

BAY AREA RAPID TRANSIT

BART



San Francisco Bay Area. Connects 5 counties, 50 stations, 2 airports, 5 lines. 130 miles of track.



Funded by BART's \$1.6 billion in federal emergency funds (runs out 2025). Relies on state and regional funds to cover operational costs.



67% identify as non-white
• 44% do not have a vehicle
• 31% report having annual household incomes under \$50K.

source: [Bart](#)



DATA CARD



The data is procured from Kaggle and from Bart.gov.
Provenance is BART.gov.

	Date	Hour	Origin Station	Destination Station	Trip Count
0	2011-01-01	0	12TH	12TH	1
1	2011-01-01	0	12TH	16TH	1



Data comes into two different types:

- 2011 – 2023, Trip Count by unique combination Origin and Destination by day by hour.
- 2023-2024, Trip Count by unique combination Origin and Destination by month.

GOALS AND OBJECTIVES

Historical Ridership

Examine historical ridership trends from 2011-2024, from the rise of rideshare to Covid.

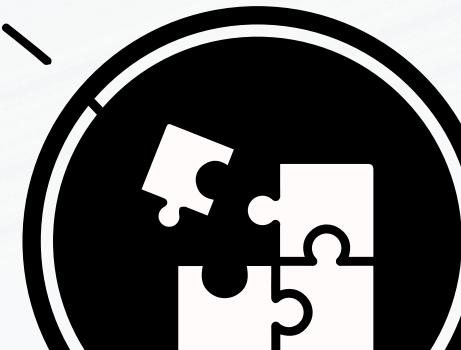
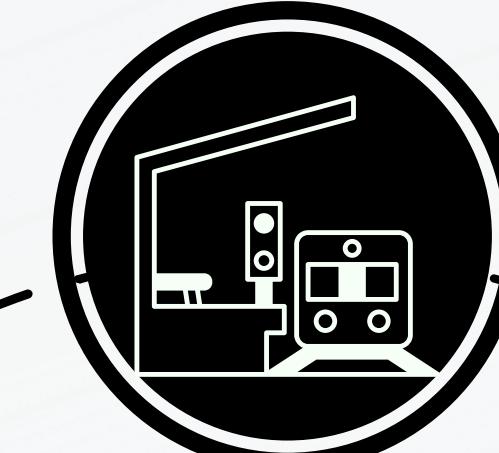
Examine Trips by Station and commute type, SF Downtown

Examine station ridership to identify higher and lower performing stations, post Covid. Outline major stations and examine their volume by hour and day.

Uncover key influencers of ridership volume

Identify key drivers of ridership in post pandemic era. Develop a perspective on ridership outlook in the coming years.

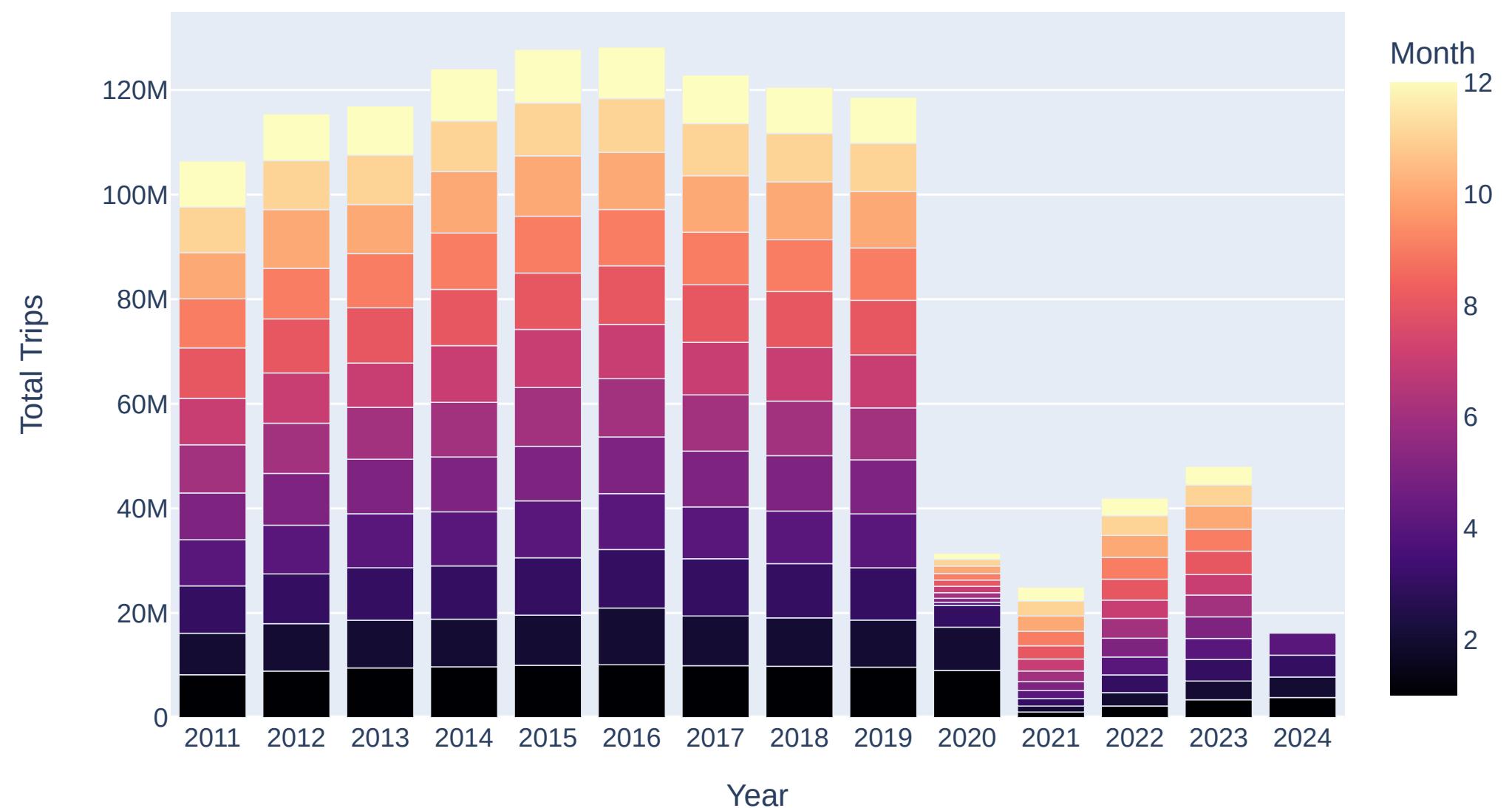
Provide recommendations.



2011-2024 RIDERSHIP

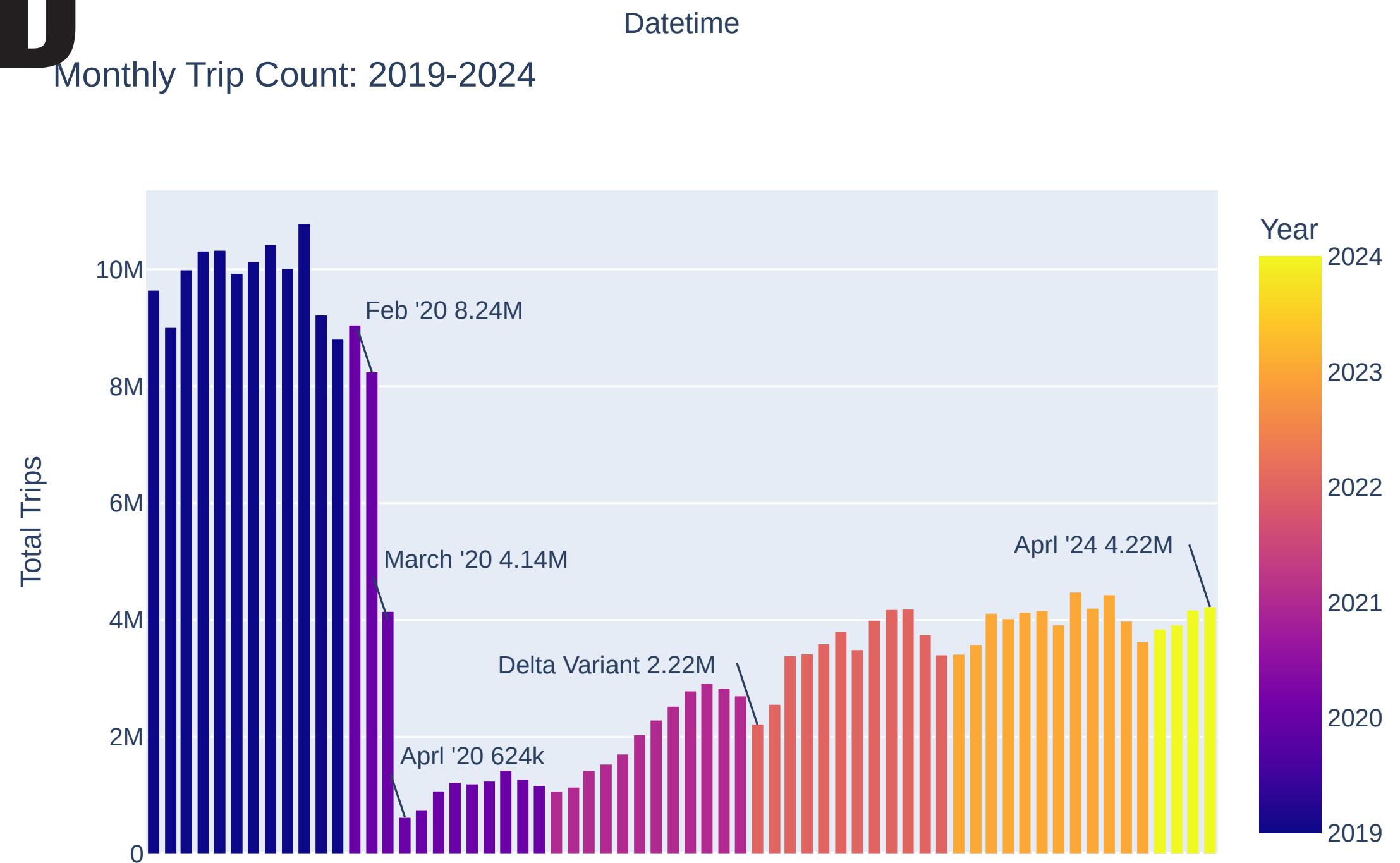
- From 2011 to 2019, BART averaged 120 millions rides a year, peaking in 2016 at 128 million, steadily decreasing by 7.4% in 2019.
- Uber and Lyft launched in 2010 and 2012 in SF, gaining traction around 2016.
- Severe drop off in March 2020, which correlates to Covid shelter in place..

