Recommendations for Increasing Access to Public Transportation in Chicago

Afsara Ali, Brianna Sanzone, Shengjie Lin, Maitiu Sexton

Problems to Consider

1. How do we define current demand?
    a. High ridership
    b. Low ridership
2. Where are employment opportunities concentrated?
3. Where do people live?
4. Can we predict and map ridership?
5. Can we find the most and least popular routes?

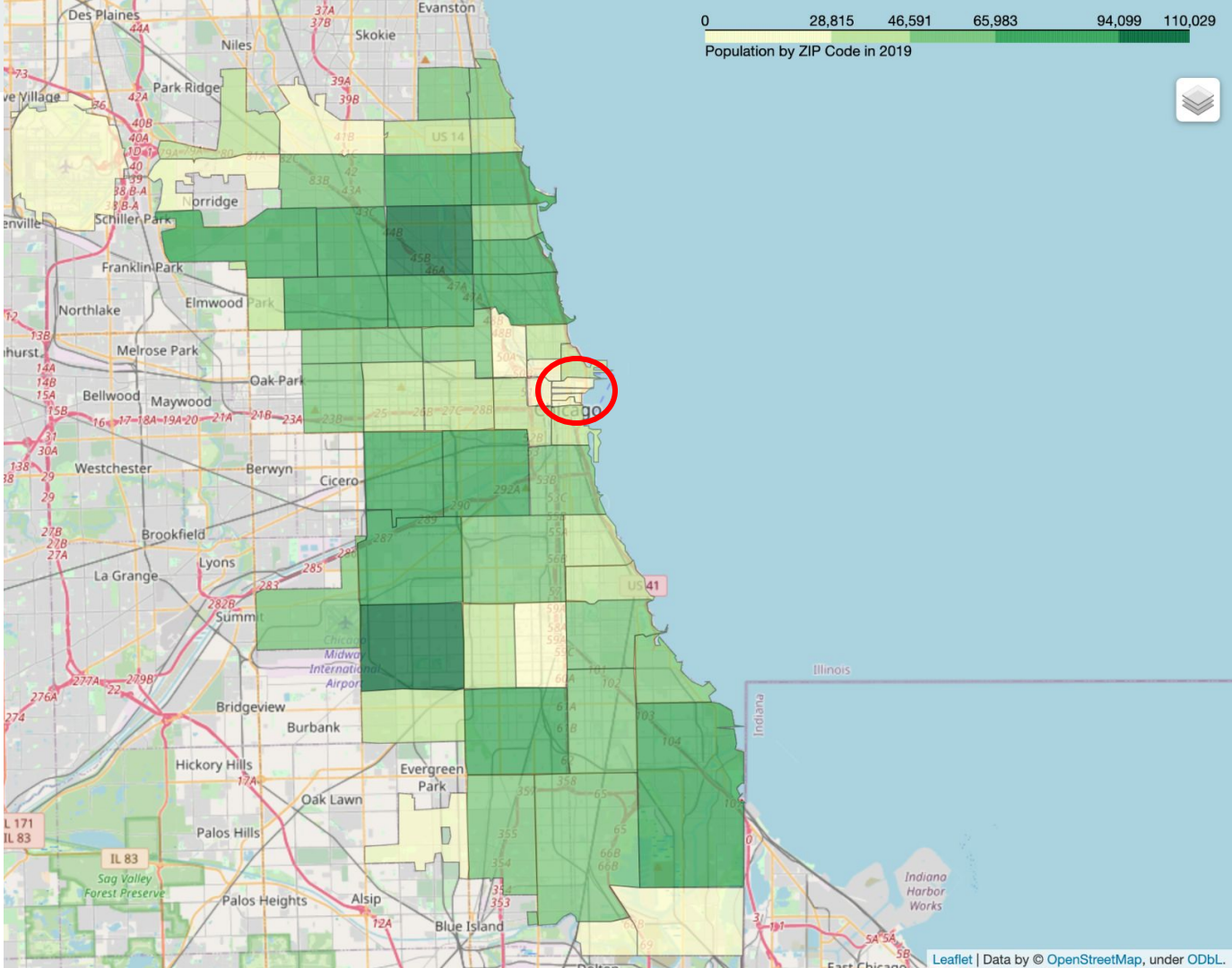
Problem Statement

Where would be the most effective place(s) to run additional bus/train service? This will be evaluated based on:

- Historical and predicted ridership levels
- Locations of employment
- Current access to public transit
- Population density

Population by Zip Code (2019)

Percentiles (darker is higher):
0-25%
25-50%
50-75%
75-98%
98%+



Population by Zip Code (2019)

Percentiles (darker is higher):
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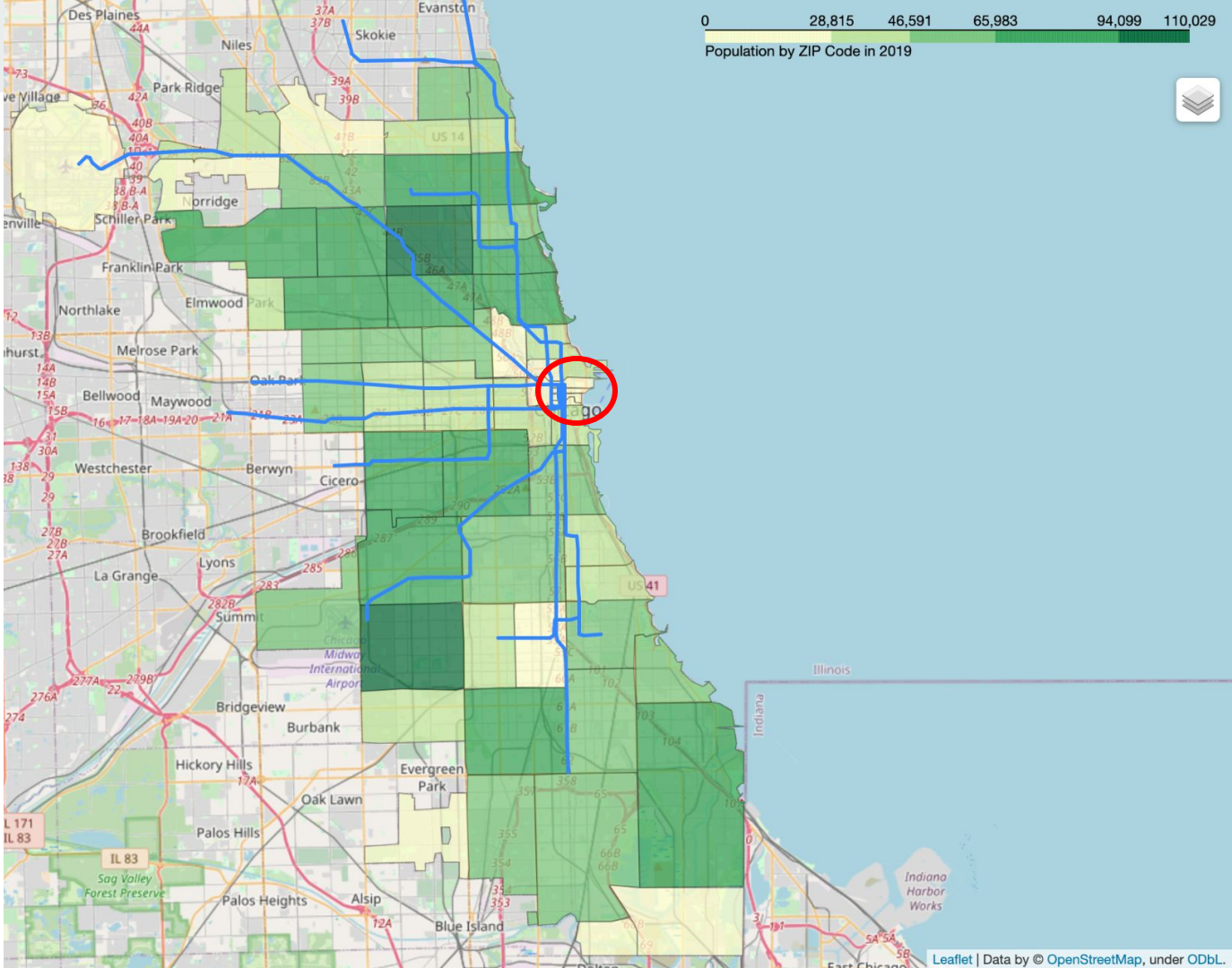
25-50%
50-75%
75-98%
98%+

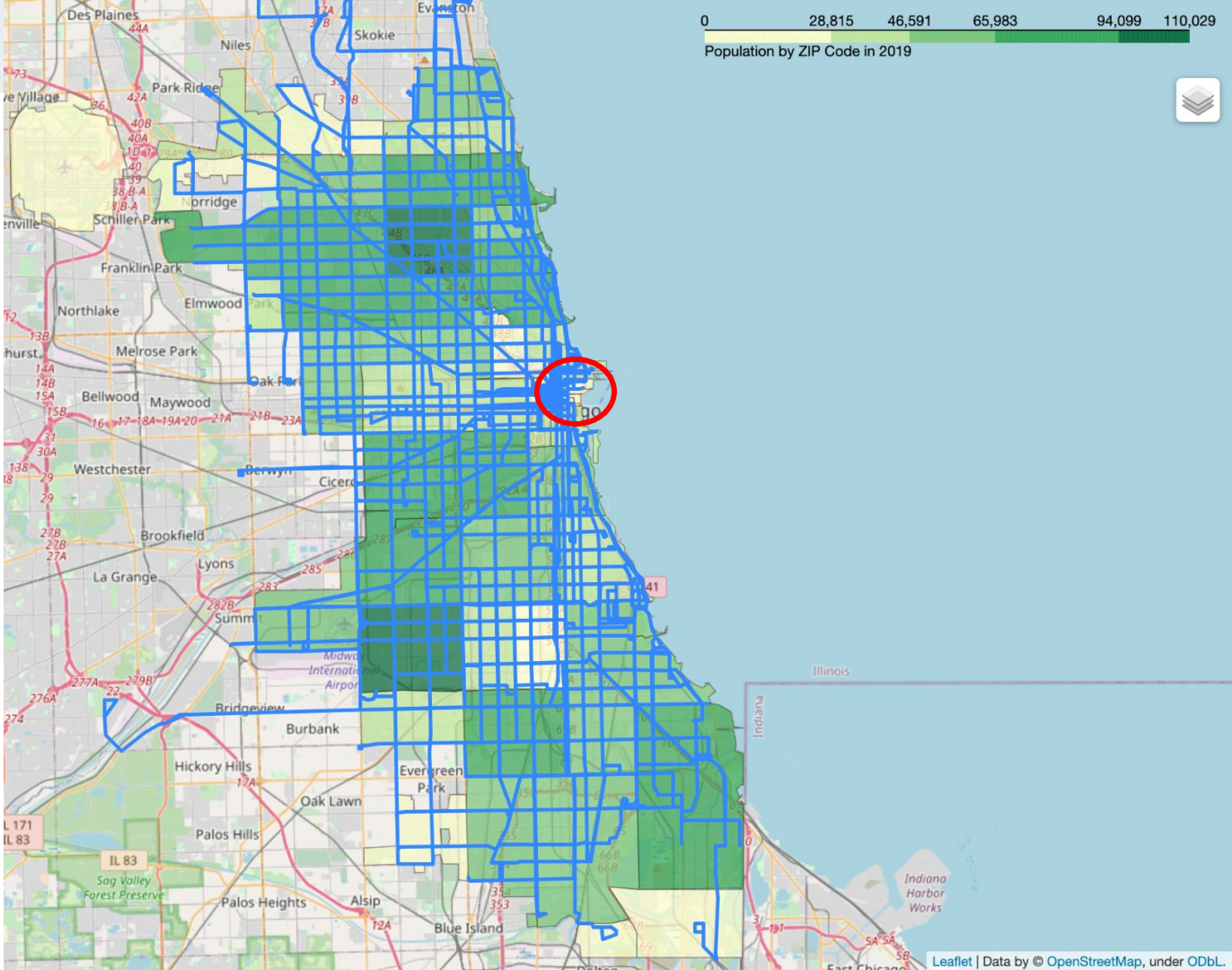
Train Lines



Population by Zip Code (2019)

Percentiles (darker is higher):
0-25%
25-50%
50-75%
75-98%
98%+

Bus Routes



Location of Jobs by ZIP code 2001-2020

Percentiles (darker is higher):

