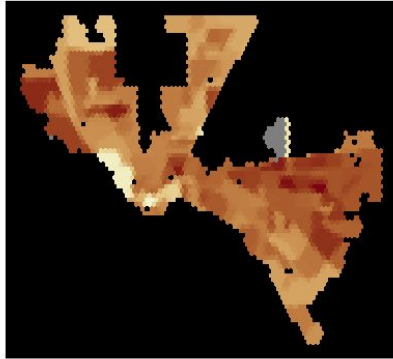
- Health facilities
- Entertainment
- Shopping centers
- Food establishments

OTHER SPATIAL FEATURES

- Stop density

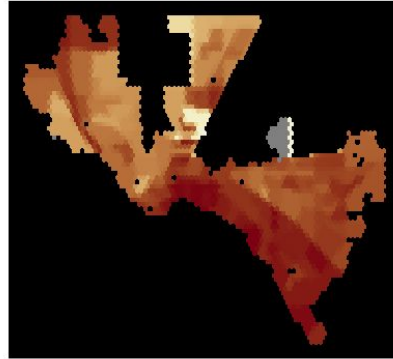
Racial Distribution in El Paso, TX (Total Population per square mile)

White Population



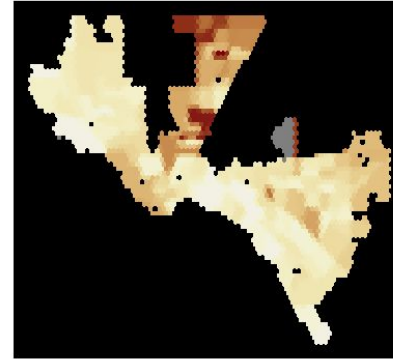