BART Ridership Over The Years

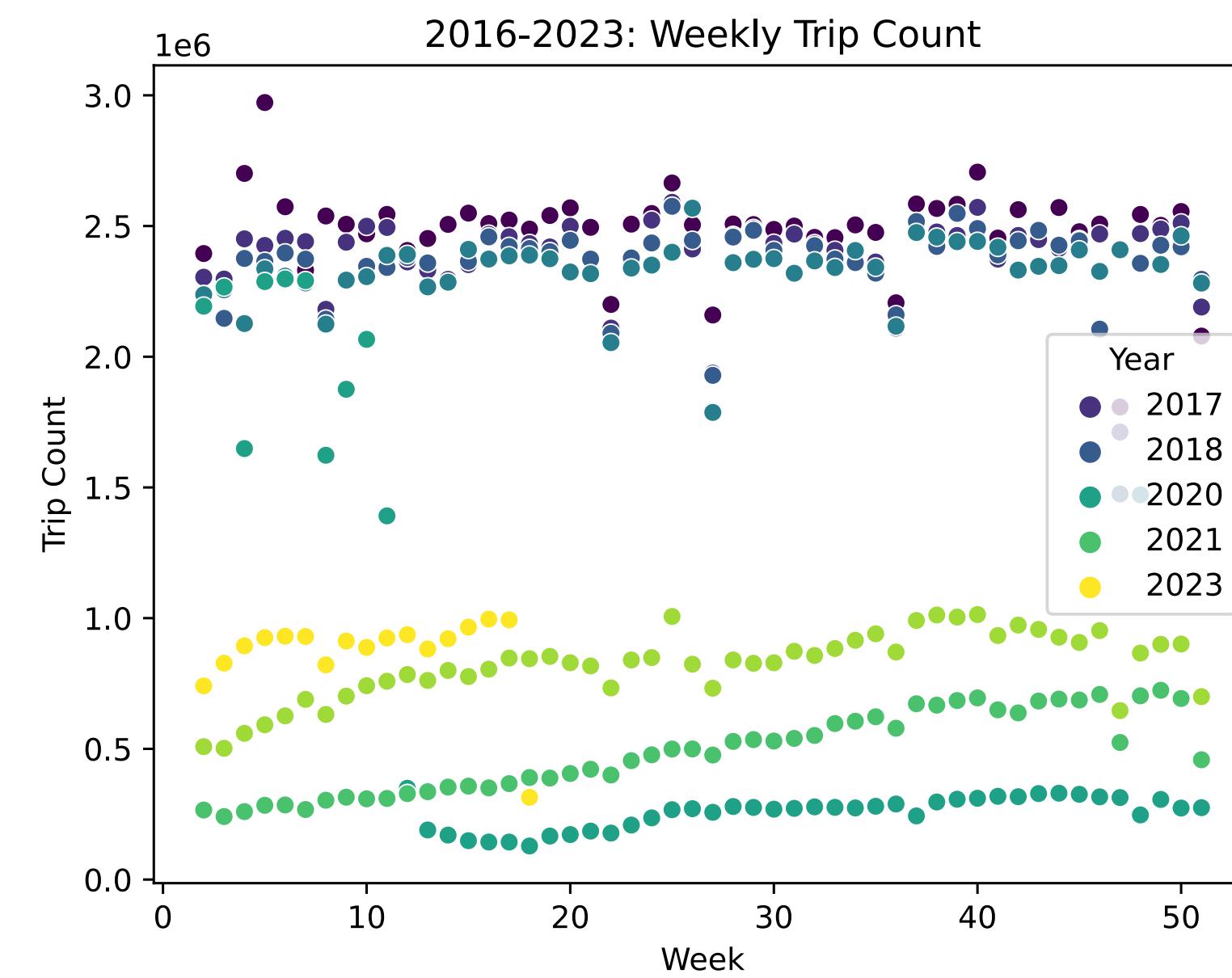
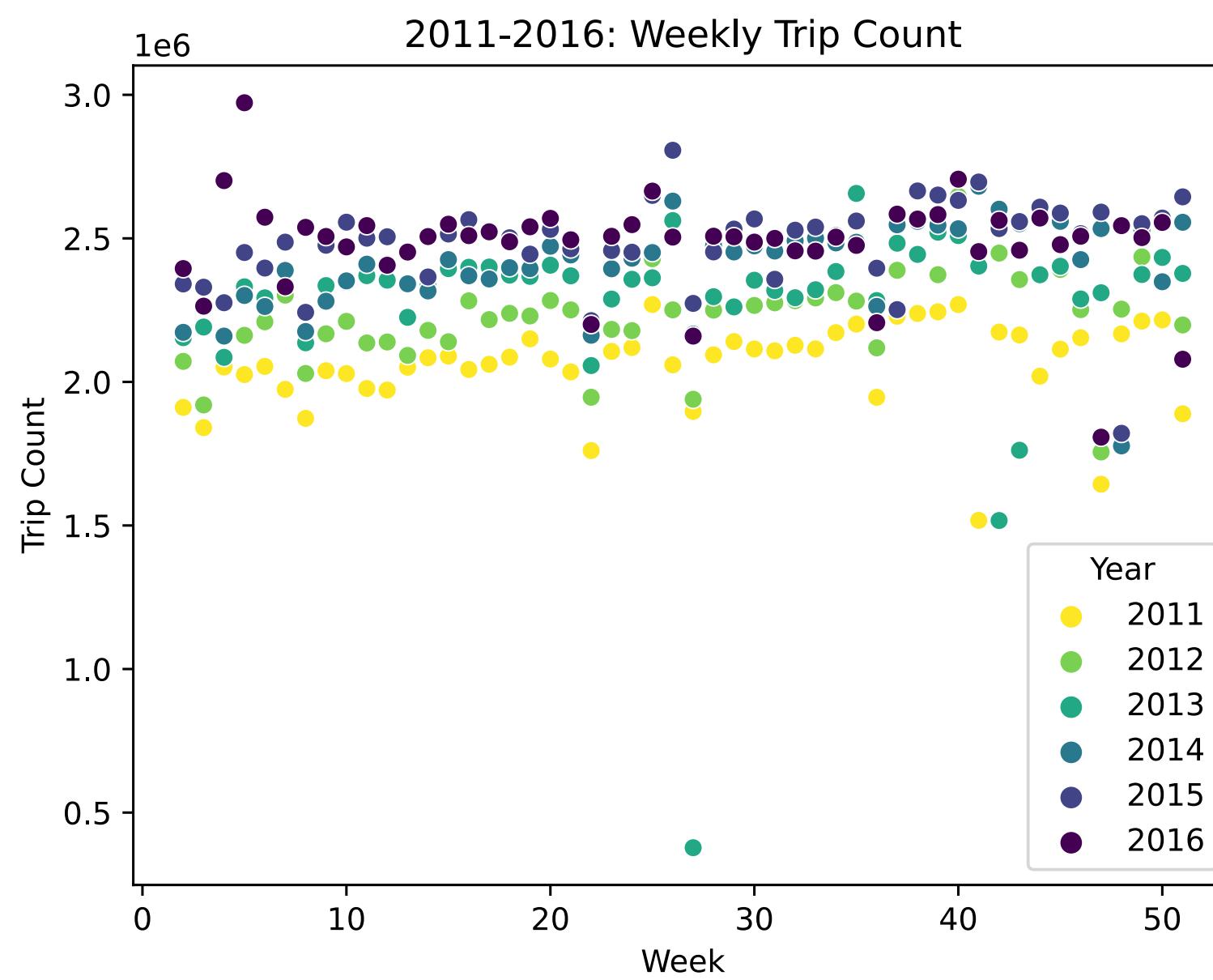


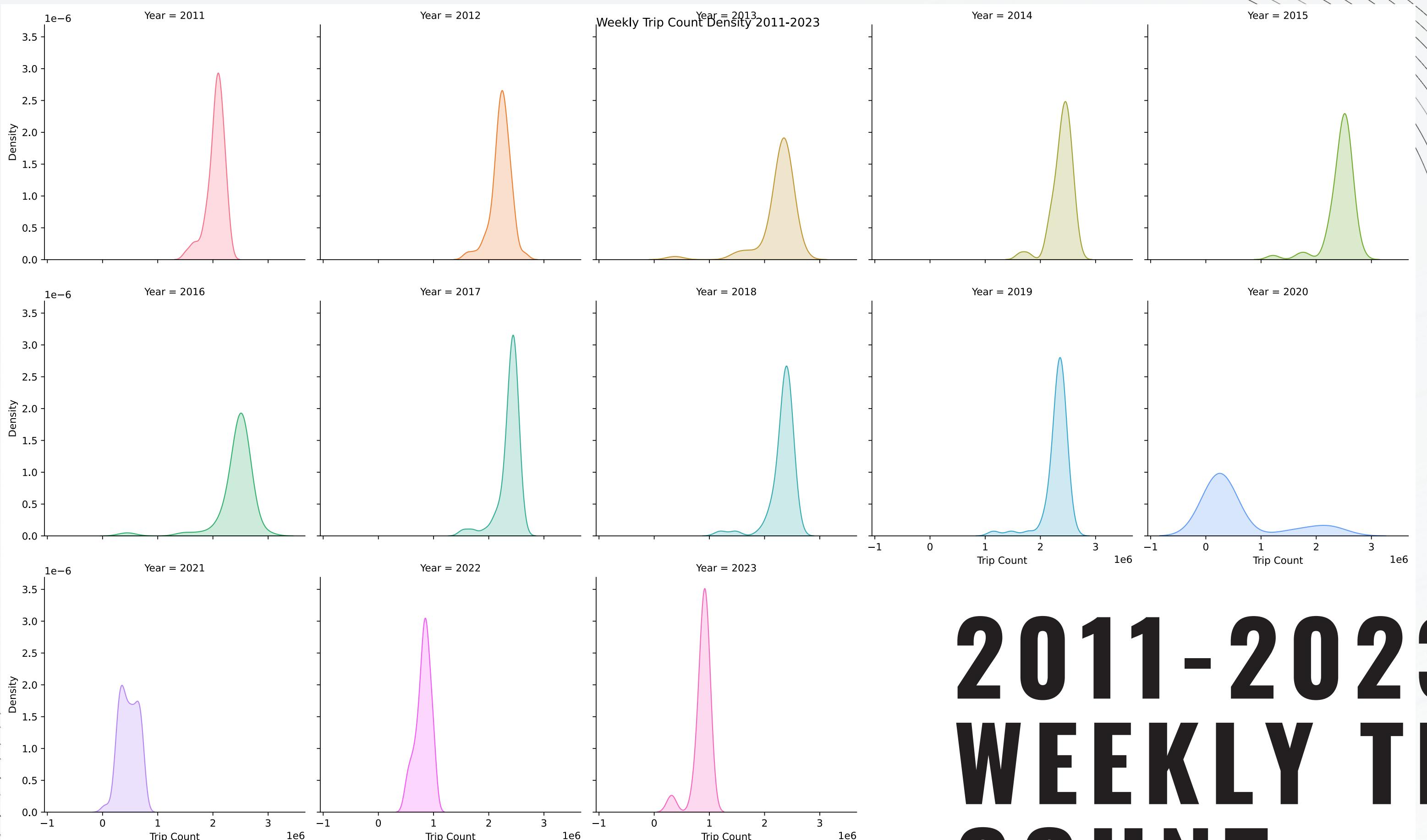
2020 COVID DROP

- April - Dec 2020 combined Total Trips total 9,986,282. Avg Trips per month in 2019 is 9,884,134.
- April 2020 Total Trips is 6.04% of April 2019.
- April 2024 shows BART at roughly 50% of pre pandemic times.



WEEKLY TRIP COUNT





2011-2023 WEEKLY TRIP COUNT

2011 V 2012 T TEST

2 sample T – Test to determine is there is a significant change in the Monthly Ridership from 2011 – 2012

Sample 1: 2011 Total Trip Count by Week

- 51 observations (dropped the last week bc outlier)

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Assumptions: Normal, Independent, similar variance.

F Test to assess variance between groups.

- Null Hypothesis: No difference in variance between groups.
- Alt Hypothesis: There is a difference in variance between groups
- F statistic = 0.807
- P value = 0.224
- P value is > .05. Therefore, we accept the Null Hypothesis and confirm that the variances are similar.

Two Sample T Test to determine if the weekly means are statistically significant.

- Null Hypothesis: there is no difference in the means of the two samples.
- Alt Hypothesis: there is a significant difference in the means.
- T statistic = -5.194
- P value = 1.086517e-06
- P value is < .05. Therefore, **we reject the Null Hypothesis** and confirm that there is a **statistical significance** between the means.