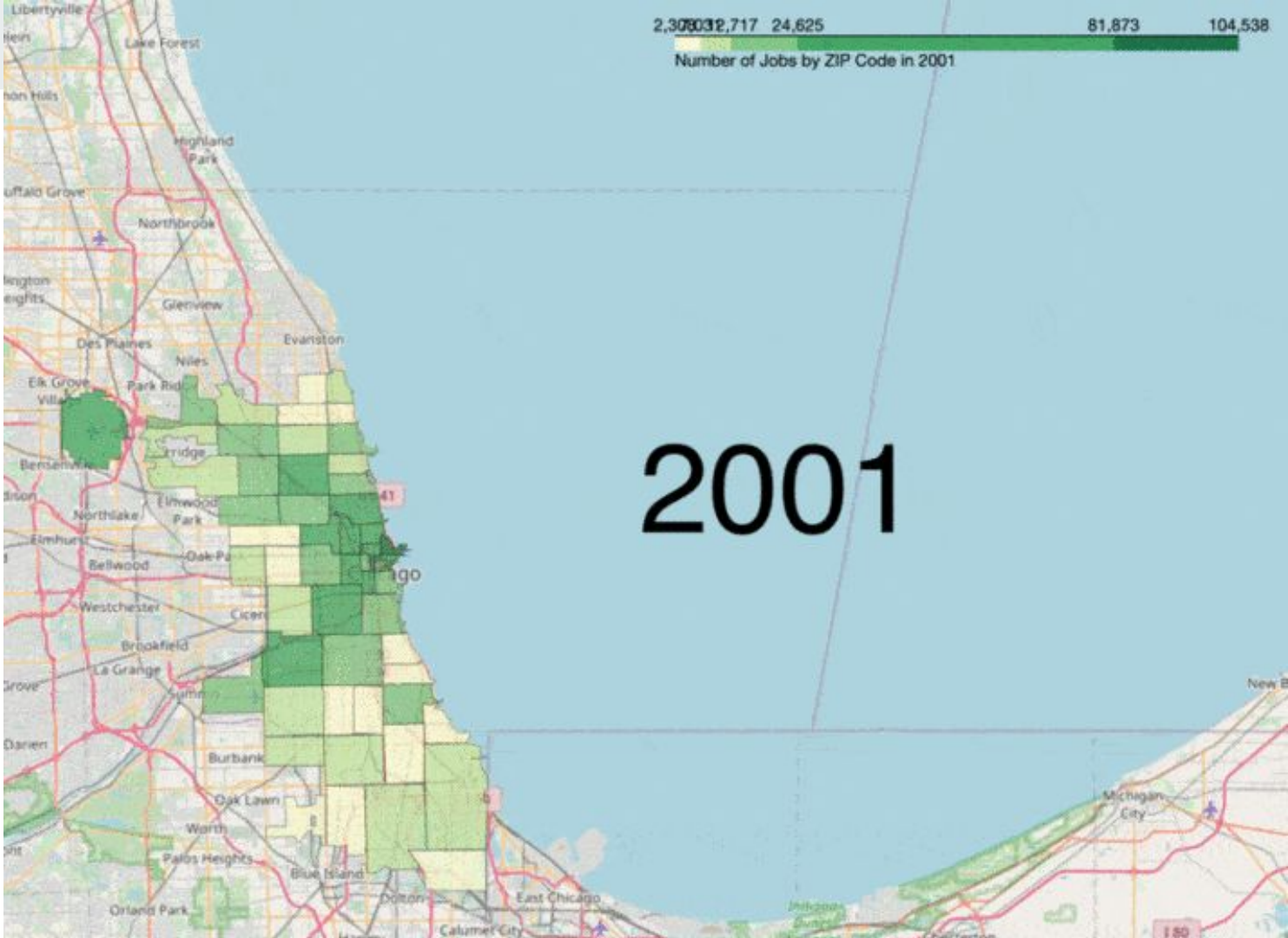
0-25%

25-50%

50-75%

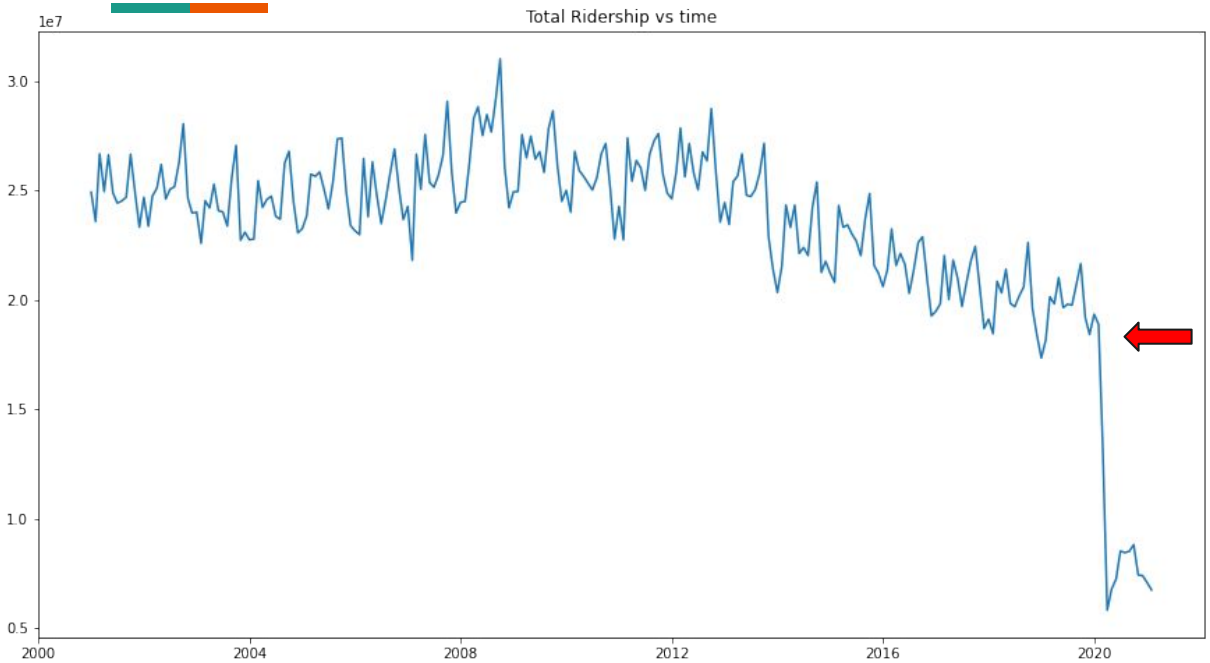
75-98%

98%+



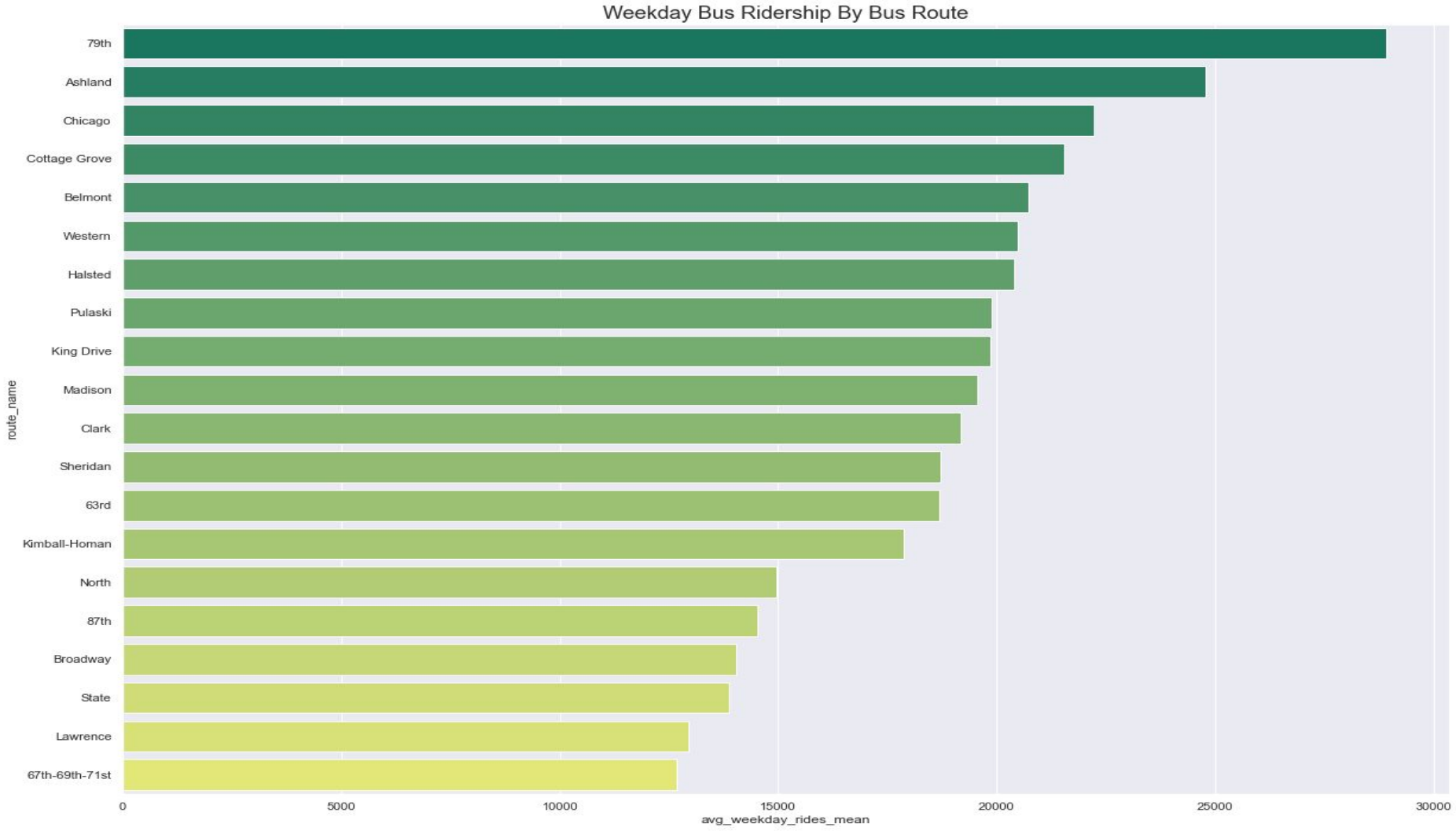
EDA of Bus and Train Averages

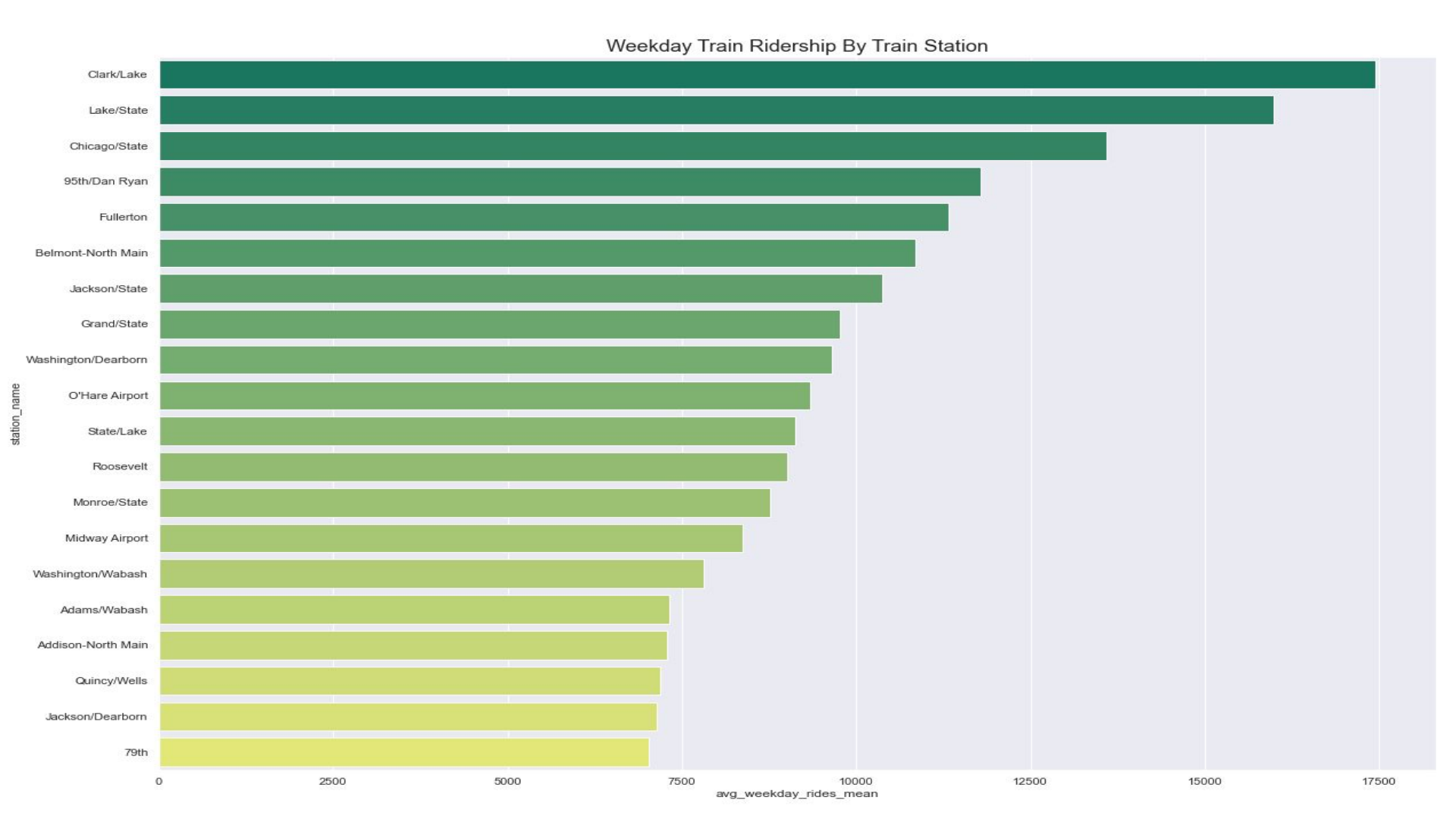
Total Bus Ridership vs Time



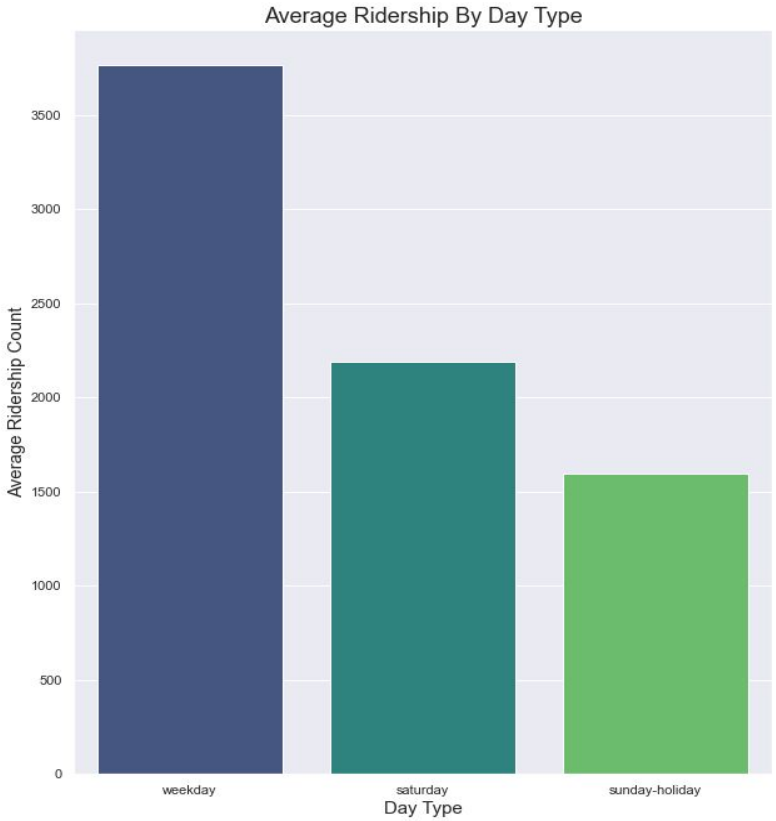
Ridership dropped dramatically due to pandemic.

In order to get a better estimate of ridership trend, we dropped the data after 2020.

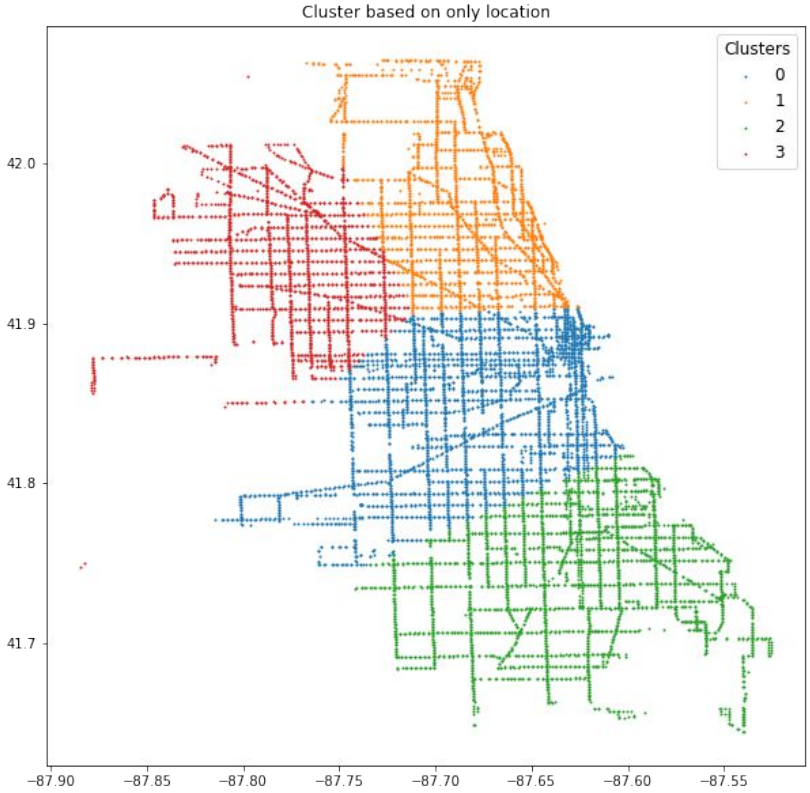

Weekday Bus Ridership By Bus Route
79th
Ashland
Chicago
Cottage Grove
Belmont
Western
Halsted
Pulaski
King Drive
Madison
Clark
Sheridan
63rd
Kimball-Homan
North
87th
Broadway
State
Lawrence
67th-69th-71st
route_name
0
5000
10000
15000
20000
25000
30000
avg_weekday_rides_mean

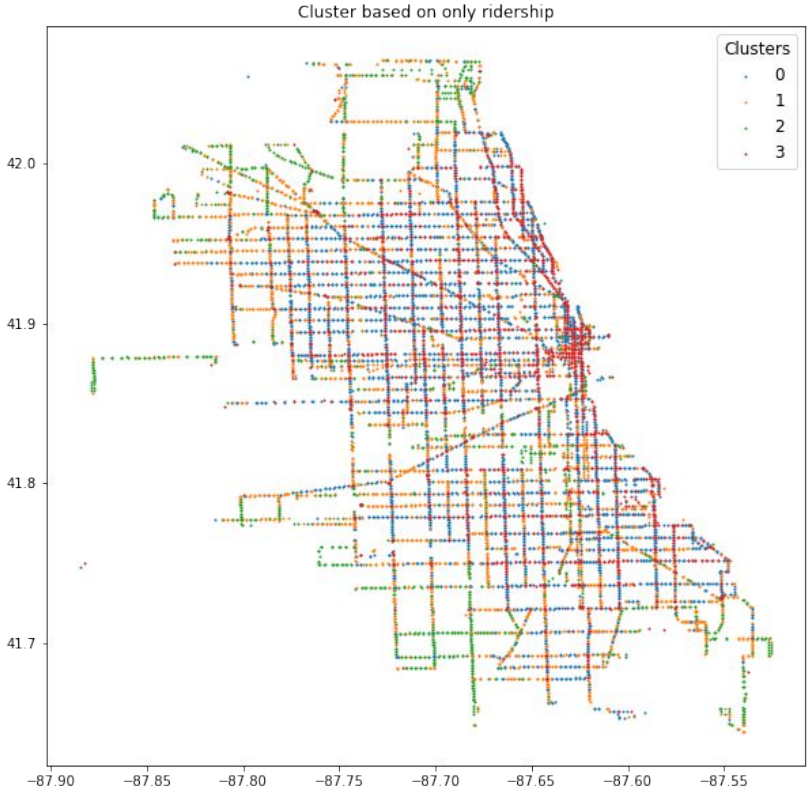

Weekday Train Ridership By Train Station
Clark/Lake
Lake/State
Chicago/State
95th/Dan Ryan
Fullerton
Belmont-North Main
Jackson/State
Grand/State
Washington/Dearborn
O'Hare Airport
State/Lake
Roosevelt
Monroe/State
Midway Airport
Washington/Wabash
Adams/Wabash
Addison-North Main
Quincy/Wells
Jackson/Dearborn
79th
station_name
0
2500
5000
7500
10000
12500
15000
17500
avg_weekday_rides_mean