%
90
80
70
60
50

Hispanic/Latino Population



%
80
60
40

Black Population



%
15
10
5
0

Asian Population



%
8
6
4
2
0

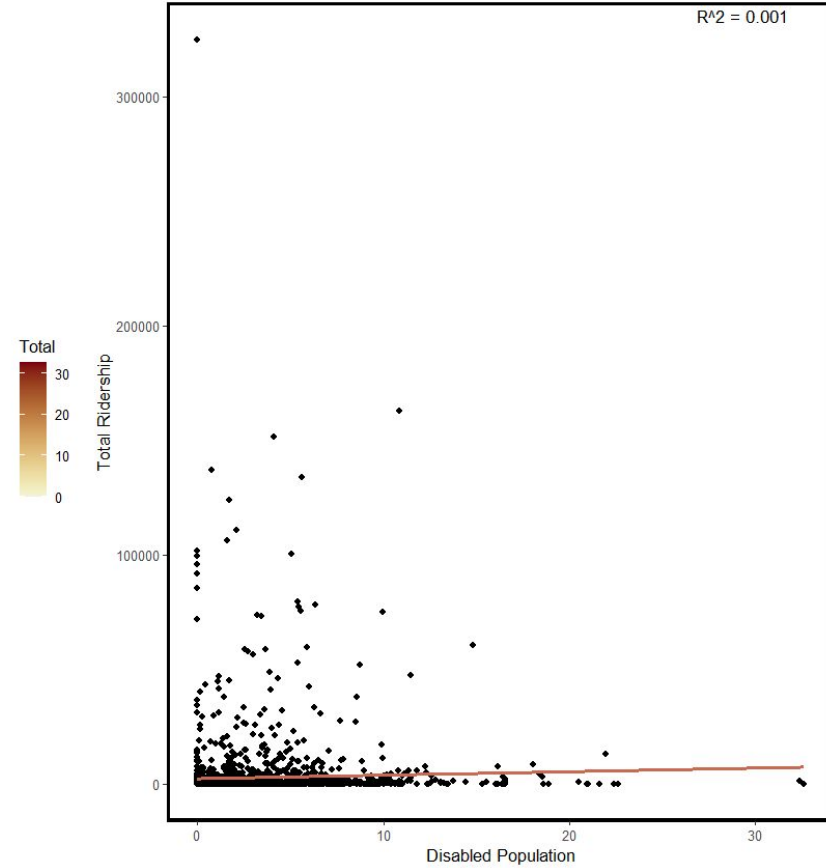
Other Race Population



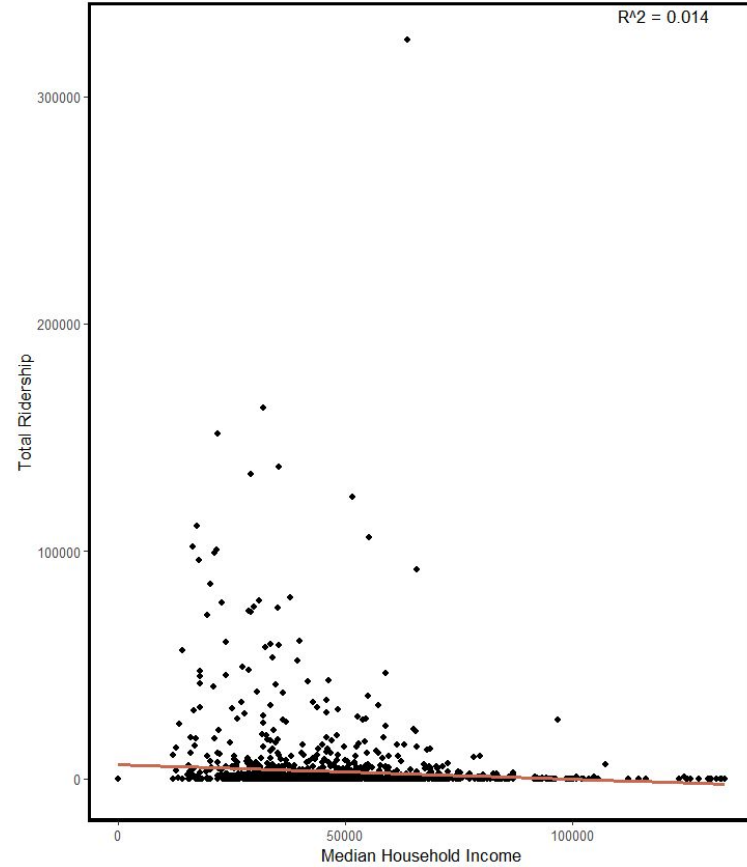
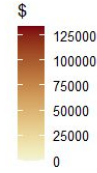
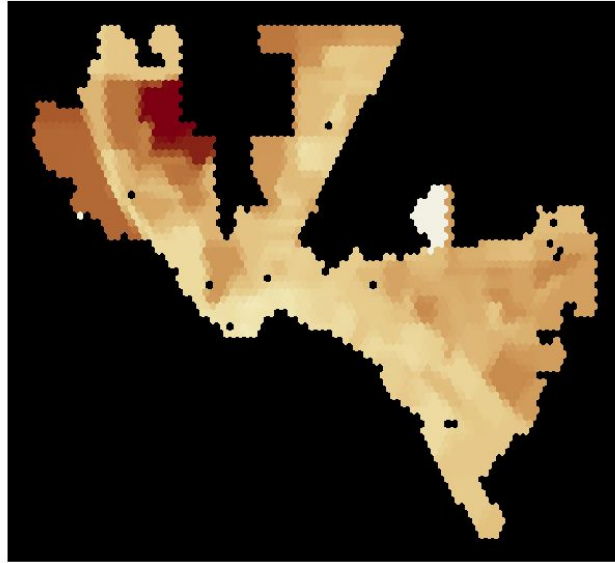
%
40
30
20
10