2011-2023 TESTS

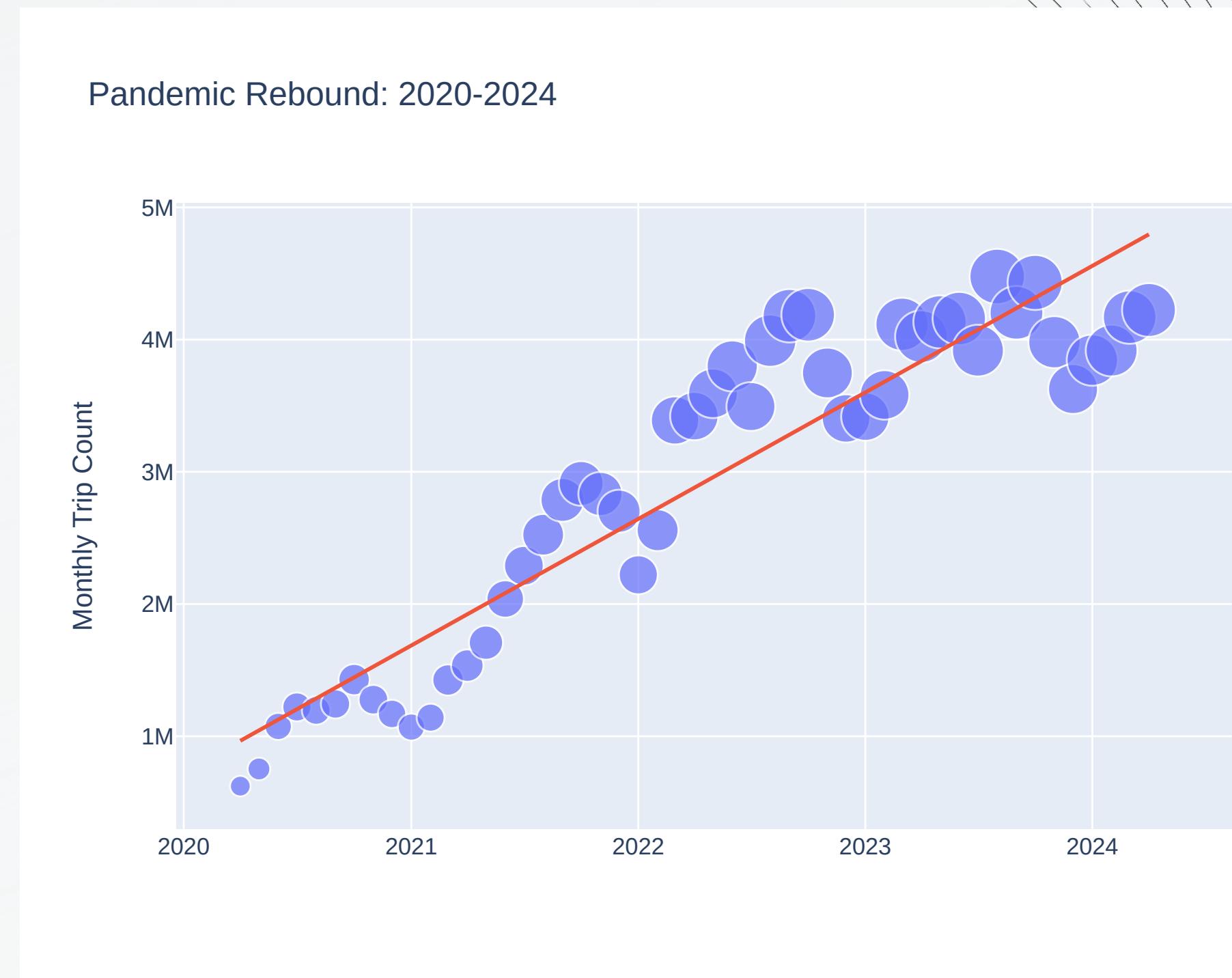
Expanding the two sample T Test to compare each year with the following.

- Significant increase in 2011–2012.
- Significant increase in 2013–2014.
- Peak in 2016. Significant decrease in 2016 – 2017.
- Significant drop in 2019 to 2020.
- Significant growth coming out of pandemic.

Sample 1	Sample 2	f_statistic	f_test pval	t_statistic	t_test pval
2011	2012	0.807899	2.244466e-01	-5.194131	1.086517e-06
2012	2013	0.257565	1.635929e-06	-0.537157	5.923521e-01
2013	2014	3.315507	9.999827e-01	-2.522050	1.324542e-02
2014	2015	1.016689	5.234486e-01	-1.980498	5.039481e-02
2015	2016	0.741222	1.441012e-01	0.169717	8.655755e-01
2016	2017	1.270144	8.019721e-01	2.122849	3.623536e-02
2017	2018	0.679850	8.582119e-02	1.128780	2.616913e-01
2018	2019	1.010941	5.154217e-01	0.725653	4.697463e-01
2019	2020	0.108538	2.055146e-13	16.095672	1.625961e-29
2020	2021	21.792523	1.000000e+00	1.094532	2.763510e-01
2021	2022	1.322859	8.395422e-01	-11.625085	2.827878e-20
2022	2023	0.720411	1.817078e-01	-1.470421	1.461993e-01

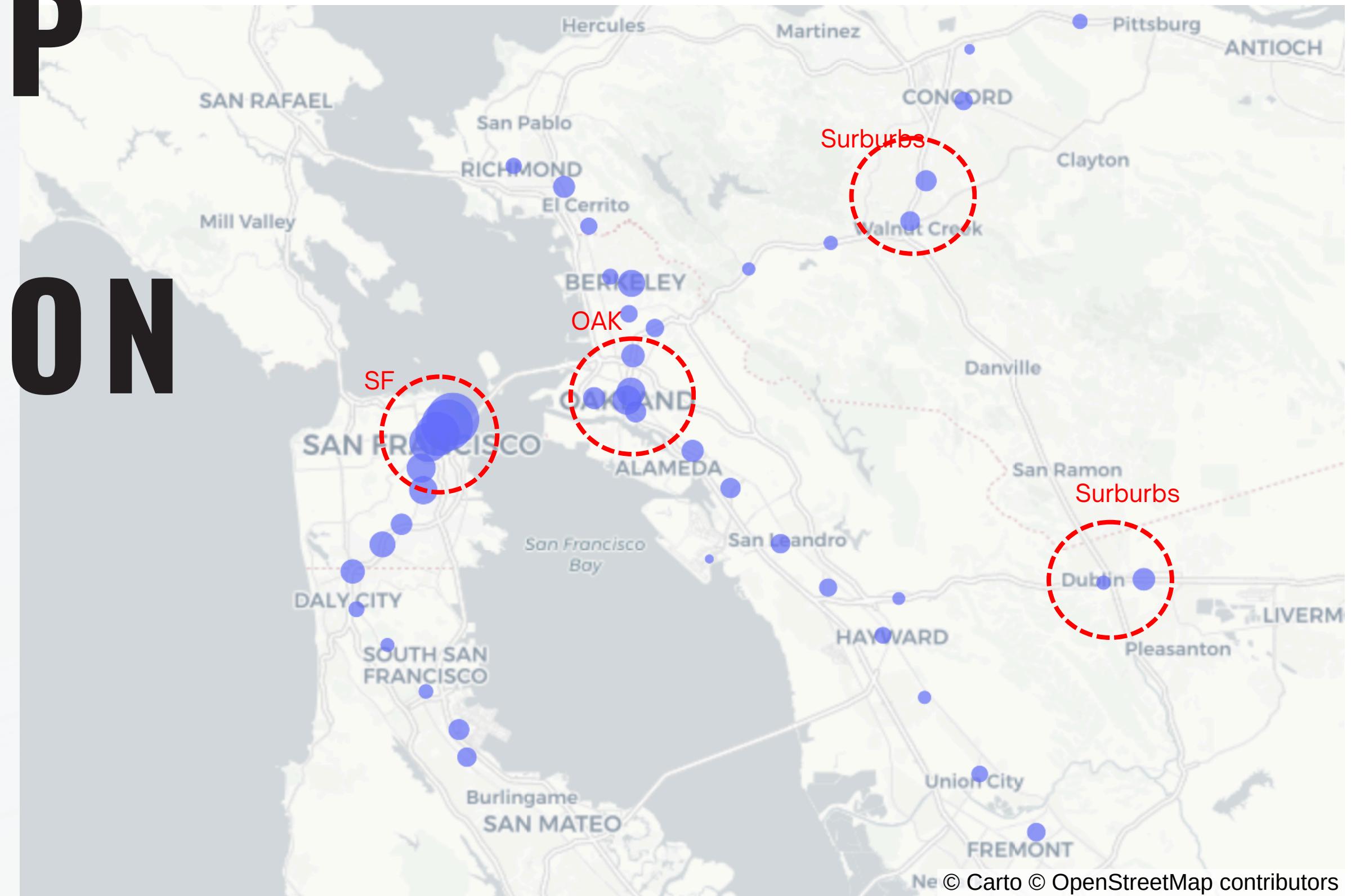
2020-2024 MONTHLY GROWTH

- Starting April 2020, avg monthly riders has growth by 929,018 per year. Growth appears to be linear but may plateau out.
- Should ridership continue to increase linearly, ridership would return by Jul 2027.
- Will ridership return to pre-pandemic volume?
- At what trip count will it plateau? When?
- What are key factors in growth?