Average Train Ridership by Type of Day

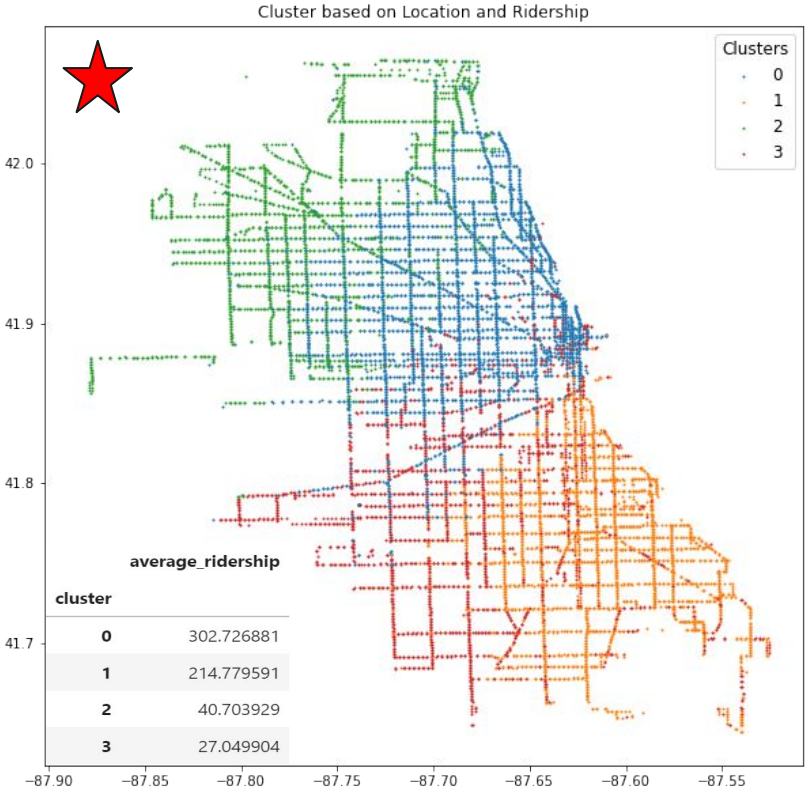


Bus Clustering

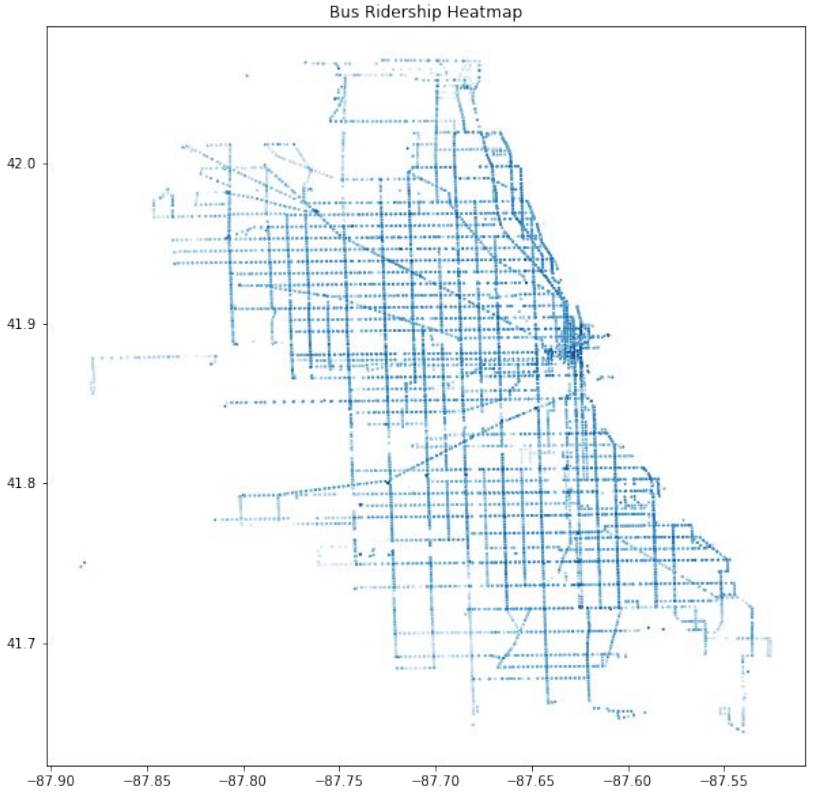




Bus Clustering



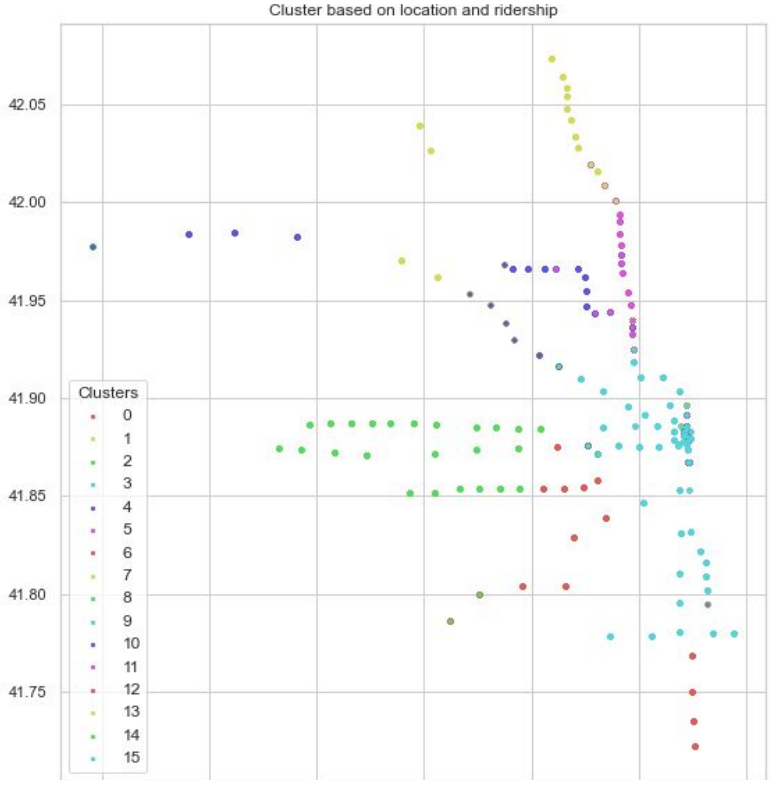
cluster	average_ridership
0	302.726881
1	214.779591
2	40.703929
3	27.049904