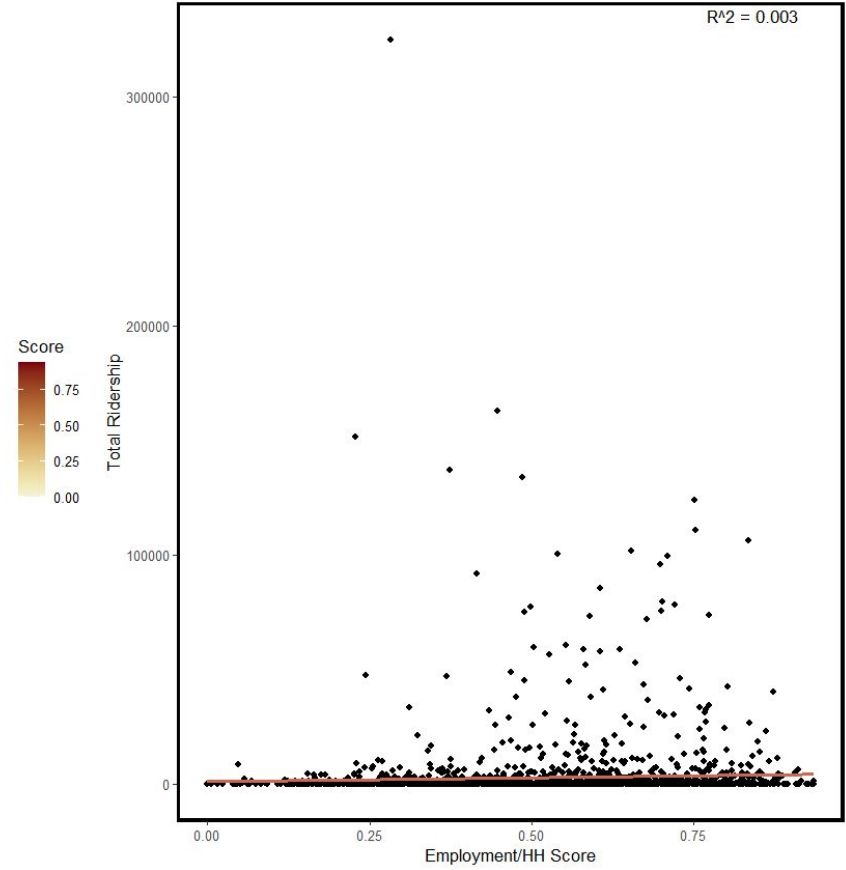
Disabled Population



Median Household Income



Employment Opportunity to Occupied Housing Ratio