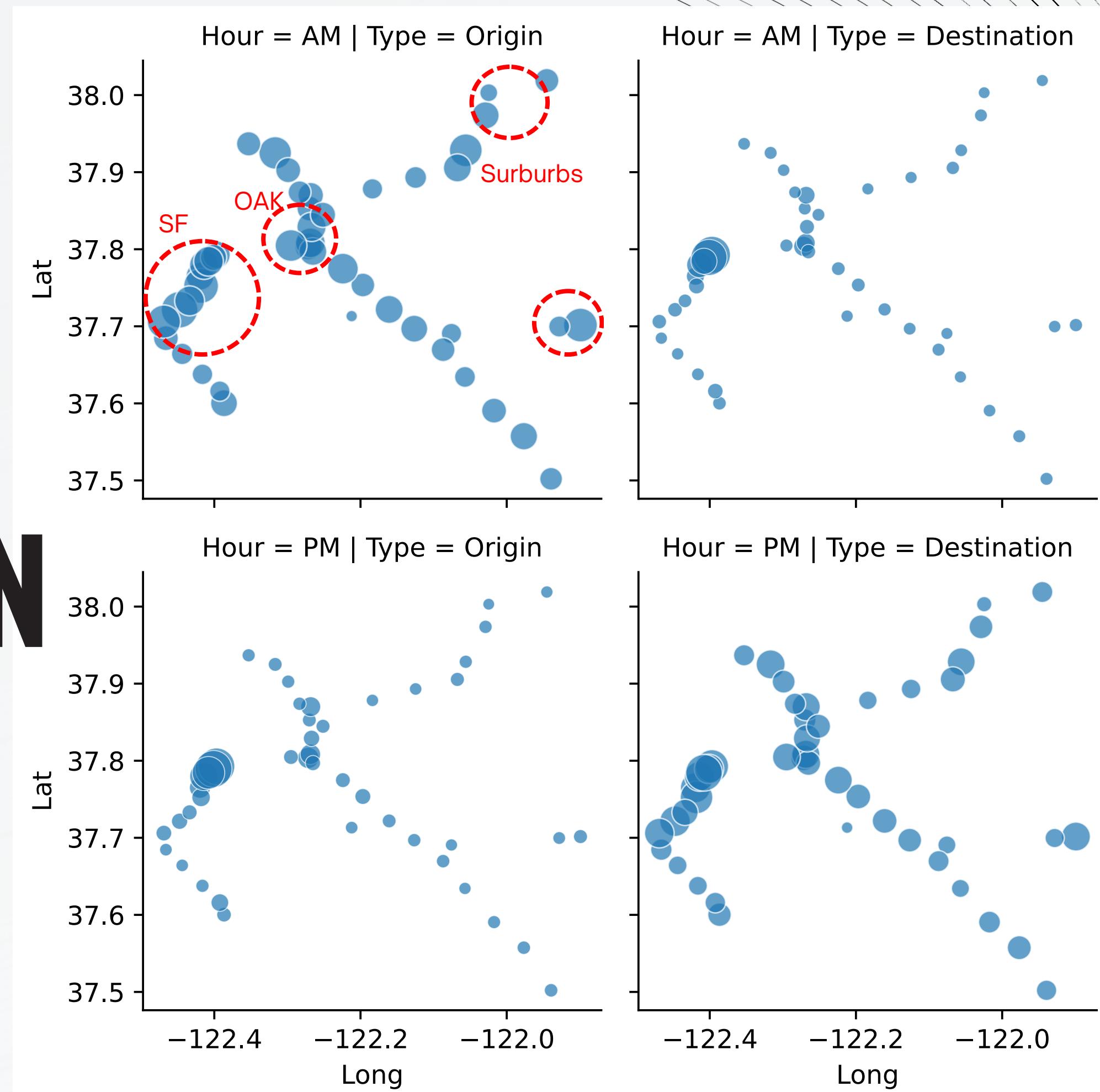
2019 TRIP VOLUME BY STATION MAP

2019 Monthly Trip Volume



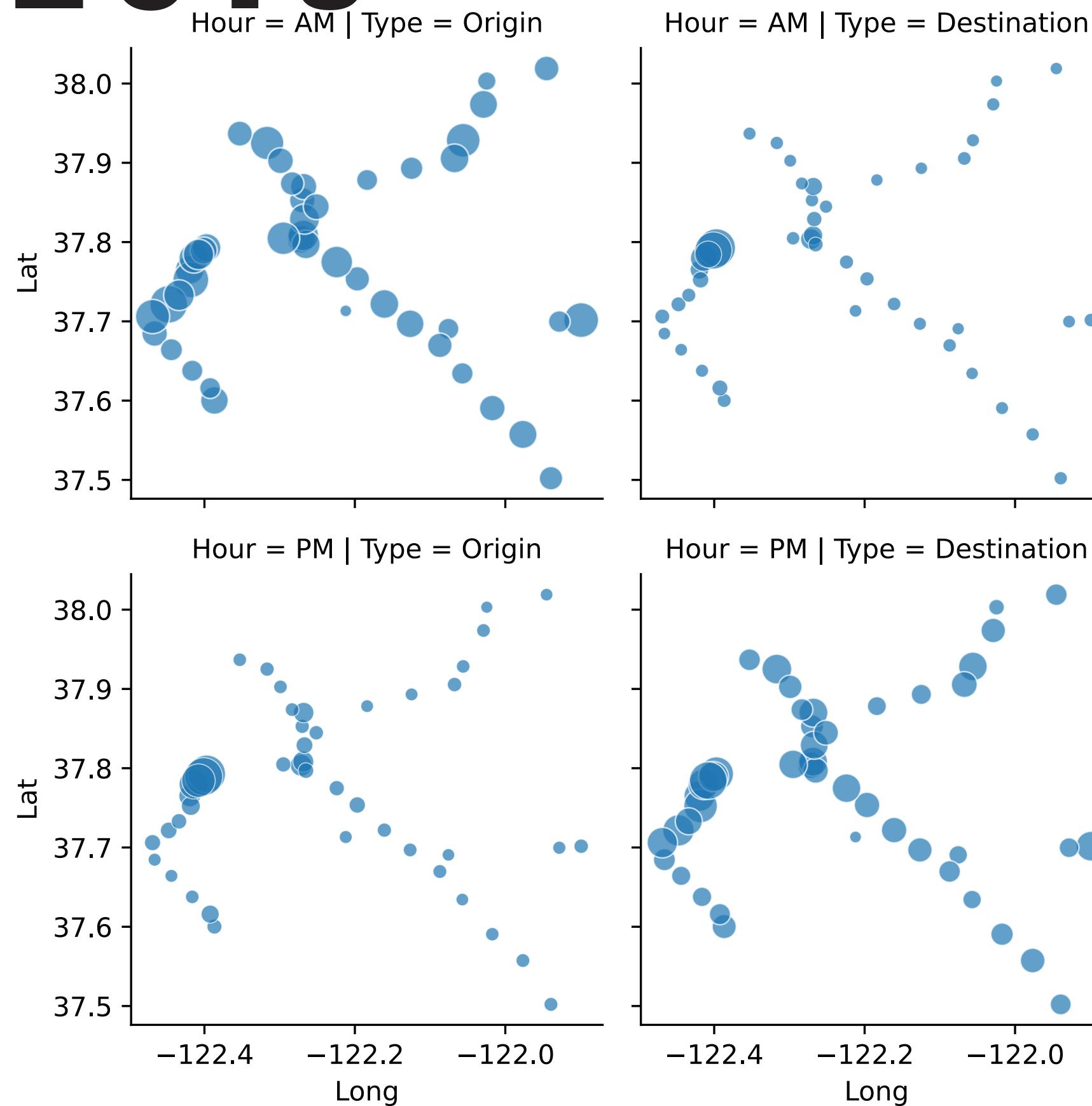
2019 BY STATION ORIGIN DESTINATION AM PM

- AM = 12AM-12PT
- PM = 12PM - AM
- AM/PM appear to be inverse of each other in station volume