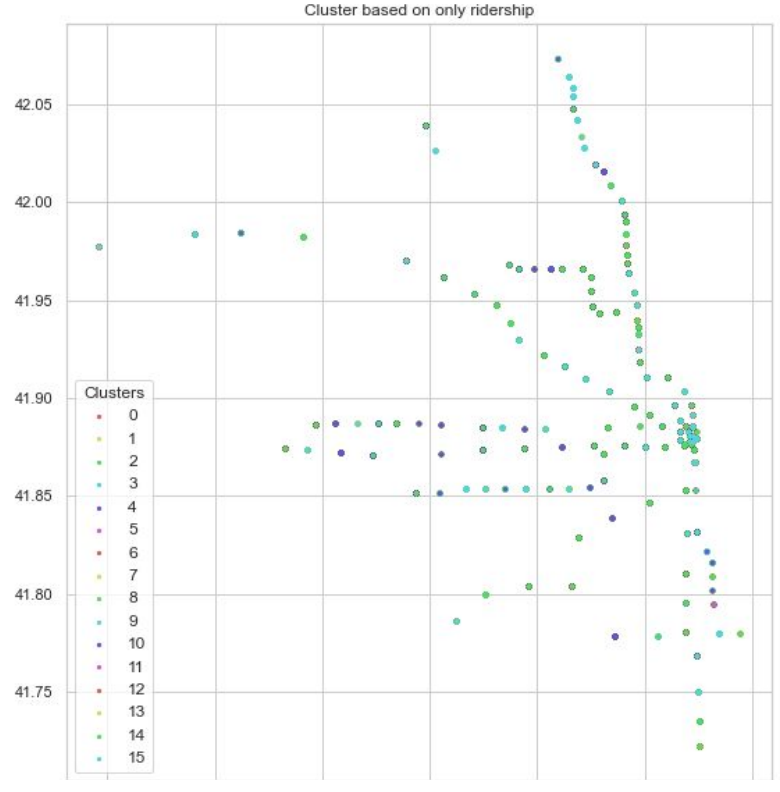


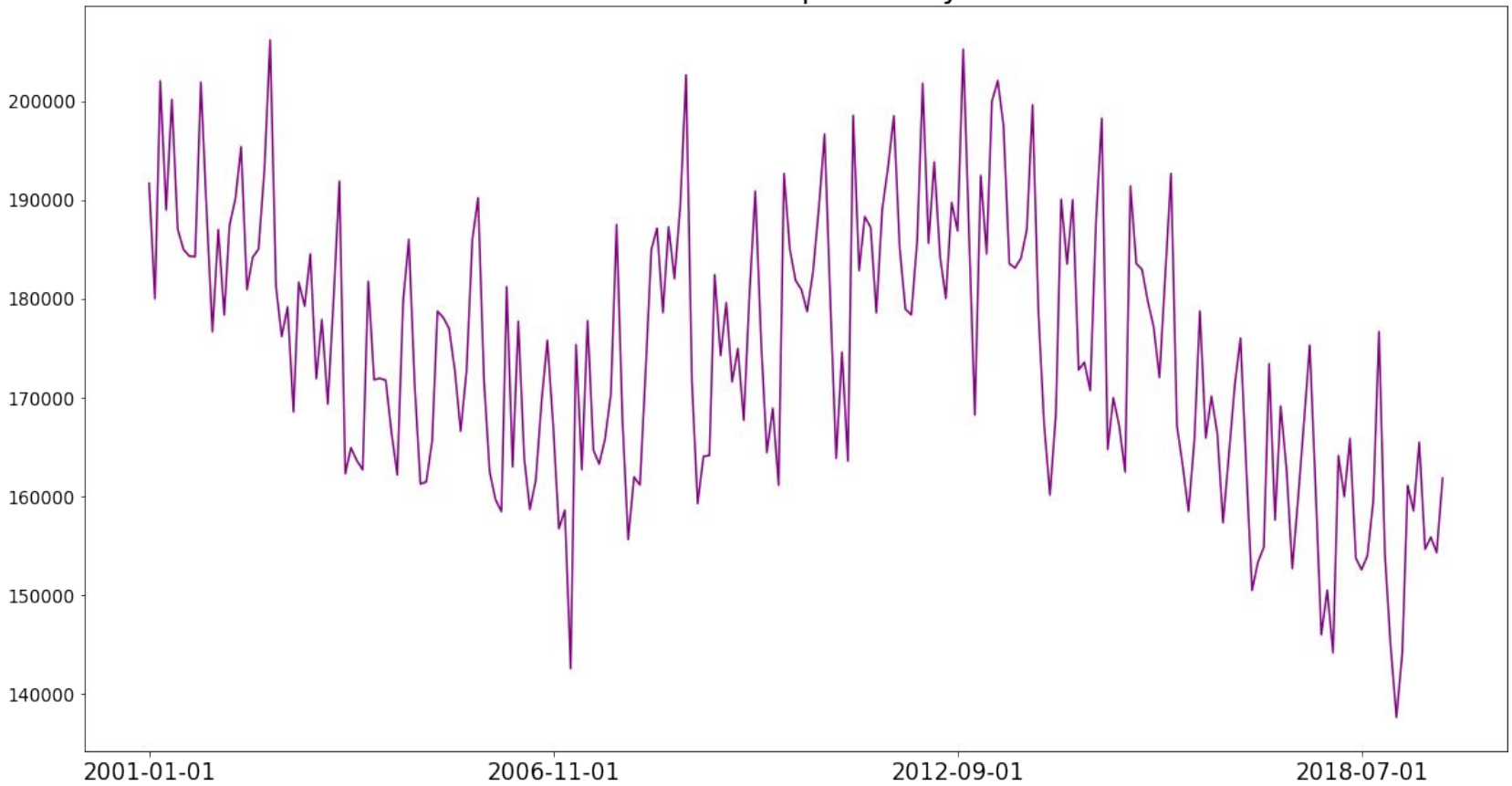
Train Clustering

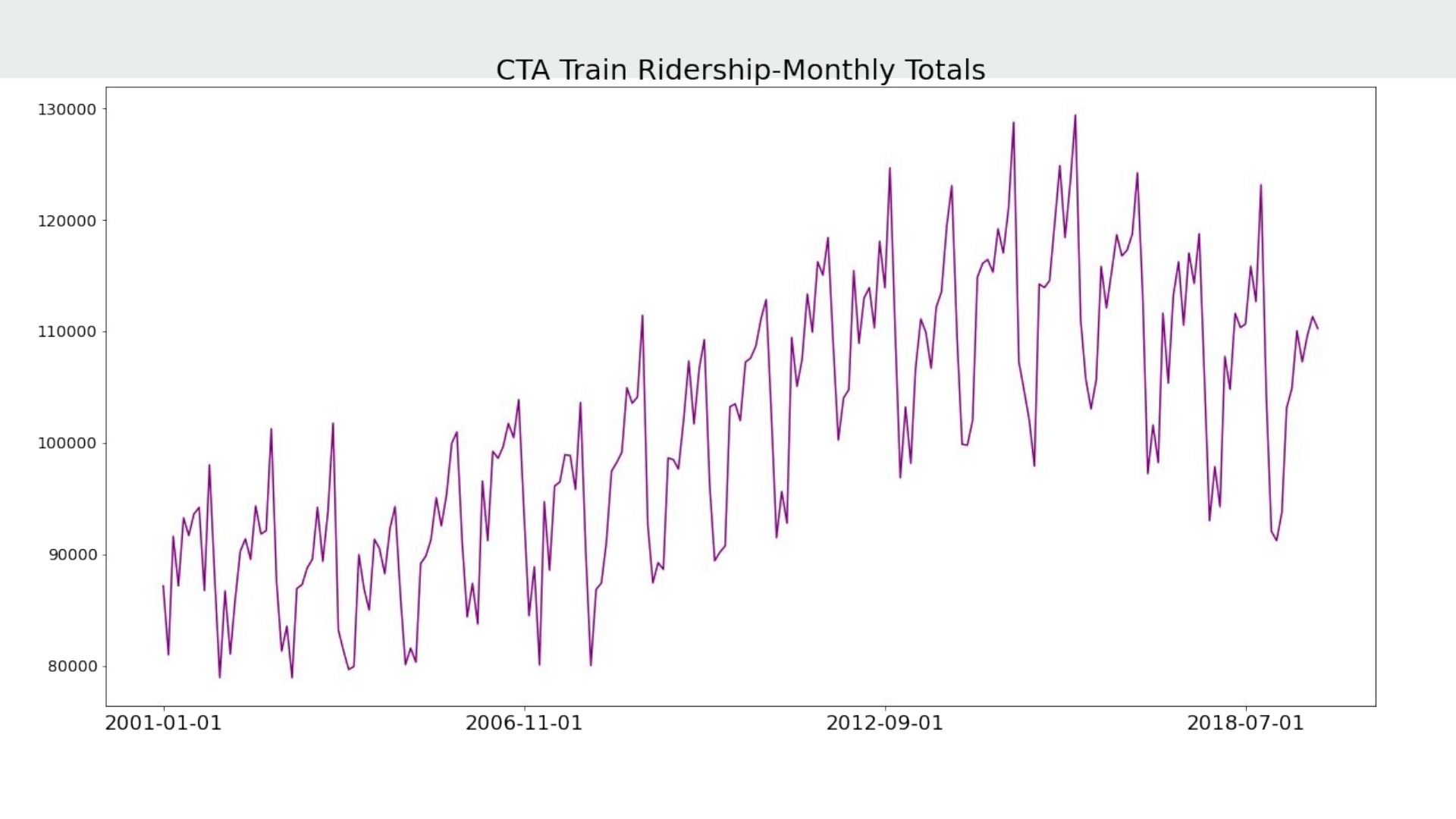
Best # *k* clusters: 16

Silhouette Score: 0.42

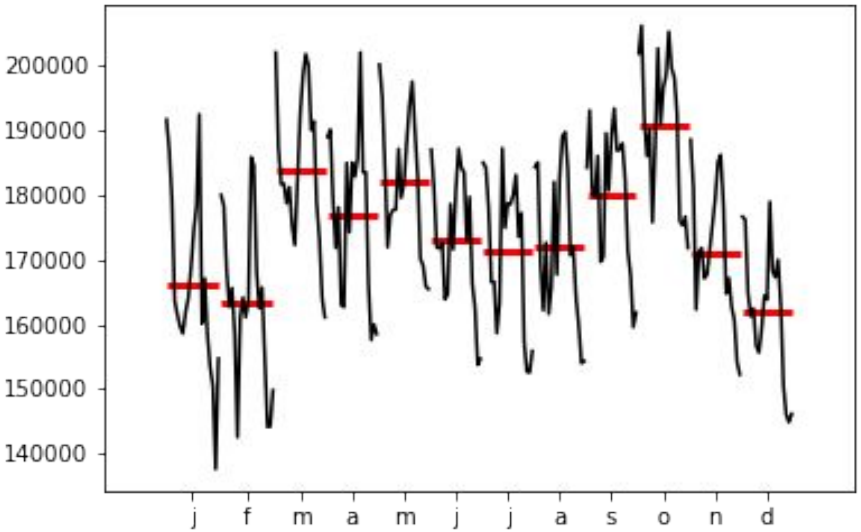




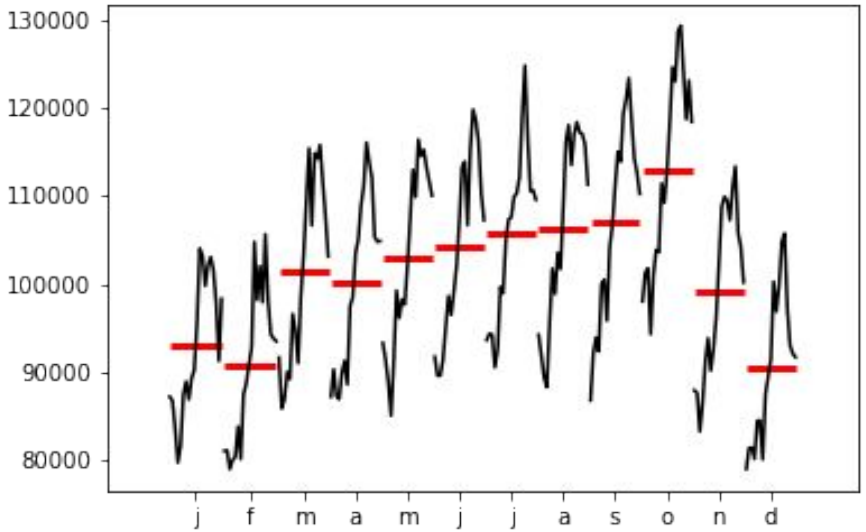

CTA Bus Ridership-Monthly Totals
200000
190000
180000
170000
160000
150000
140000
2001-01-01
2006-11-01
2012-09-01
2018-07-01


CTA Train Ridership-Monthly Totals
130000
120000
110000
100000
90000
80000
2001-01-01
2006-11-01
2012-09-01
2018-07-01