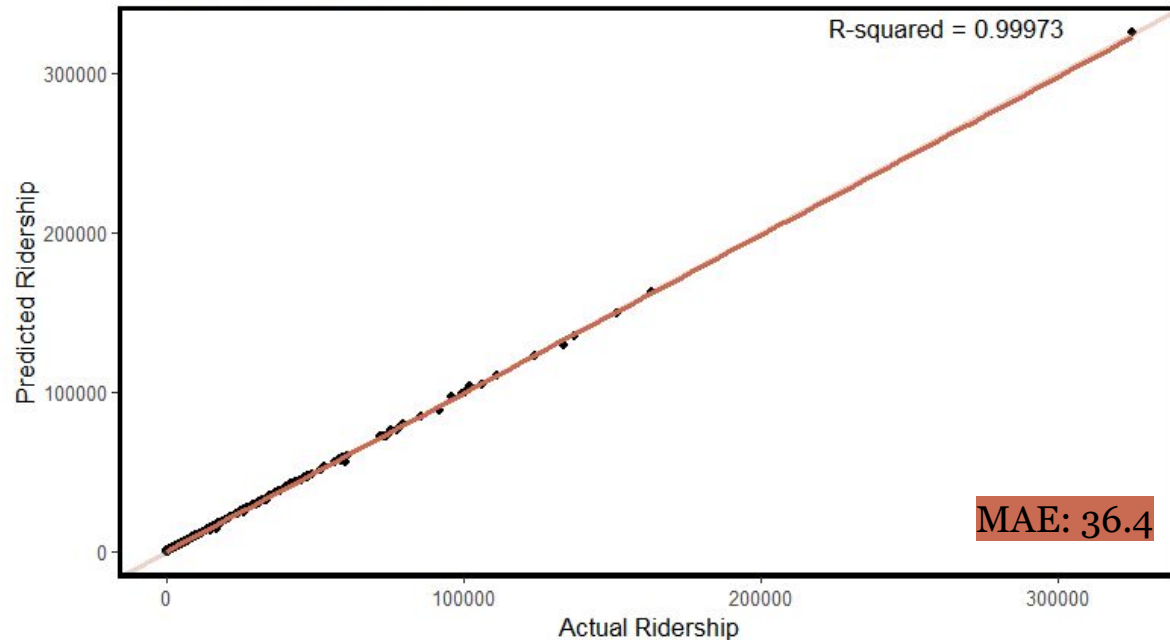




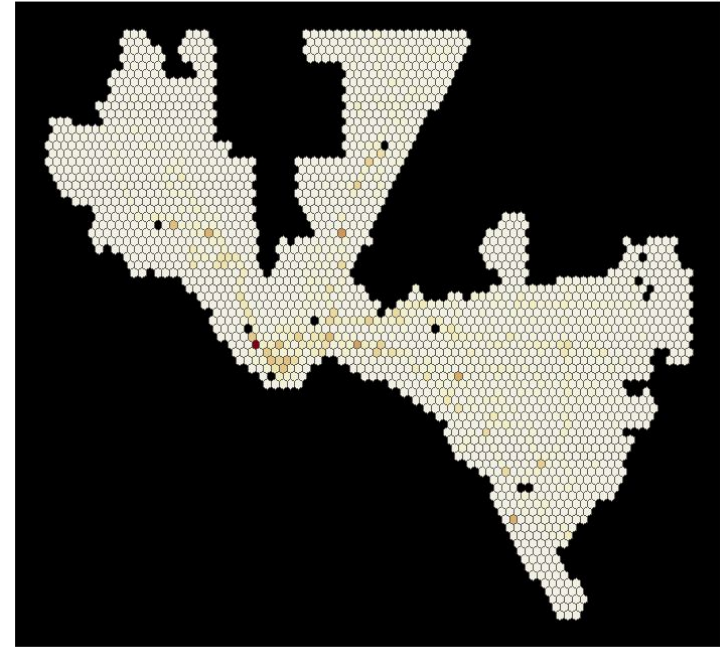
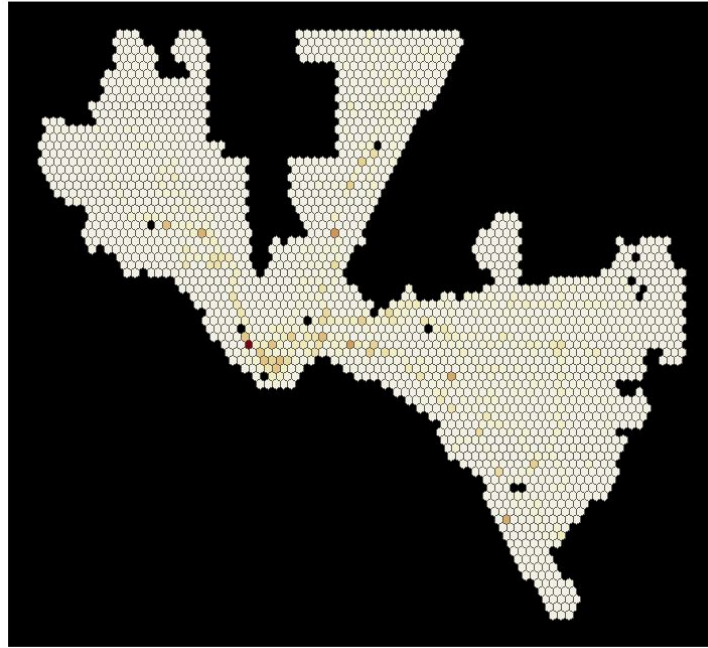
Model: XGBoost