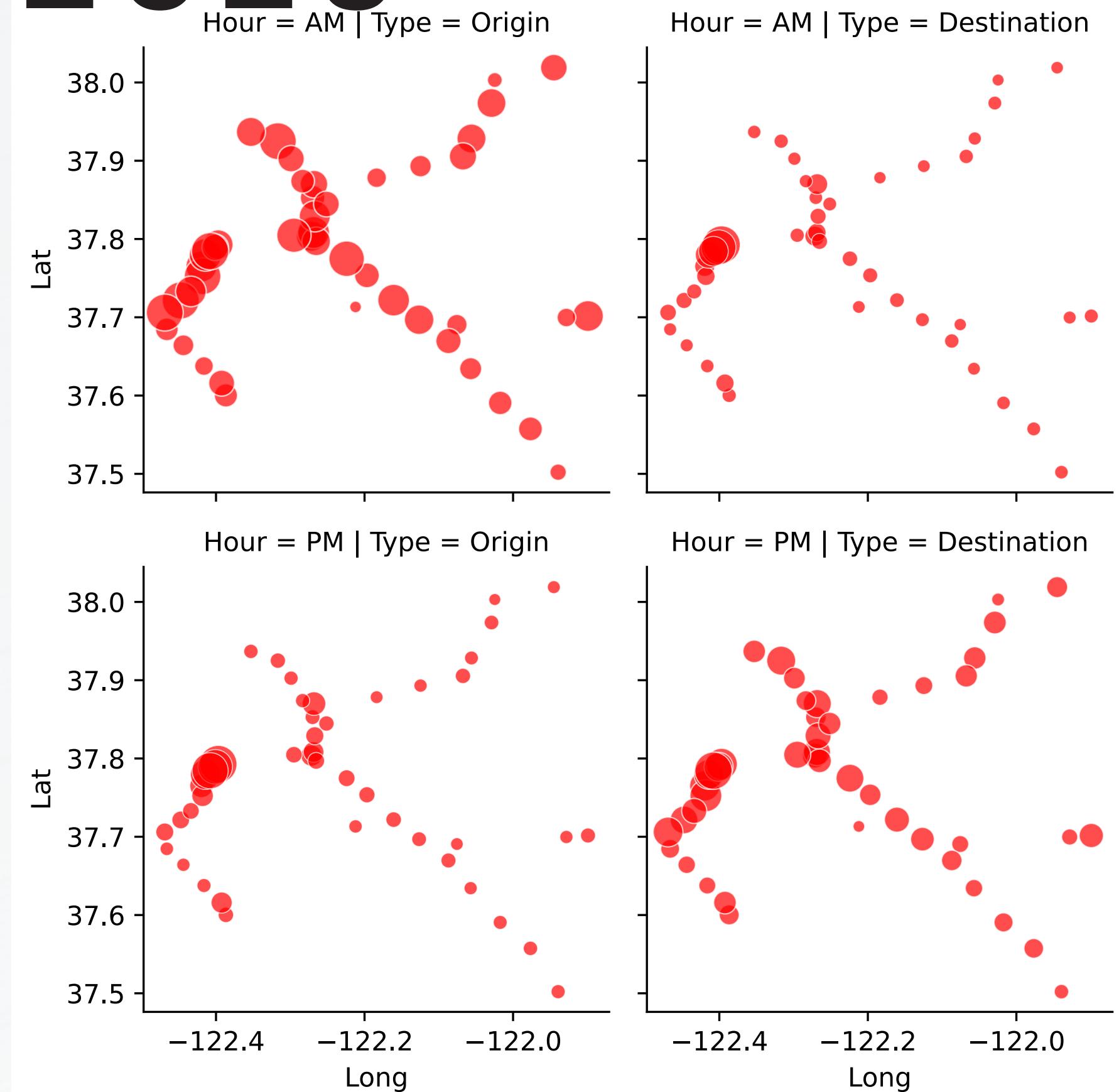
2019

Avg Monthly
Trips = 9.8 Million

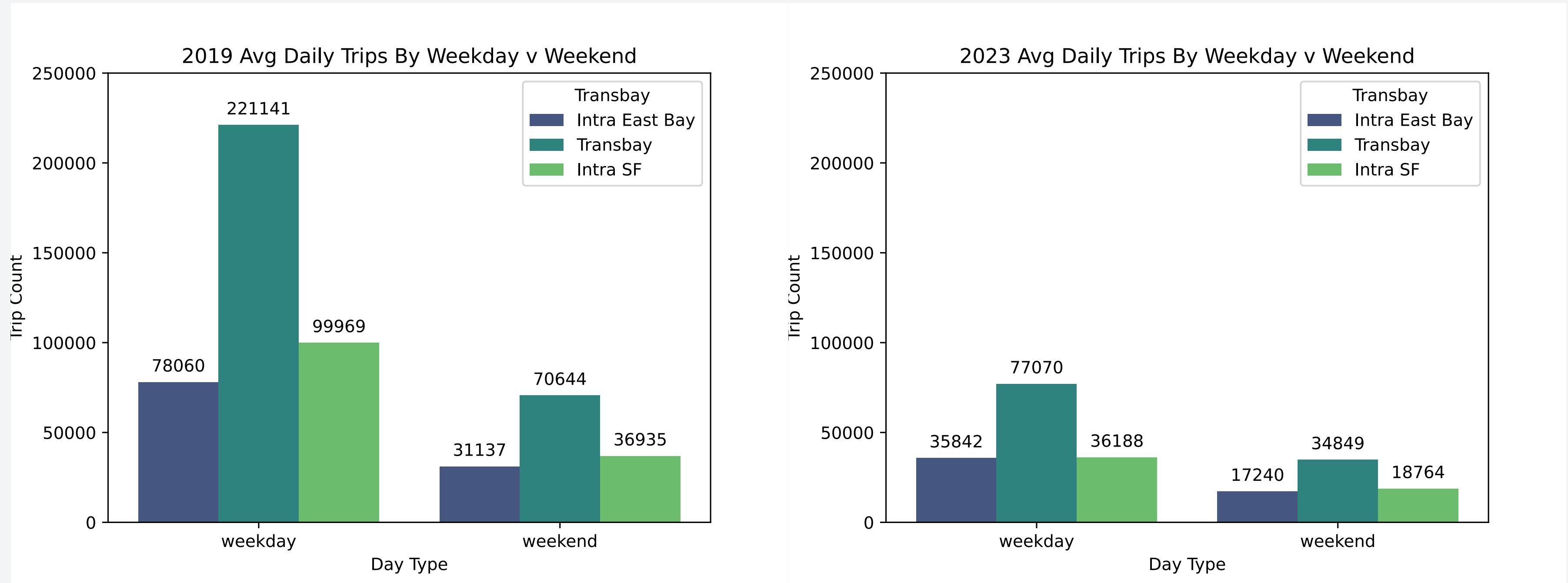


2023

Avg Monthly
Trips = 3.1 Million



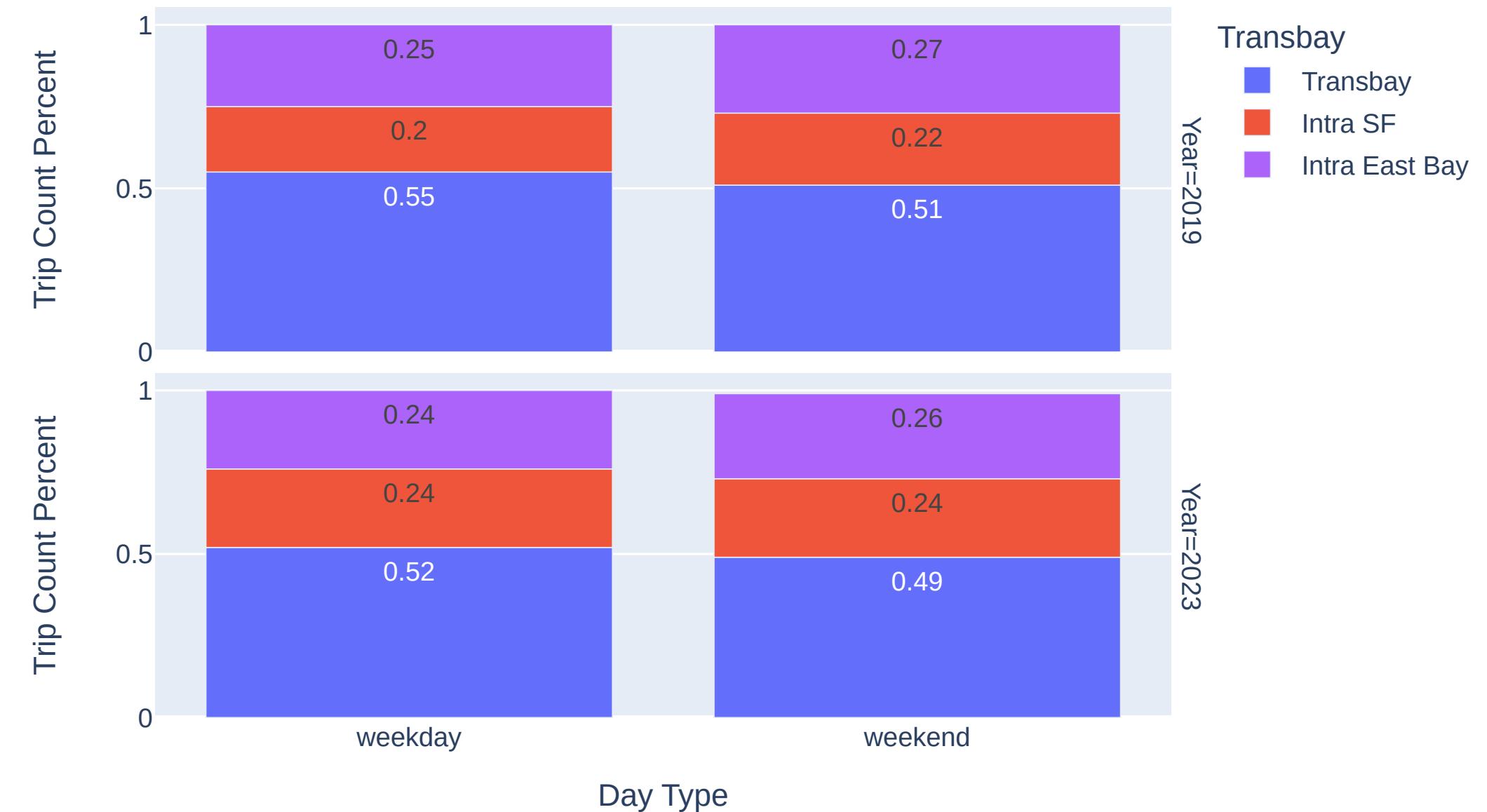
COMMUTE DISTRIBUTION



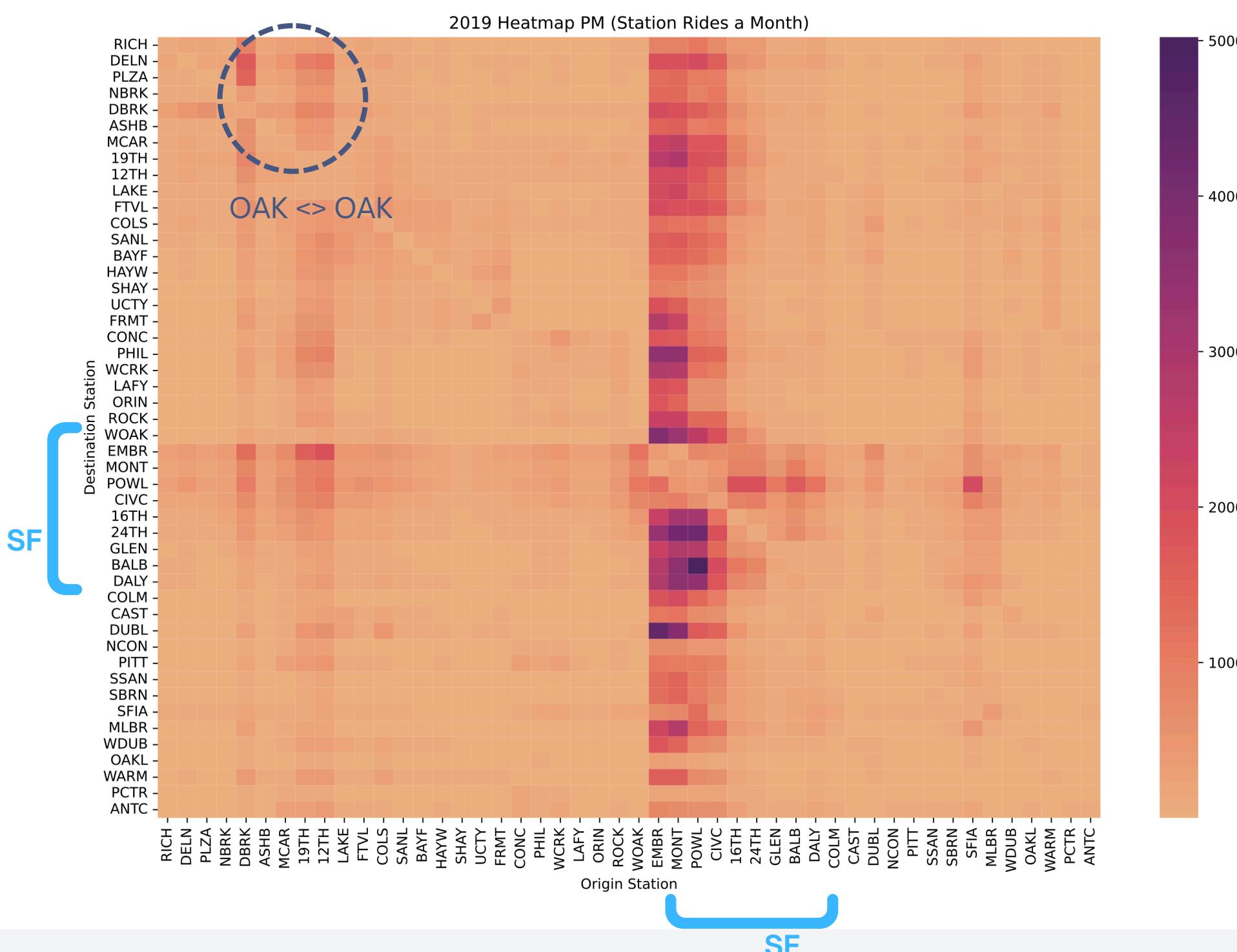
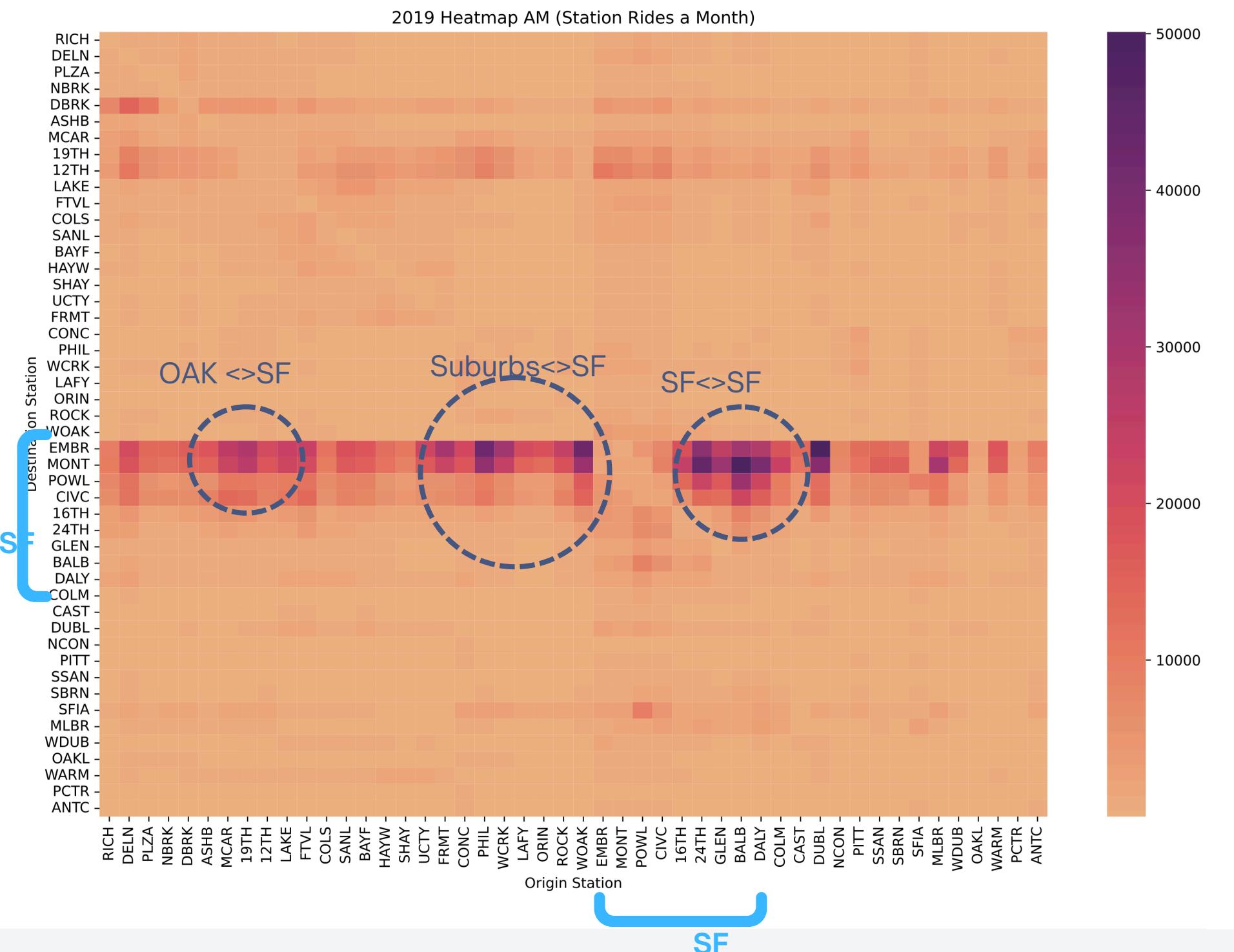
COMMUTE TYPE

- The percentage breakdown of commutes type (Intra SF, Intra East Bay, and Transbay) has shifted 2019 v 2023.
- A smaller percentage of riders relative to overall rider volume are using BART to travel across the bay.
- A higher percentage of riders are traveling within SF.