Month Plots

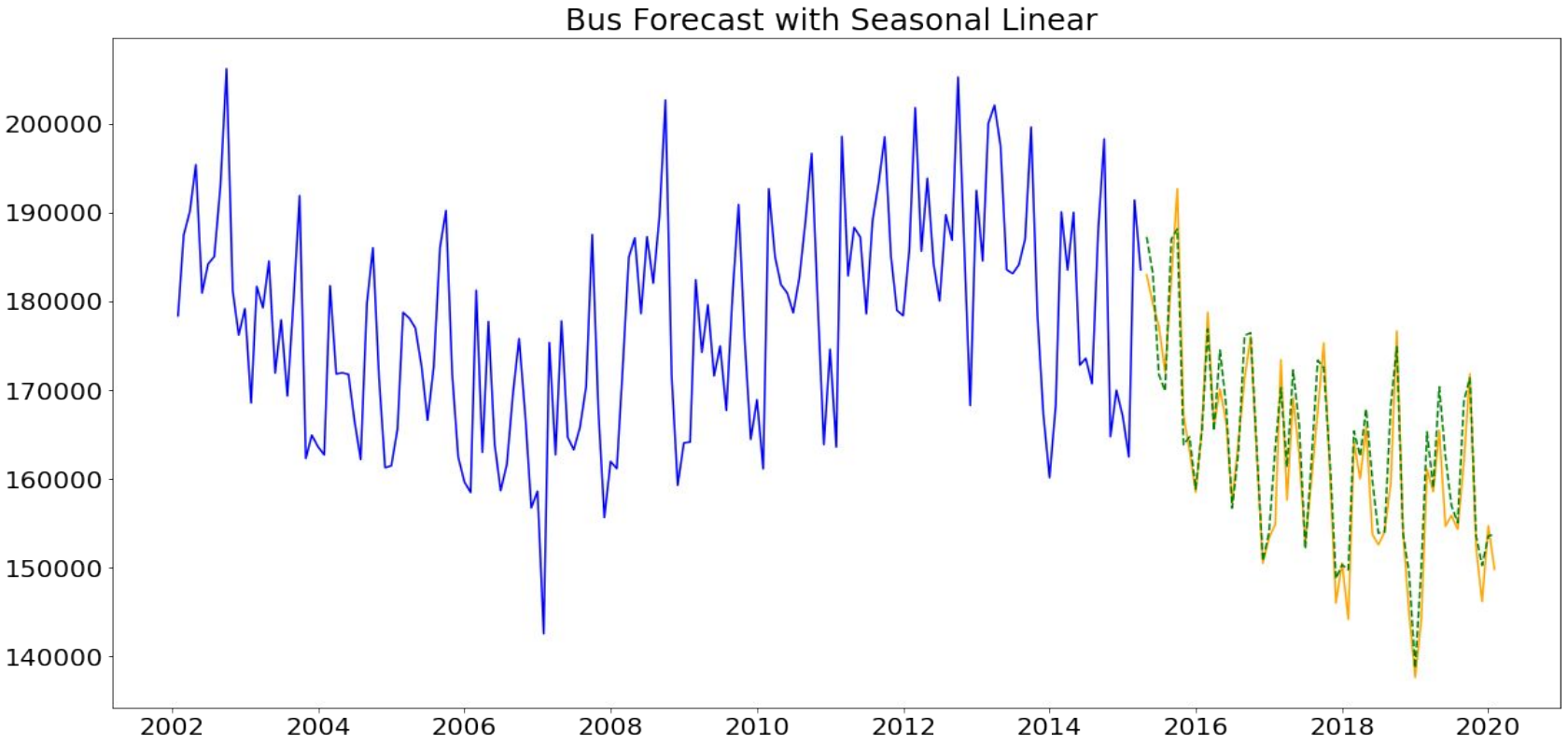


Bus Ridership



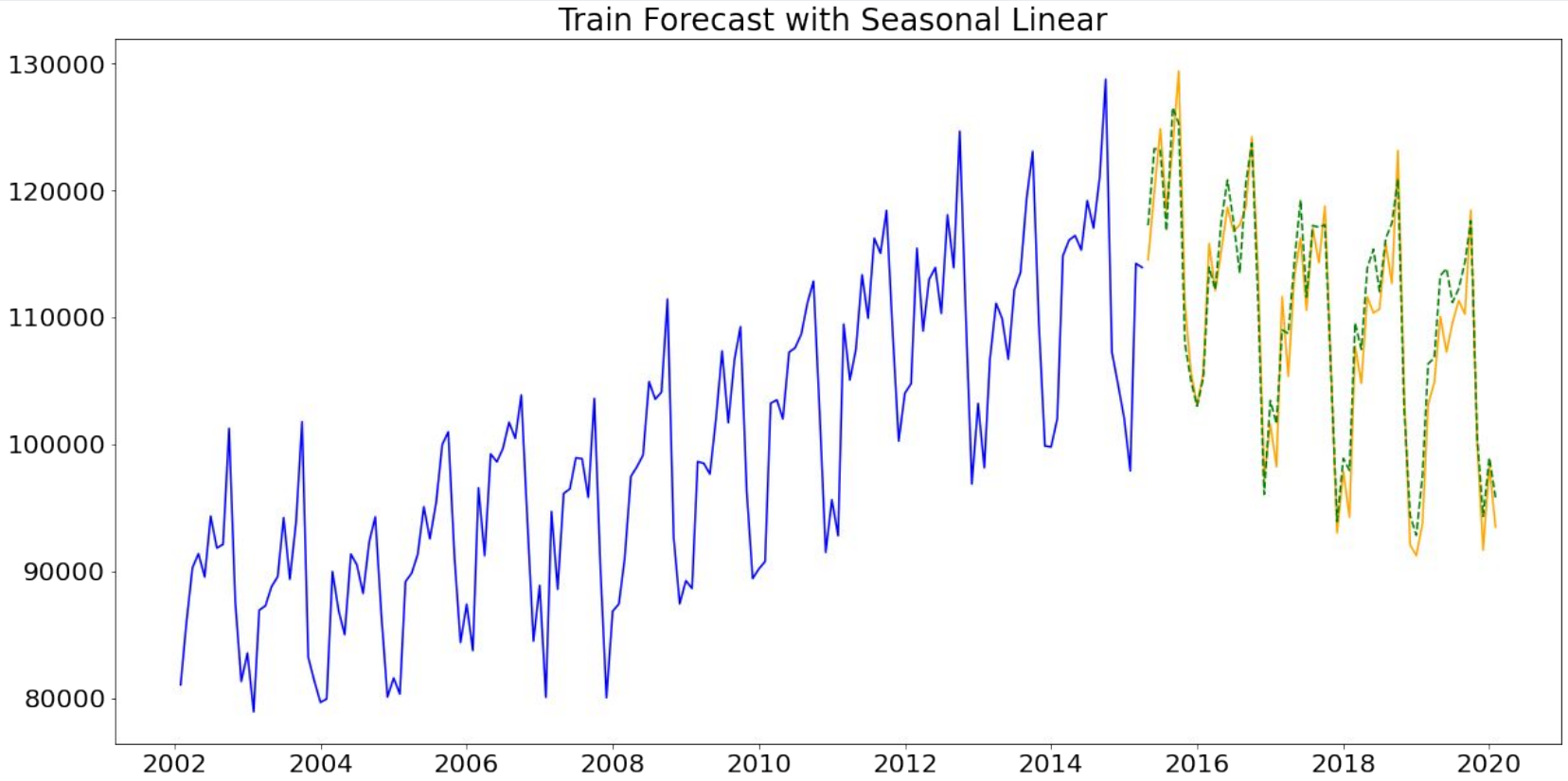
Train Ridership

Linear Forecasts



R2 score: 0.89

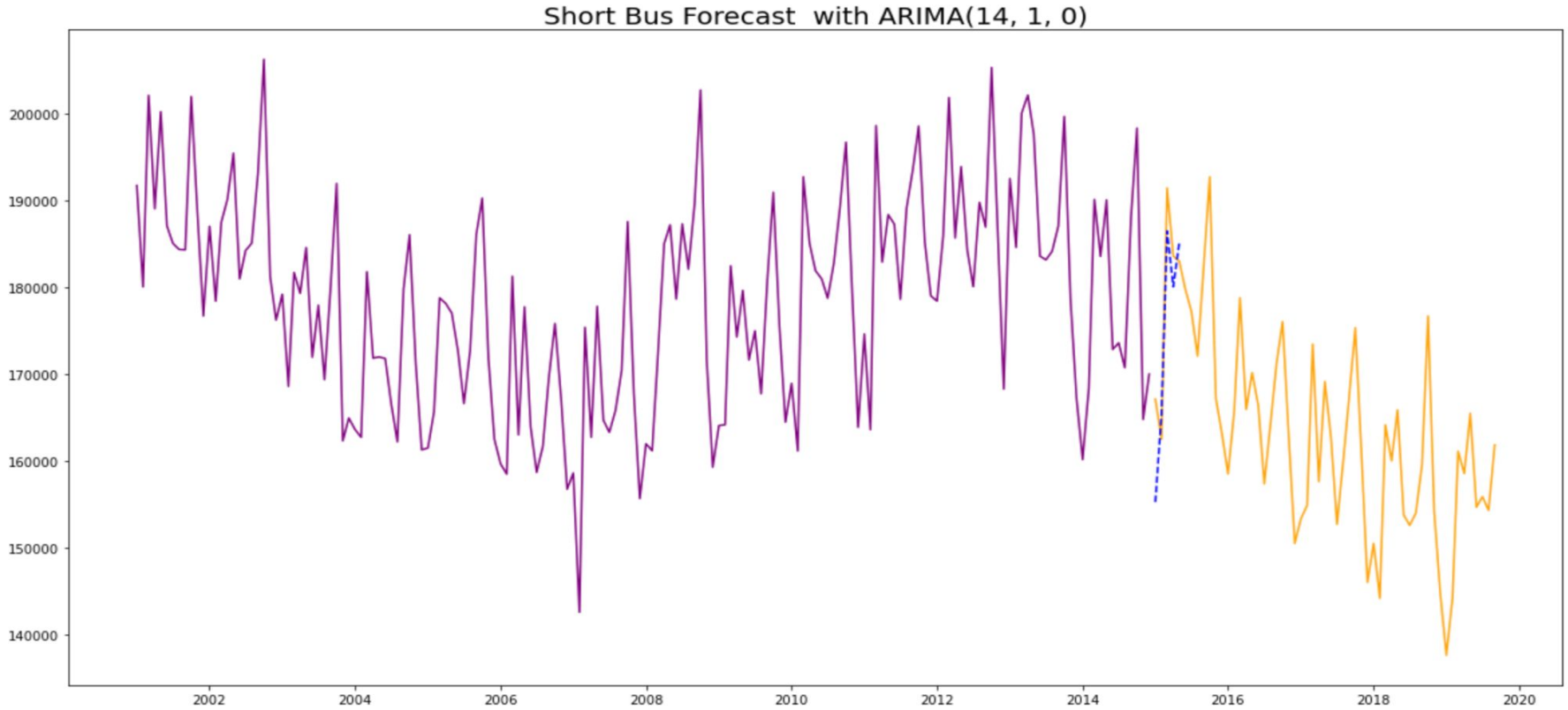
MSE: 3605.66



R2 score: 0.93

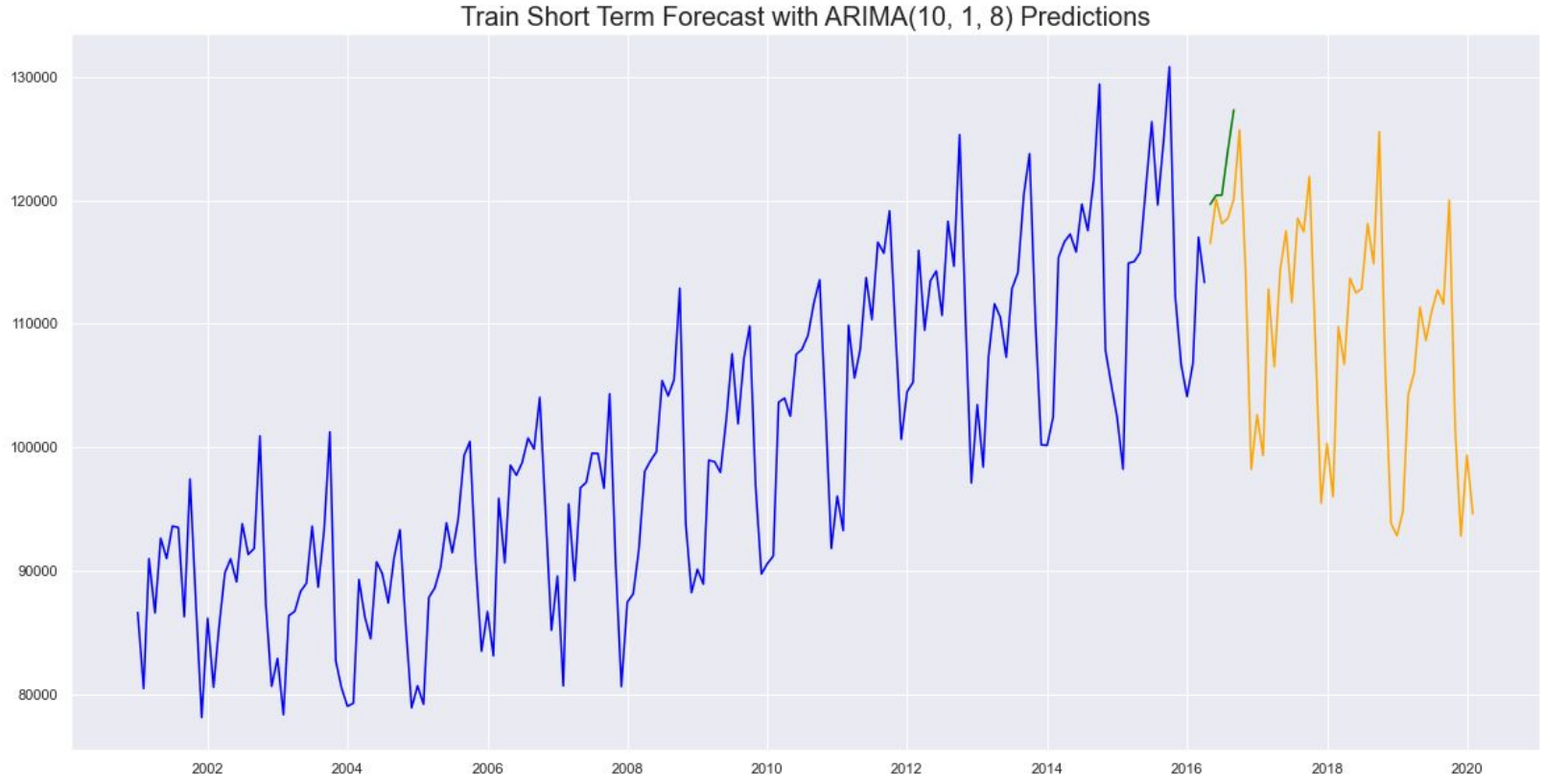
MSE: 2514.46

Forecasts Using ARIMA



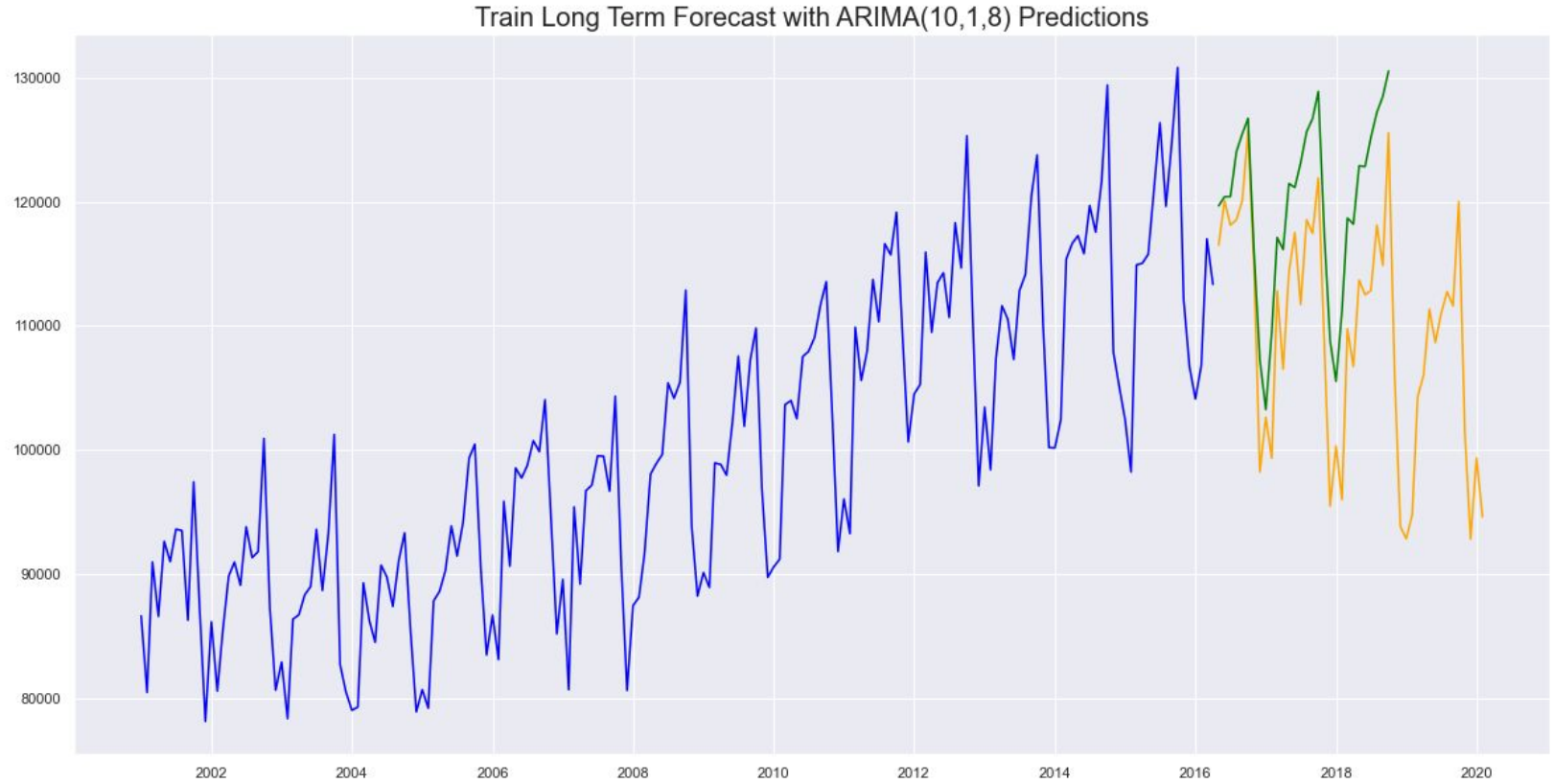
Best params: p = 14, d = 1, q = 0

AIC: 17239.05



Best params: p = 10, d = 1, q = 8

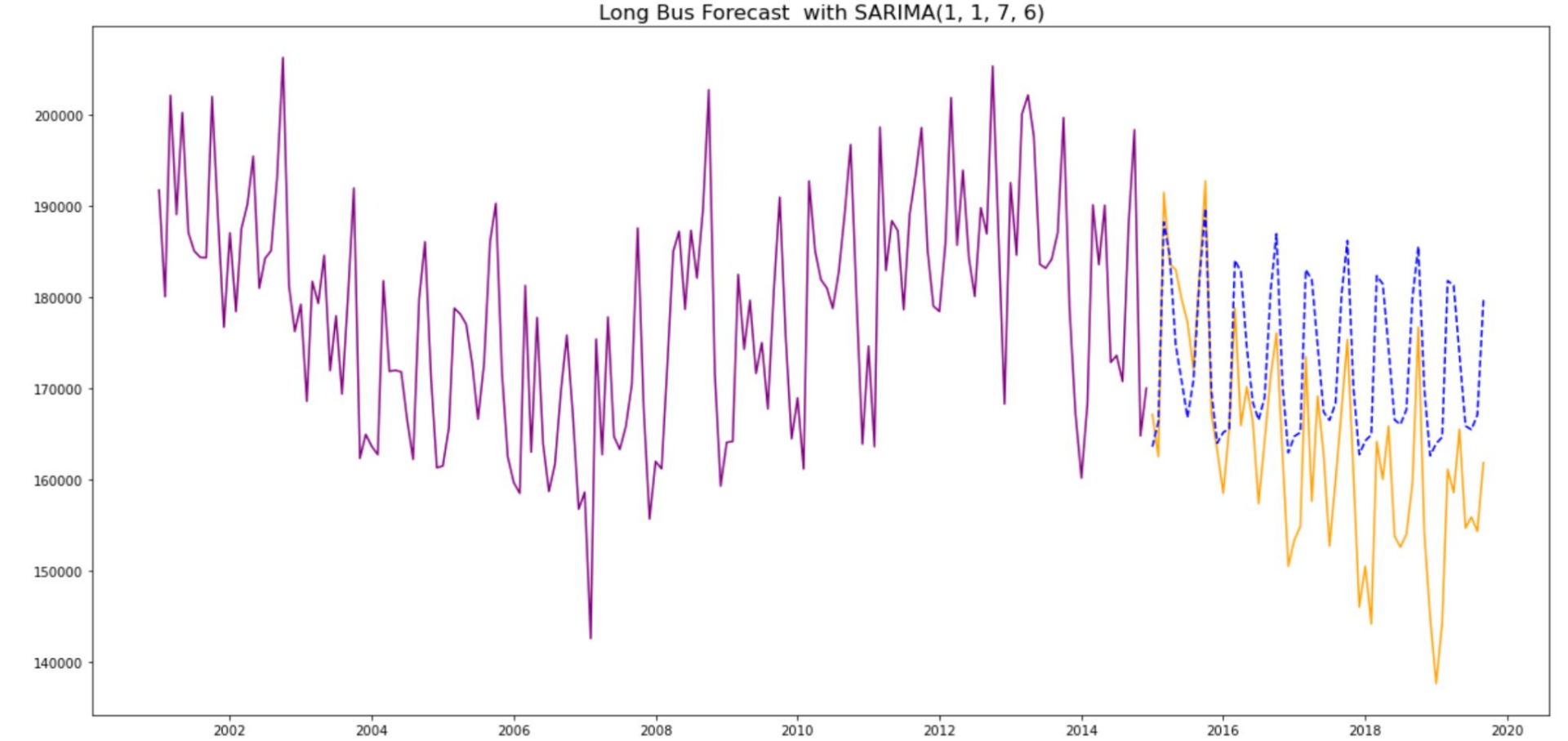
AIC: 3487.56



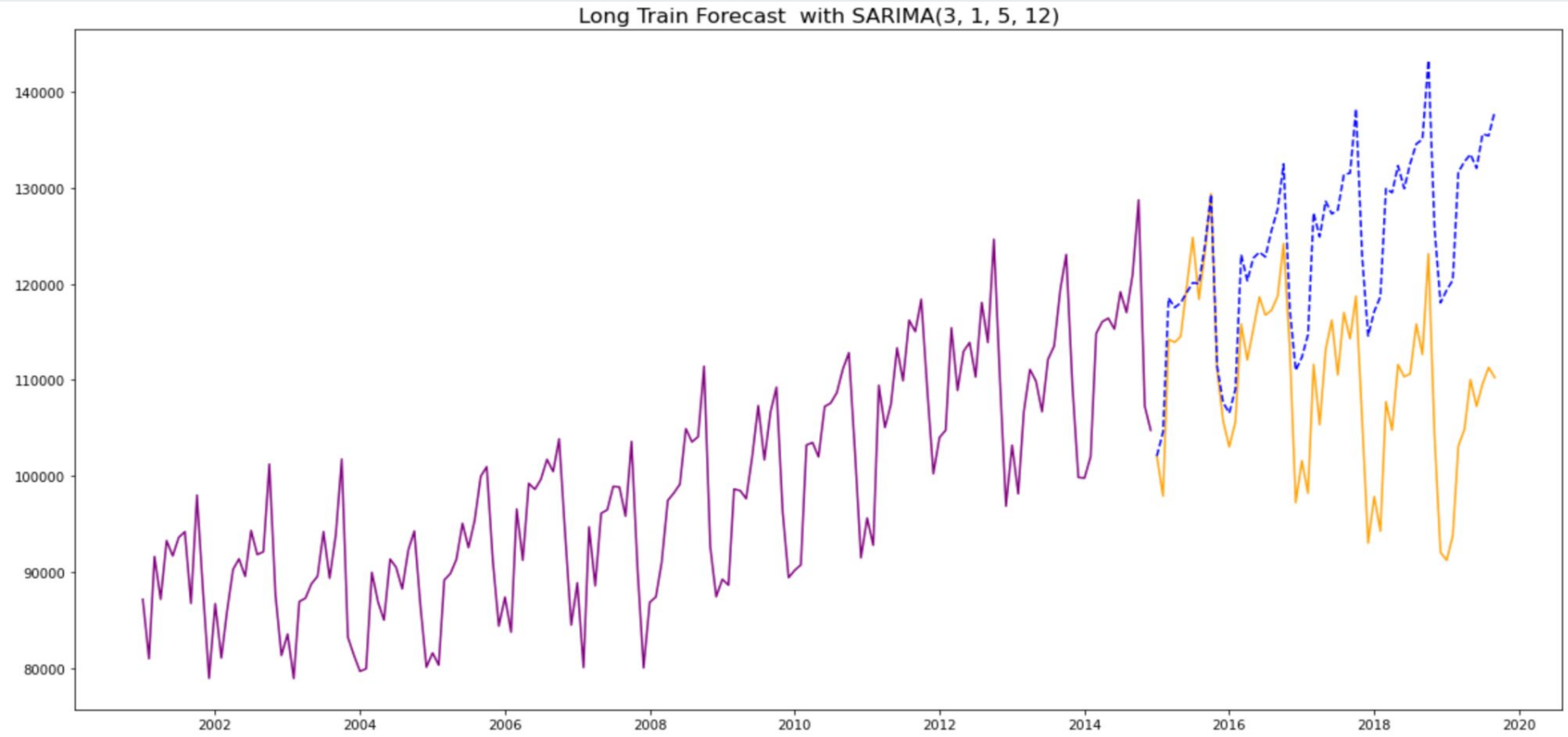
Best params: p = 10, d = 1, q = 8

AIC: 3487.56

Forecasts Using SARIMA



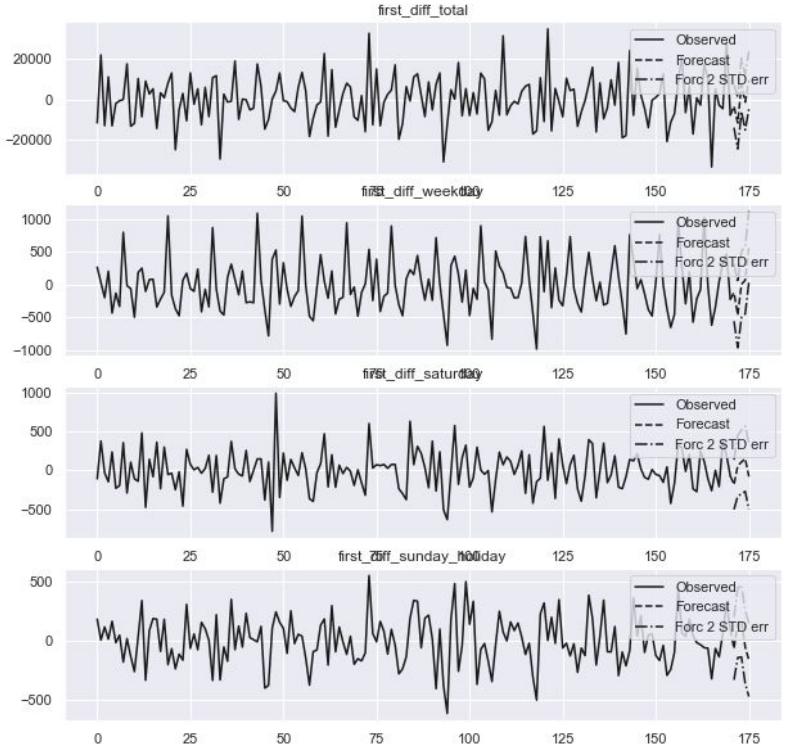
RMSE: 12537.14 **AIC: 28**



RMSE: 16851.8 **AIC: 38**

Forecasts Using VAR

BUS

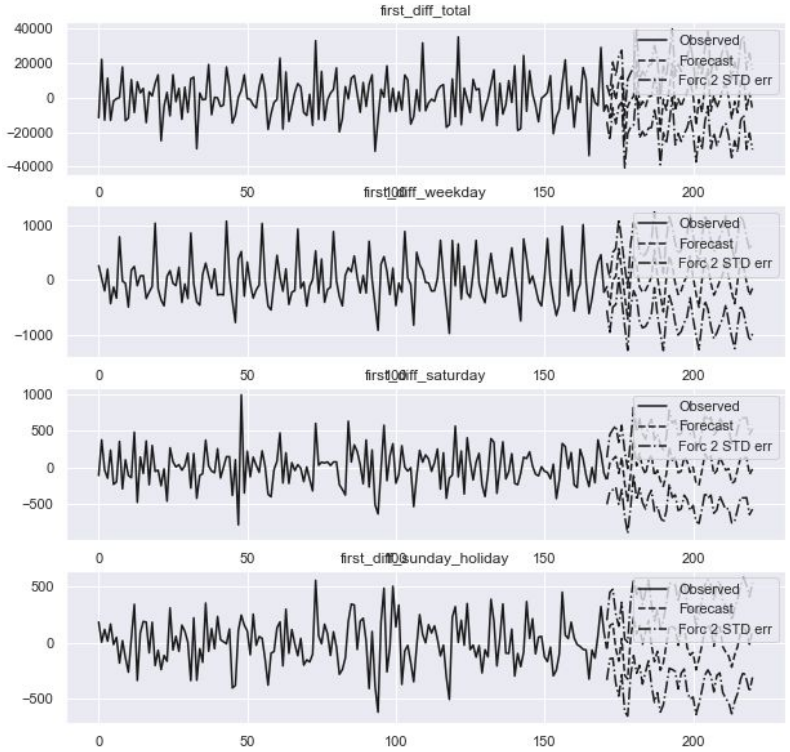


MSE:
54898731.73

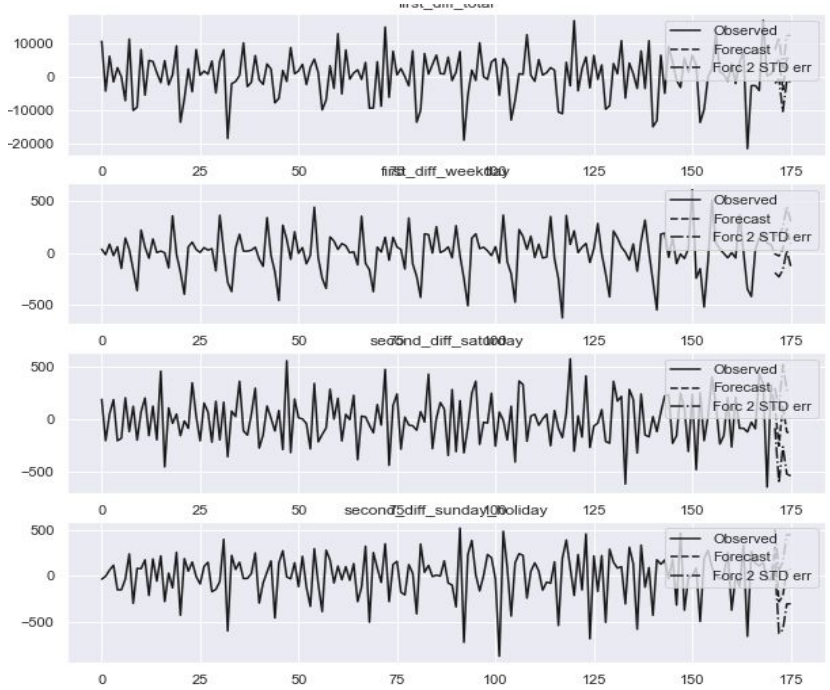
MSE:
56260.02

MSE:
35219.95

MSE:
20590.76



Train

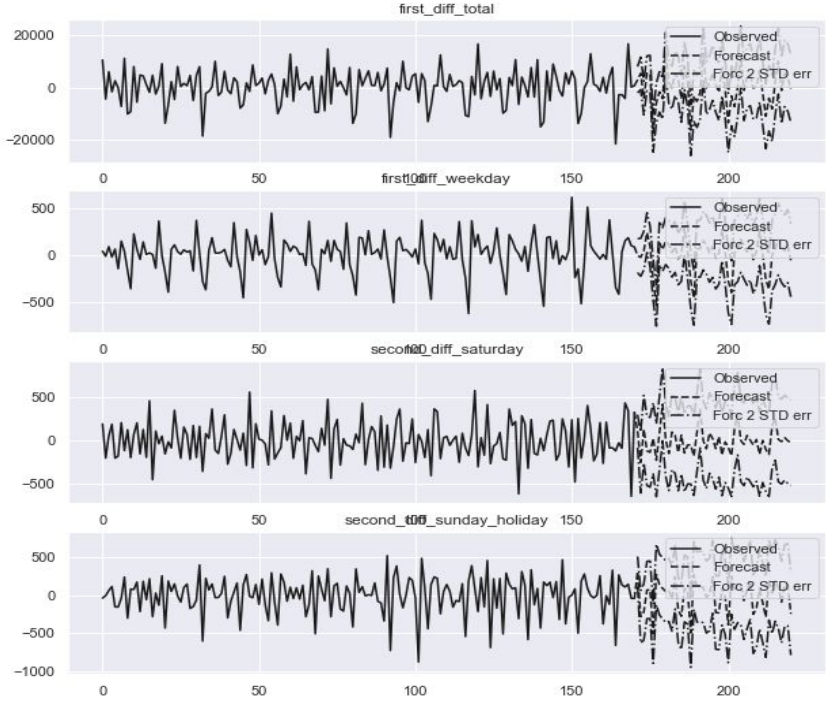


MSE:
39278153.16

MSE:
13559.86