Actual v. Predicted Ridership

Each dot represents a hexbin

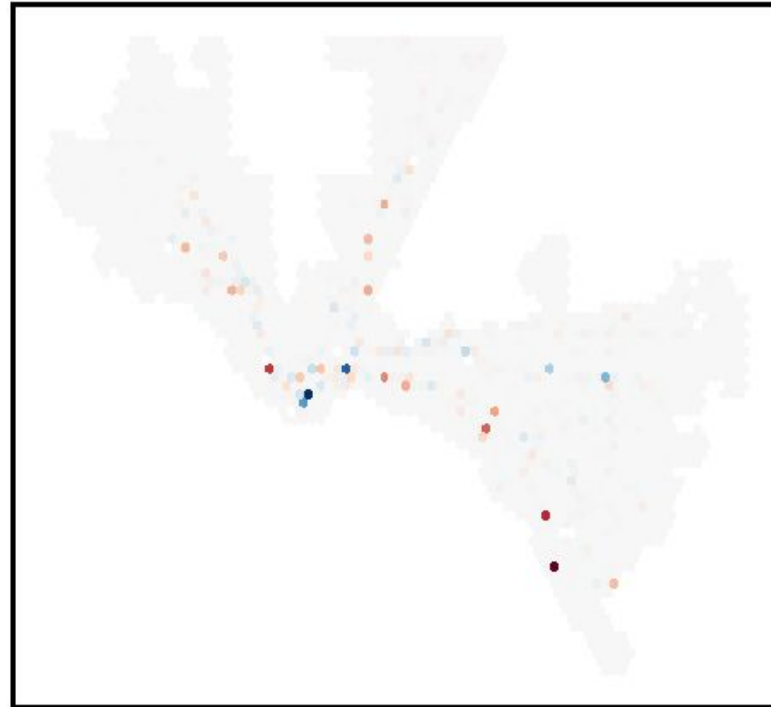
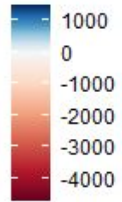


Actual vs. Predicted

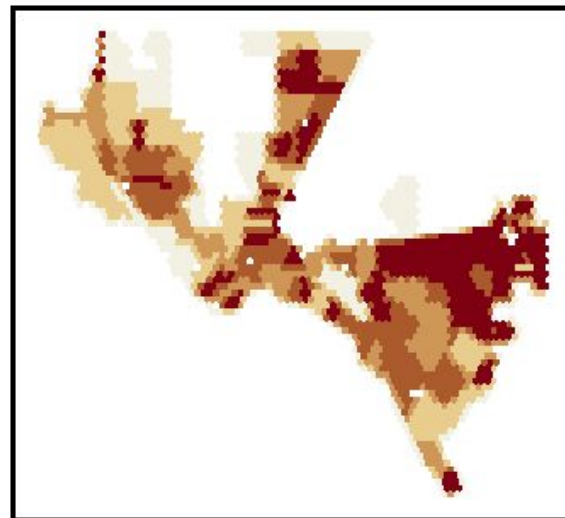
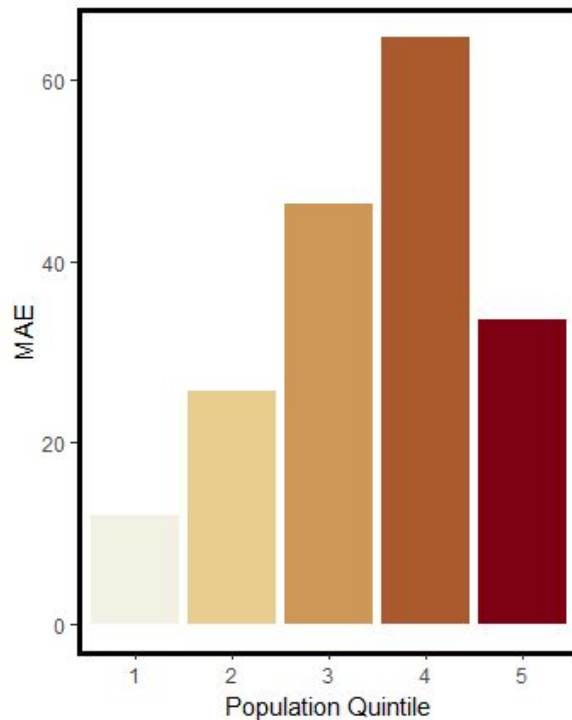