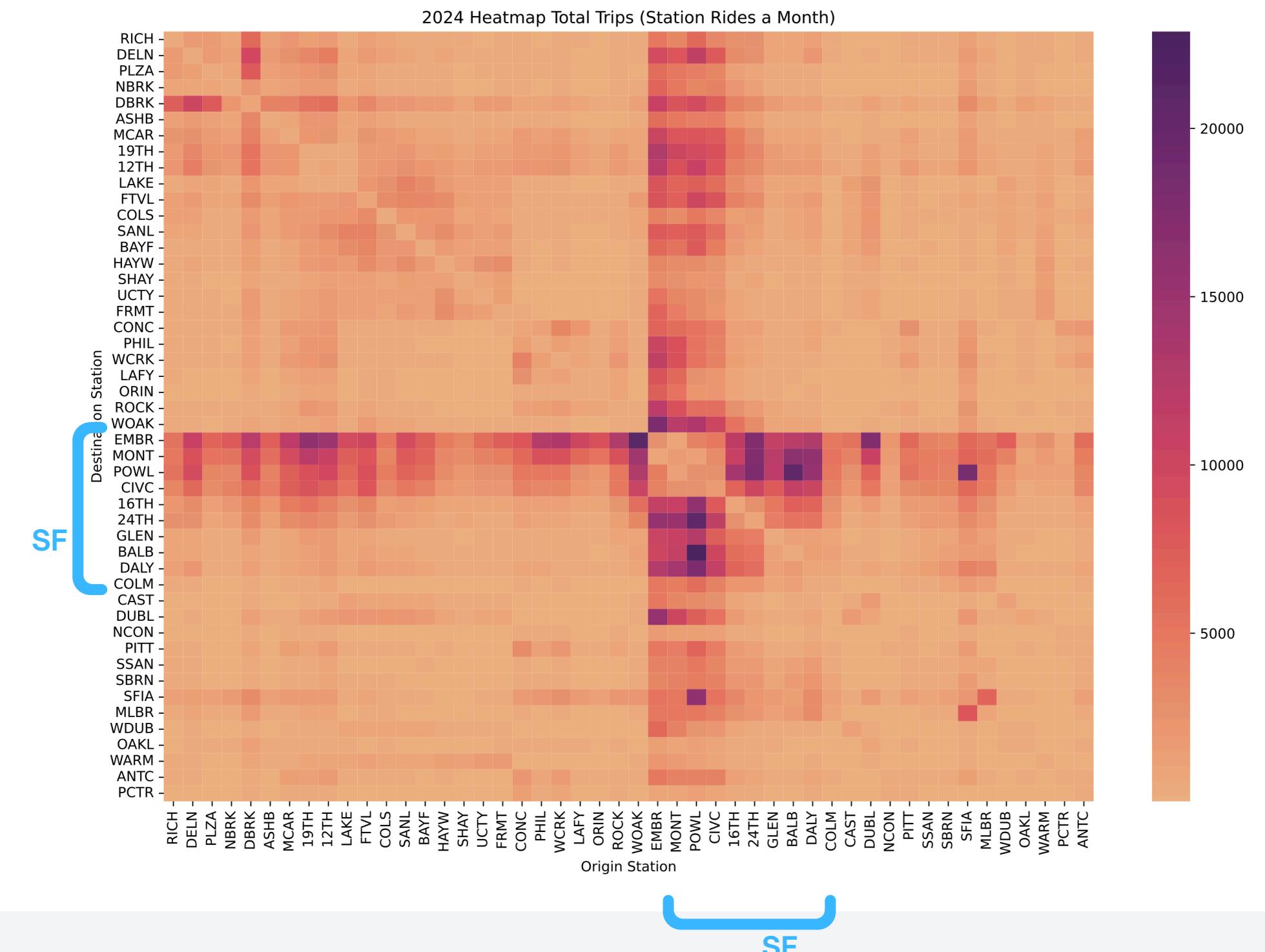
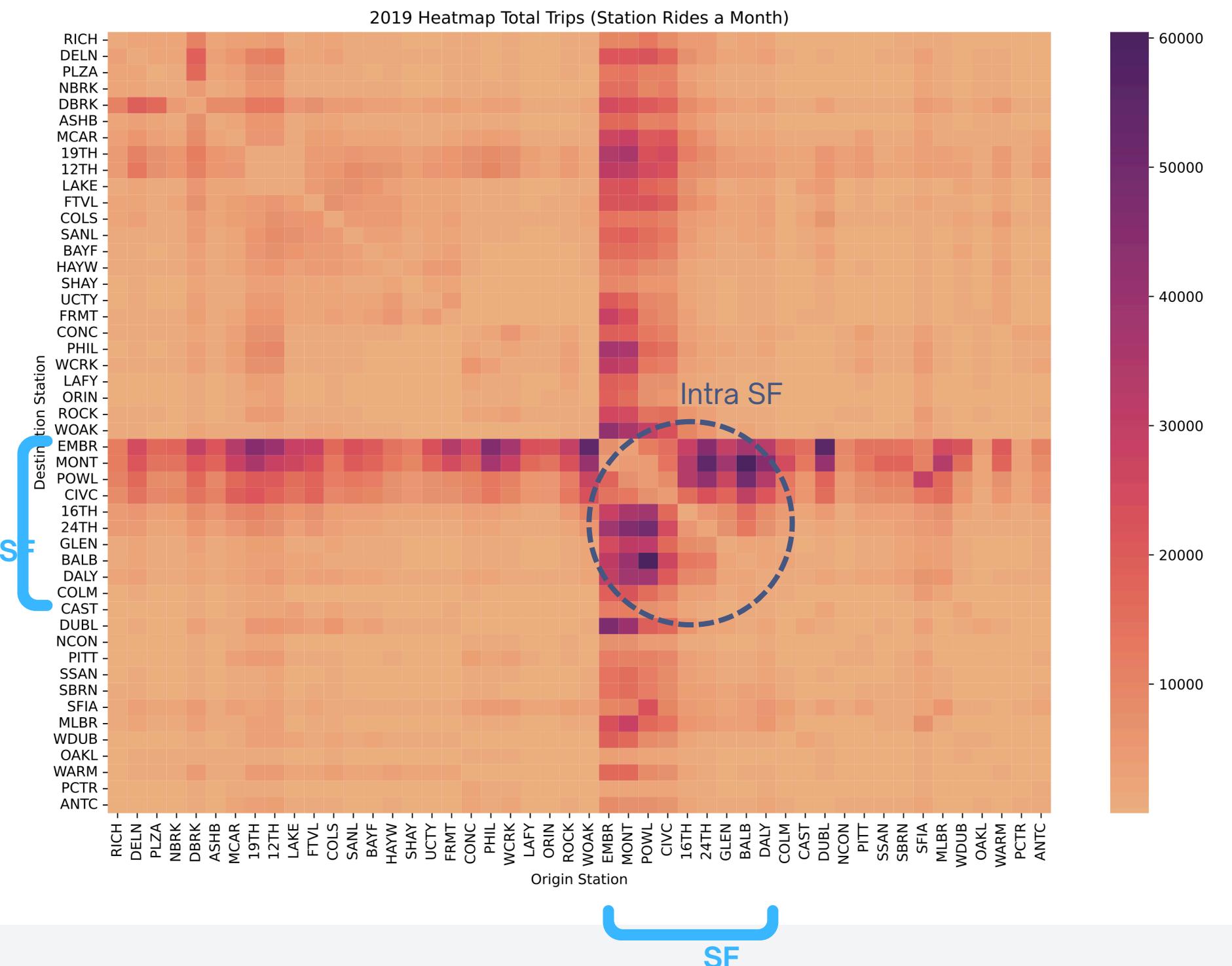
2019 v 2023: Relative Trip Percentages by Day Type and Commute Type



BART ROUTES



BART ROUTES



SF DOWNTOWN 4 STATIONS

Out of 50 total stations, SF Downtown Stations are either an Origin or Destination Station for 30% of all trips in 2023/2024.

Down from 33.6% in 2019.

30%



TRIPS



EMBARCADERO

Mix of waterfront tourism, retail, and financial district activity.

Nearby: Google, Ferry Terminal, restaurants, recreation.



MONTGOMERY

Mostly corporate offices with some takeout lunch restaurants.

Nearby: Wework, Bank of America, Chinatown.



POWELL

Epicenter of tourism with hotels and shopping. Historic Cable Car terminal.

Nearby: Cable Car, Westfield Mall, Union Square, Hotels. Flagship stores and movie theaters.



CIVIC CENTER

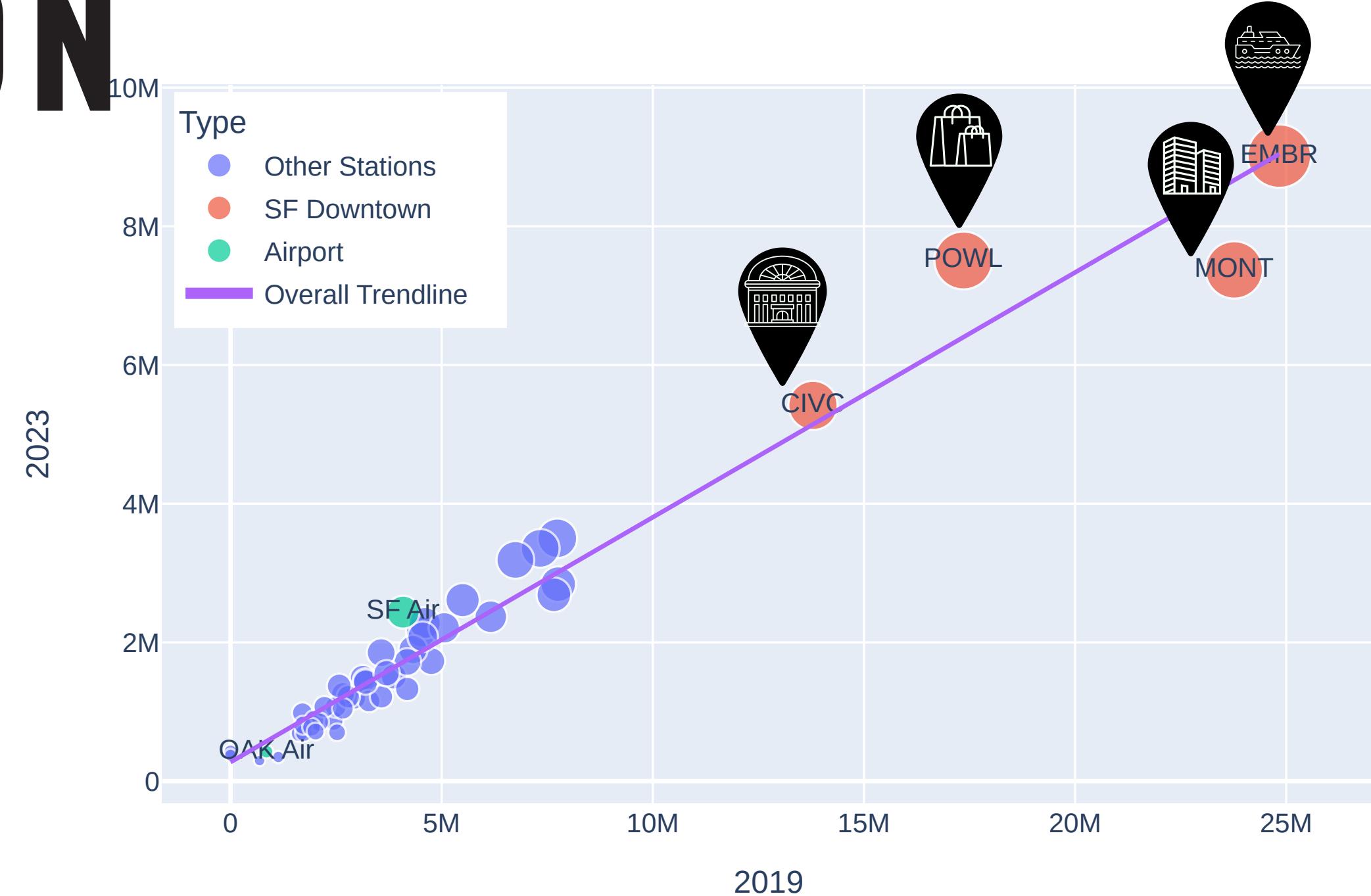
Epicenter of city organizations and city services

Nearby: City Hall, Planning, Building, Transpotation Departments. City Services.

BOUNCEBACK BY STATION

2022 vs 2019 Ridership by Station

- Average 2023 of 2019 % ridership per stations is 35%.
- Top four stations in gross ridership are SF Downtown Stations. POWL Station is leading other stations in bounce back at 43.2%, while MONT is lagging at 31.01%.

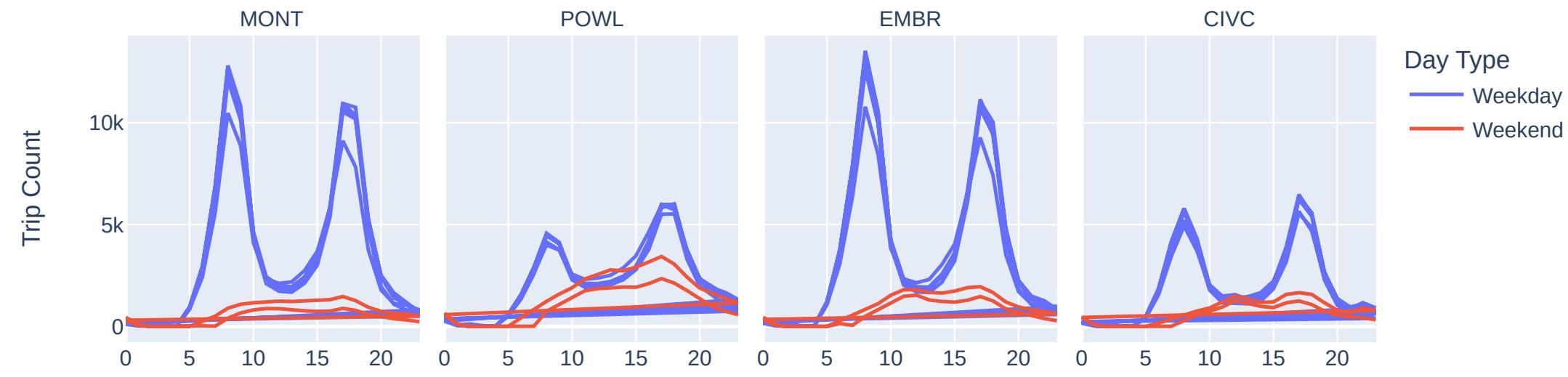


DOWNTOWN STATION BY HOUR

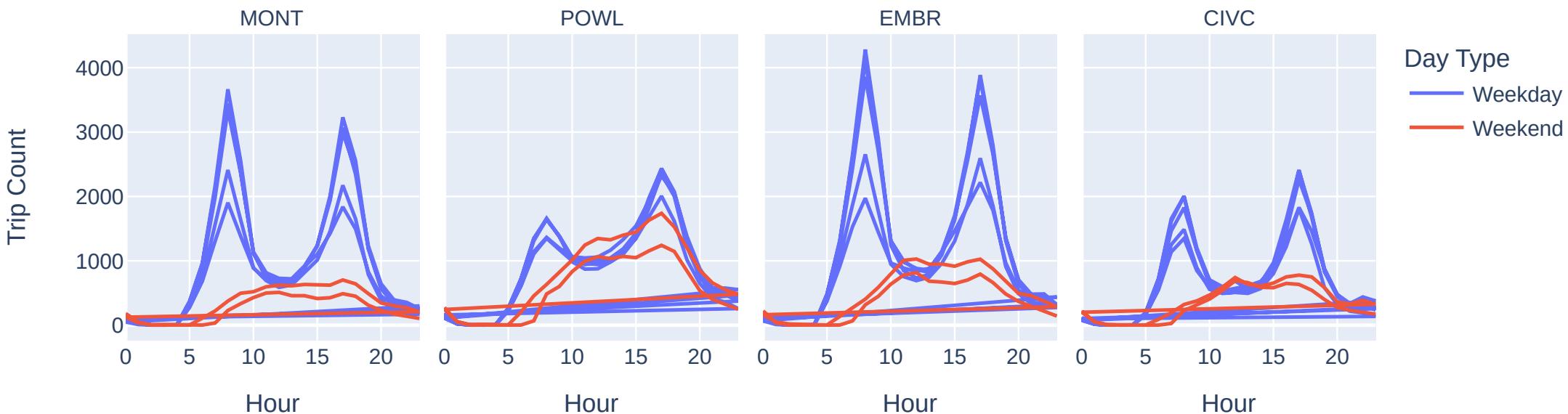
- Weekday commute has two peaks, one at 8 am and the other at 5 pm. Central purpose of riding BART is commuting.
- Weekend trips follow a more gradual slope between 10am - 8pm.
- Commute 2019 is uniform across weekdays, but start to spread out in 2023 with more variance.