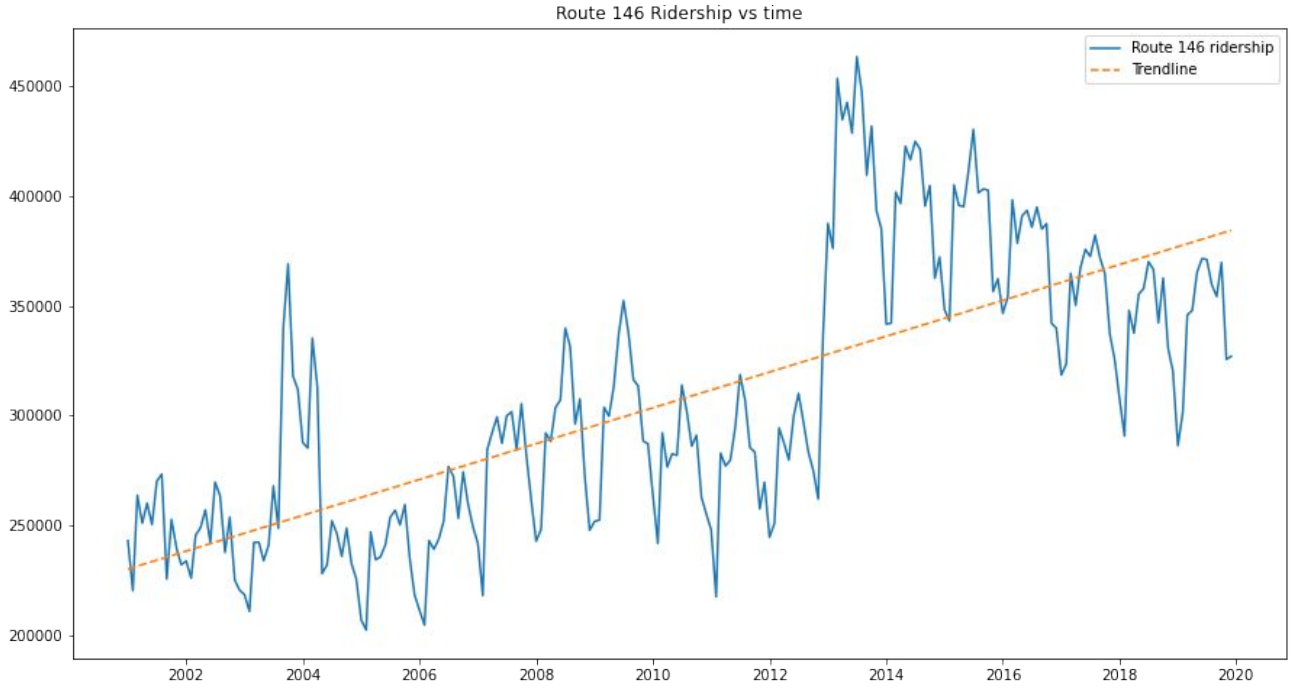
MSE:
57117.2885

MSE:
59747.7861



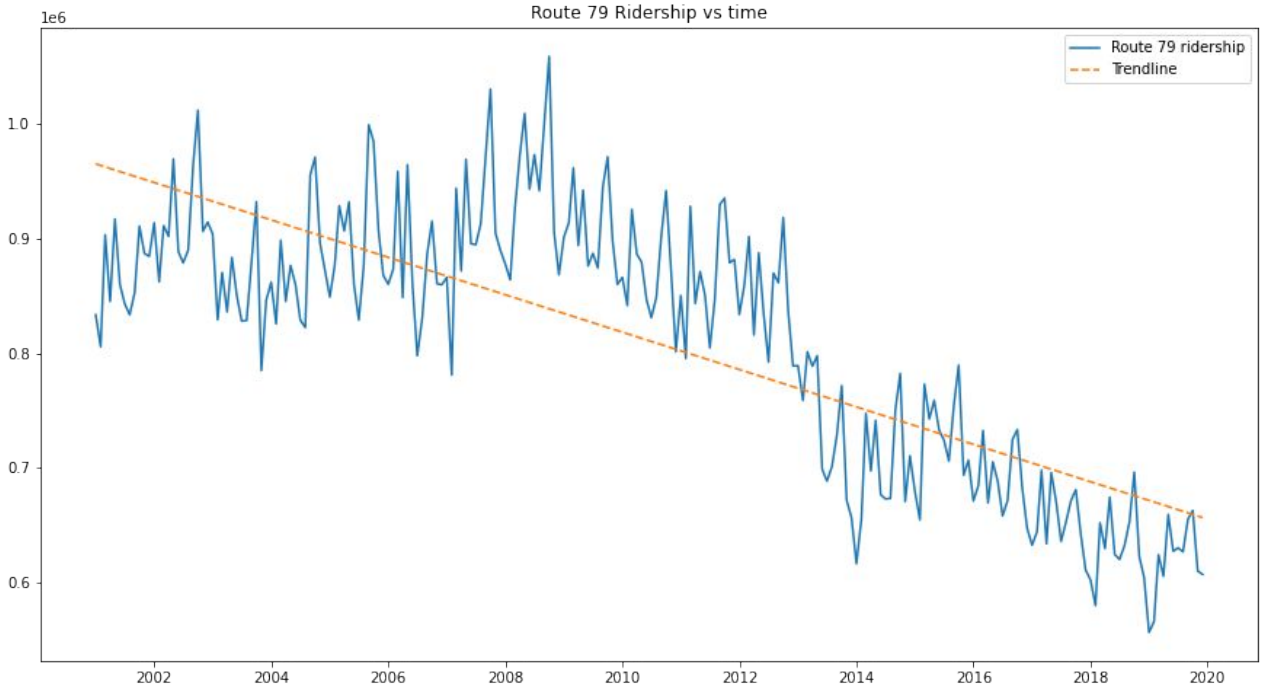
Trending Routes

Most Trending Route



route	demand
146	22.353699
147	13.782553
12	13.039129
18	12.670111
157	11.554613
65	9.905001
50	8.878316
26	8.444896
66	7.140954
2	7.115164

Least Trending Route



route	demand
79	-44.661834
9	-43.026139
63	-31.393282
56	-31.286617
20	-30.576120
151	-29.514371
28	-25.952982
3	-25.743192
29	-25.336109
J14	-24.442501

Conclusions: Overall ridership is declining. Why?

- Alternative transportation availability increasing
  - Rideshare apps like Uber
- Commuter lines suffer during summer and winter
  - Summer break
  - Christmas and New Year's
- Discontinued routes/stations
- COVID
  - work from home
- Increasing concentration of jobs downtown

Some Recommendations

1. Ashland BRT (Bus Rapid Transit)

- Major North/South route, gap not well serviced
- Highest overall ridership (but 2nd fastest loss in ridership)