Actual vs. Predicted

XG Boost Model Error



Generalizability





El Paso Bus App

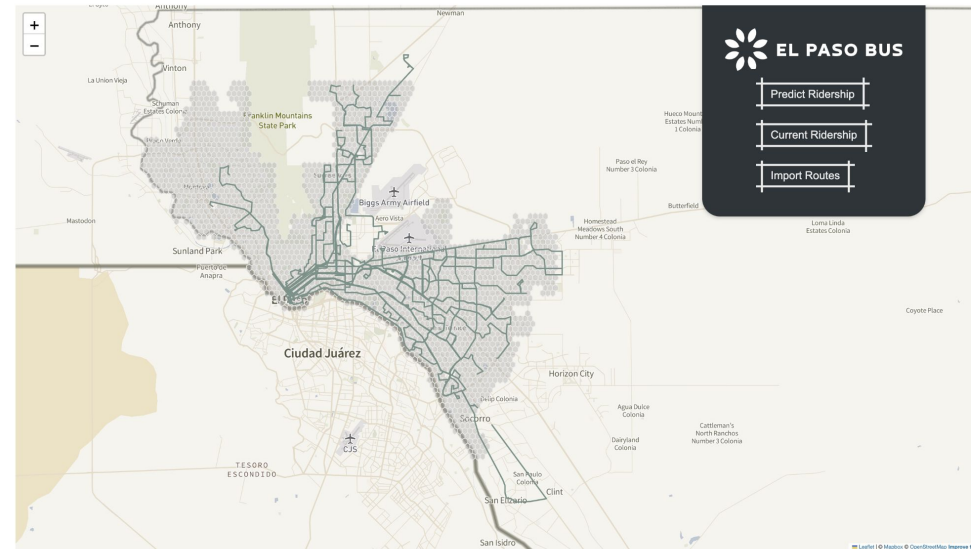
User: Sun Metro transit planner

Objective: Understand how a new bus route performs based on ridership and equity indicators

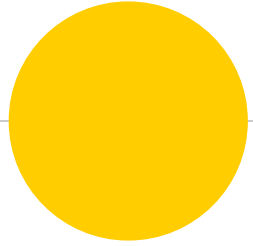
How: Upload route to web app to derive projected ridership and equity metrics



El Paso Bus App



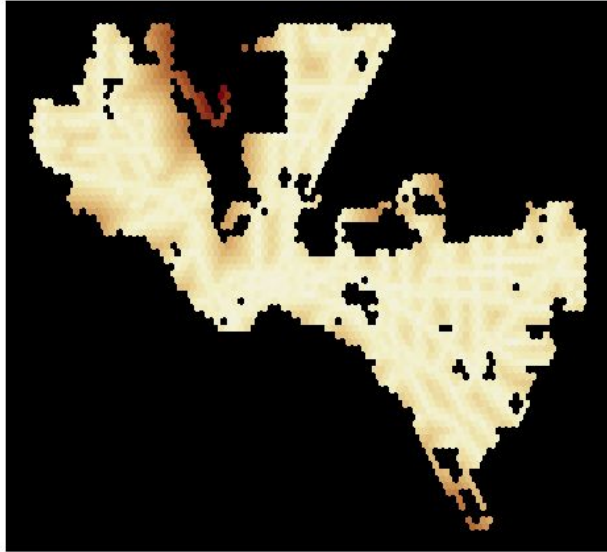
[El Paso Bus System \(chuembucket.github.io\)](https://github.com/chuembucket/el-paso-bus)



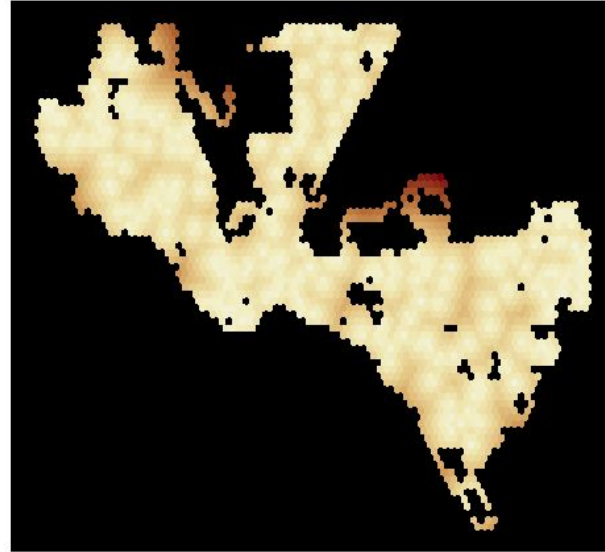
Thanks!

Any **questions?**

Distance to Nearest Major Road



Distance to Nearest Park



Distance to Nearest Department Store