DOWNTOWN STATION BY

2019 SF Downtown Hourly Ridership



2023 SF Downtown Hourly Ridership



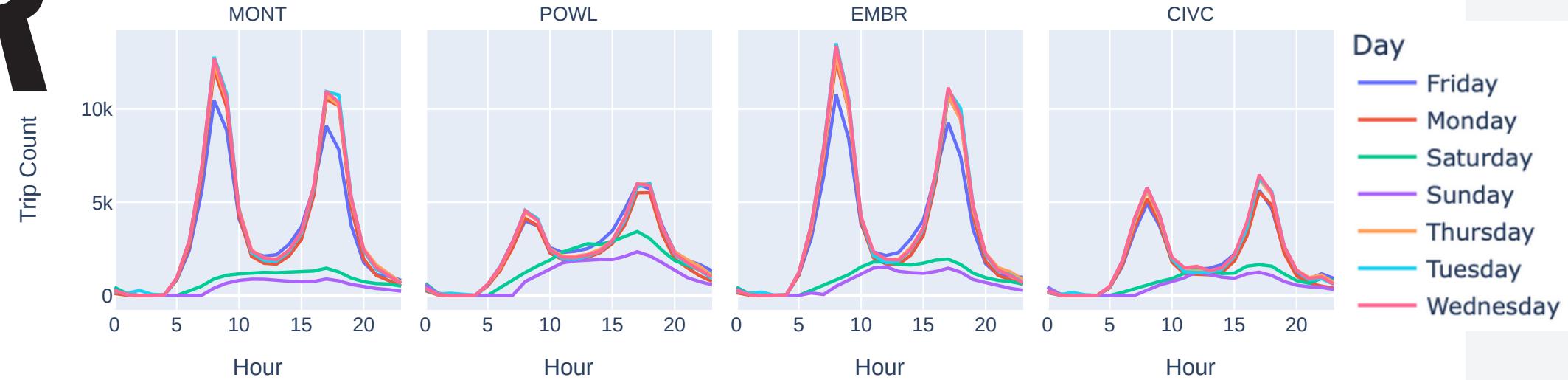
Day Type
Weekday
Weekend

Day Type
Weekday
Weekend

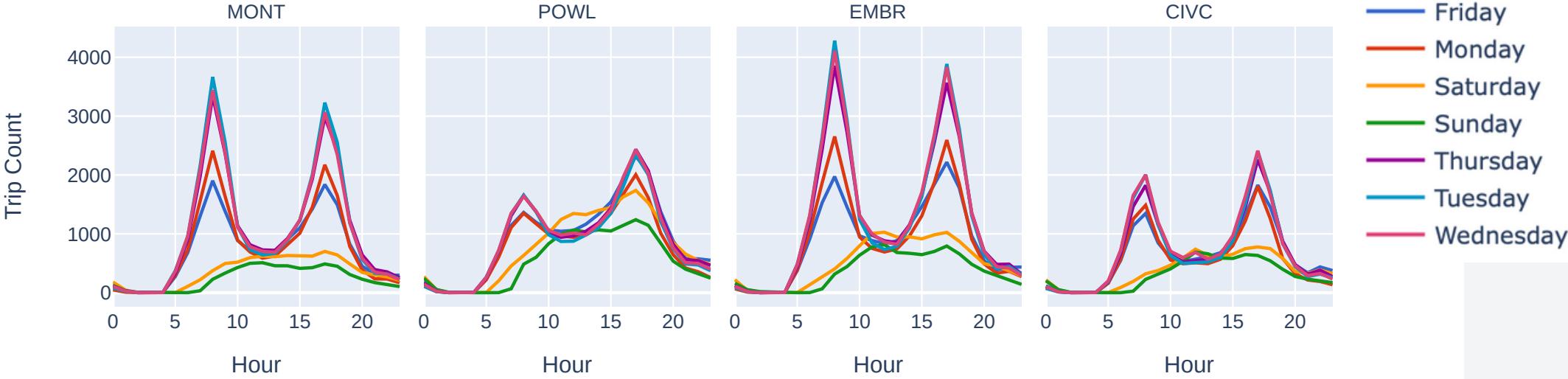
DOWNTOWN STATION BY DAY & HOUR

- Variance in weekday rider volume can most likely be attributed to hybrid remote work introduced by corporate offices. EMBR and MONT impacted the most.
- Tuesday, Wednesday, and Thursday have the highest trip volume. Friday shows the least.
- There appears to be more overlap in weekday weekend trendlines.