- Cut trip from Fullerton to 79th (15 miles) from 85 minutes to 45 minutes
- 10% of Chicago lives within ½ mile of this route
    - 1 in 4 of these houses have no car

Proposed Stops

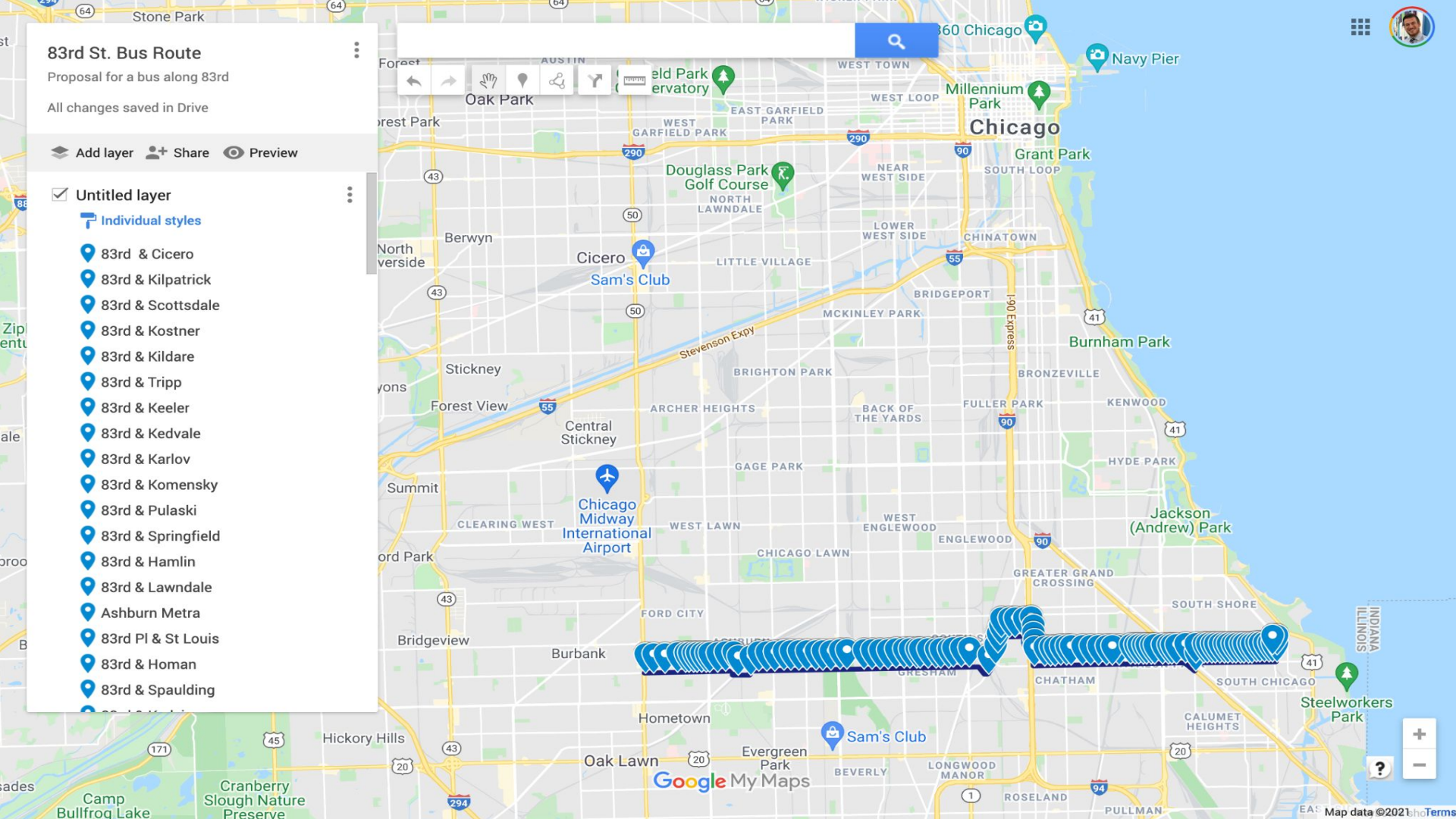
source:
https://www.transitchicago.com/ashlandbrt/

2. Addition of 83rd St Bus between Cicero & Metra Electric 83rd St. Eastern Stop (Commuter Rail Station)

- Fills a mile wide gap through South Side (10 miles long)
- 83rd St. has higher population density and job density than surrounding areas

Connections to:

- Ashburn Metra
- 83rd St. Avalon Park Metra
- Metra Electric 83rd St.
- 79th St. Red Line
- Jeffery Jump downtown express bus


83rd St. Bus Route
Proposal for a bus along 83rd
All changes saved in Drive
Add layer
Share
Preview
Untitled layer
Individual styles
83rd & Cicero
83rd & Kilpatrick
83rd & Scottsdale
83rd & Kostner
83rd & Kildare
83rd & Tripp
83rd & Keeler
83rd & Kedvale
83rd & Karlov
83rd & Komensky
83rd & Pulaski
83rd & Springfield
83rd & Hamlin
83rd & Lawndale
Ashburn Metra
83rd Pl & St Louis
83rd & Homan
83rd & Spaulding
Stone Park
Oak Park
Berwyn
Cicero
Sam's Club
Douglass Park Golf Course
Chicago
Navy Pier
Millennium Park
Grant Park
Burnham Park
Jackson (Andrew) Park
Steelworkers Park
Chicago Midway International Airport
Stickney
Forest View
Central Stickney
Summit
Bridgeview
Burbank
Hometown
Oak Lawn
Hickory Hills
Evergreen Park
Sam's Club
Google My Maps
Map data ©2021

3. Increase service on the following routes:

- 79th St. Bus #**79**
- 63rd St. Bus #**63**
- Green Line Trains to/from Ashland branch (coinciding with Ashland BRT)
- **151** Sheridan (to balance out increasing demand on **146** Inner Drive Express & **147** Outer Drive Express that run parallel)
- **J14** Jeffery Jump (hybrid BRT between deep South Side and downtown)

Factors:

- Low/decreasing ridership
- Higher population density
- Current lack of service
- Low cost compared to creating new routes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