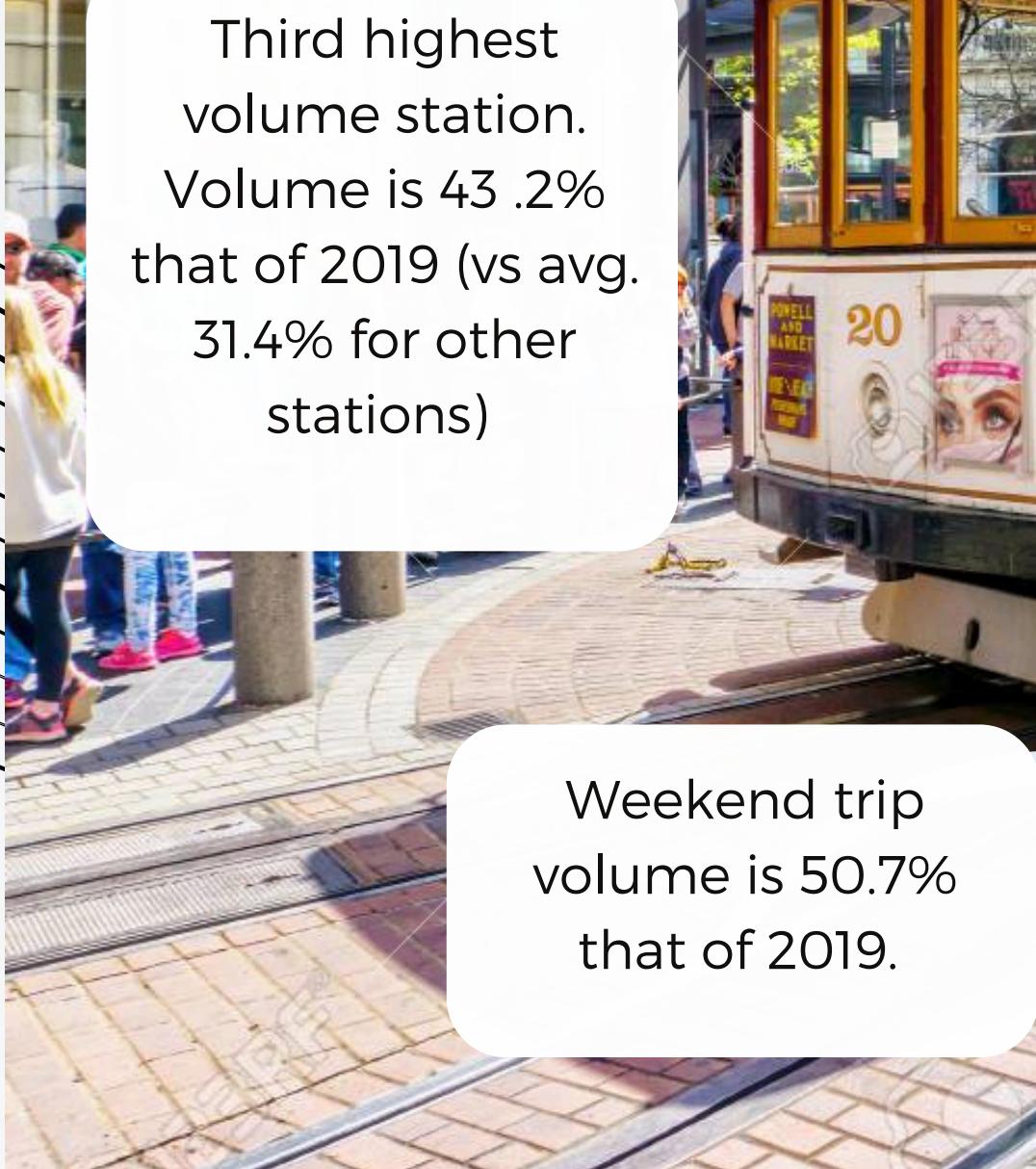
2019 SF Downtown Hourly Ridership



2023 SF Downtown Hourly Ridership



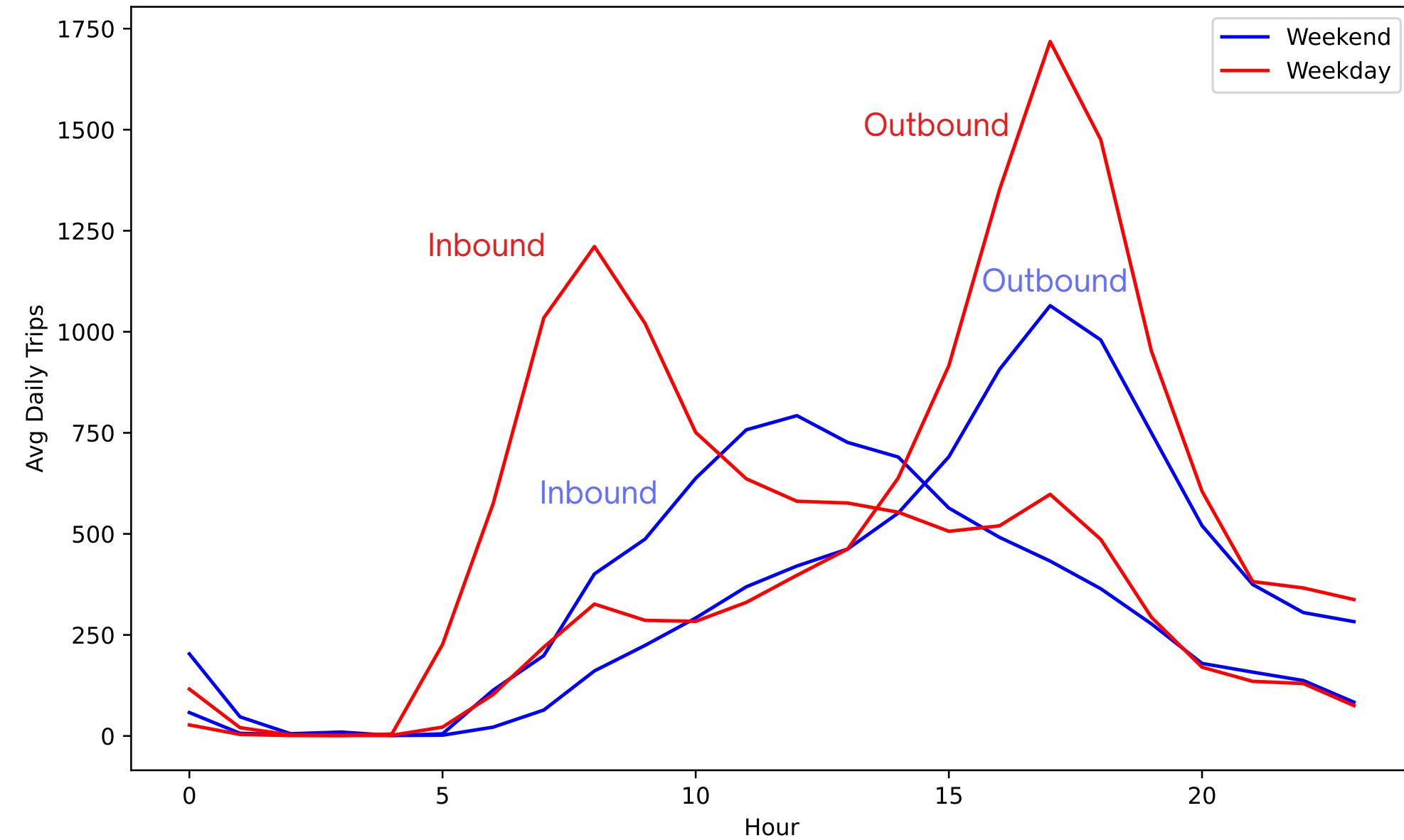
POWELL STATION



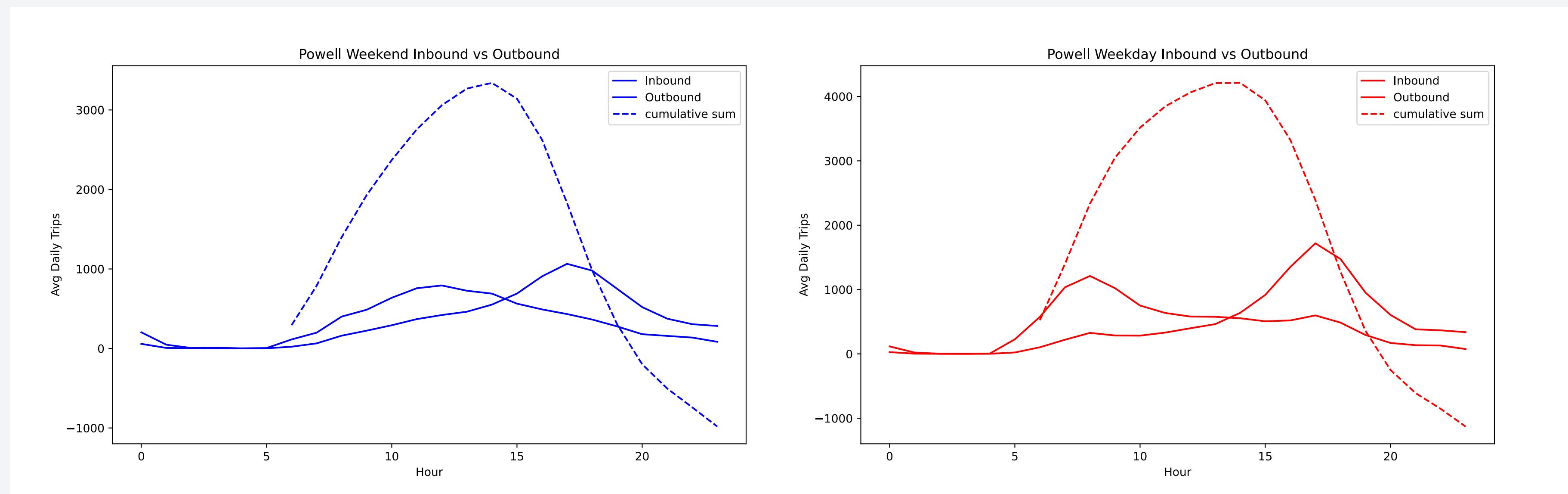
Third highest volume station. Volume is 43.2% that of 2019 (vs avg. 31.4% for other stations)

Weekend trip volume is 50.7% that of 2019.

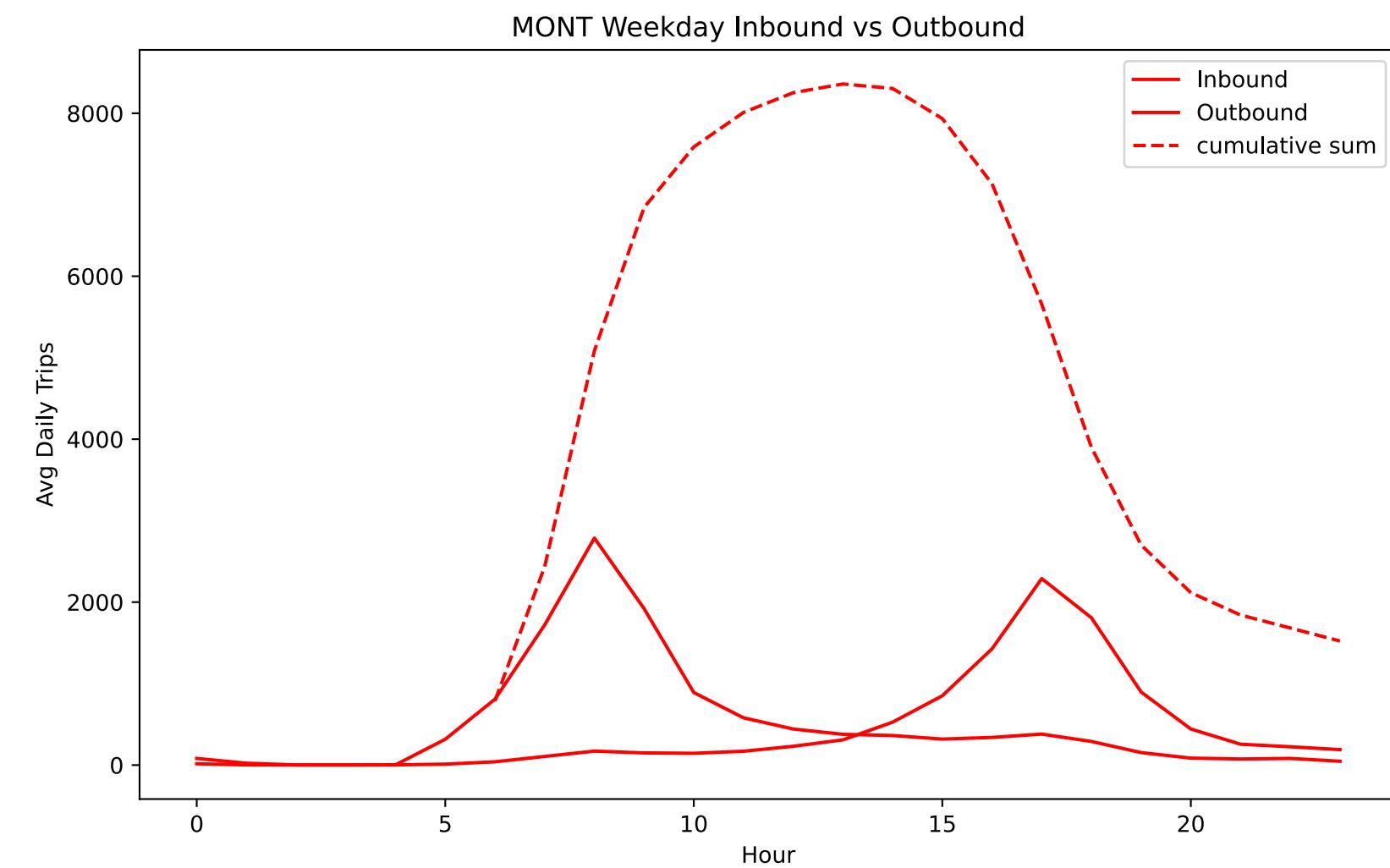
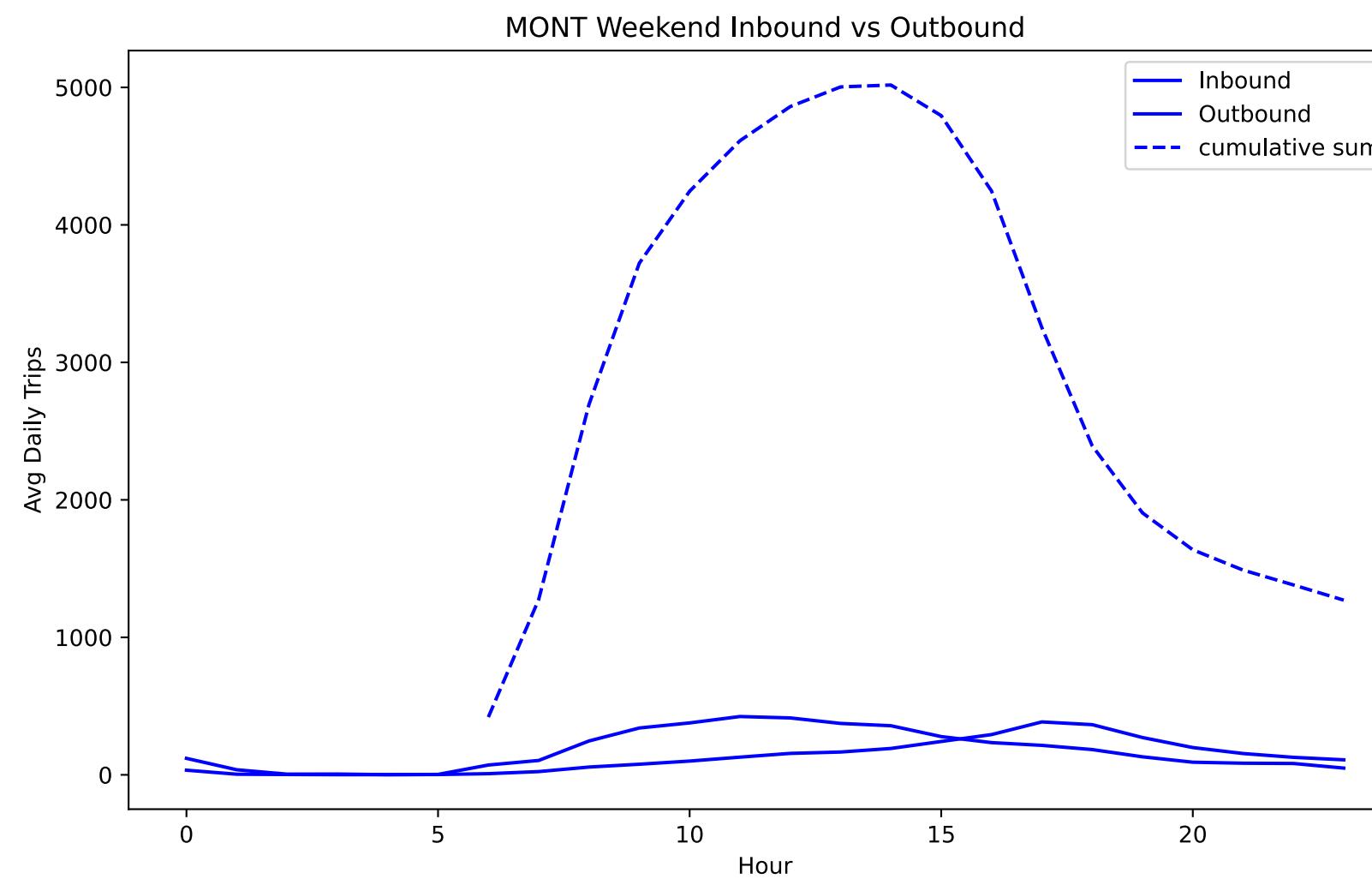
Powell Weekdays vs Weekends, Inbound vs Outbound



2023 POWELL PEAKS

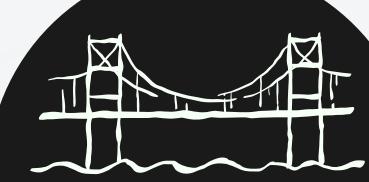


2023 MONT PEAKS



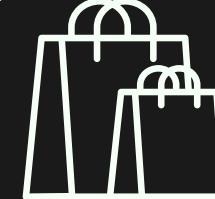
CONCLUSION

Overall ridership is at 50% of pre-pandemic times. Although BART trip volume is rebounding, it may not rebound to pre-pandemic numbers. Key factors or changes in ridership:



Transbay volume has changed. There are many east bay stations that feed into SF, but the main routes that are lagging is between Oakland downtown and SF Downton.

TRANSBAY



Weekday commutes are no longer uniform Monday – Friday. For the two busiest stations, MONT and EMBR, Friday ridership is at half the volume as its Tuesday, Wednesday, Thursday ridership.

REMOTE WORK



Stations serving retail and leisure hotspots are leading rebounded. Suggests that riders are willing to commute for these reasons.

RETAIL & TOURISM

DISCUSSION

It is unlikely that ridership will return to its pre-pandemic volume as significant changes have been made to the way we gather.

Large tech offices continue to vacate SF Downtown: Google vacate 300k square feet, Salesforce vacates Salesforce tower, decreases their footprint by 45%.

As tech companies continue downsizing, they are increasingly embracing a remote work model.



Large retailers are following suite and vacating their leases. Westfield Mall defaults on their loan, Macy's selling their two buildings, Uniqlo and Forever 21 also closing.

Vacant storefronts will negatively impact this retail hub.

Without anchors, such as corporate offices or flagship retail to draw riders to SF Downtown, BART ridership will not return to its full capacity, putting its operational costs at risk.

More concerning, SF Downtown is at risk of losing its vibrancy and commercial hub.

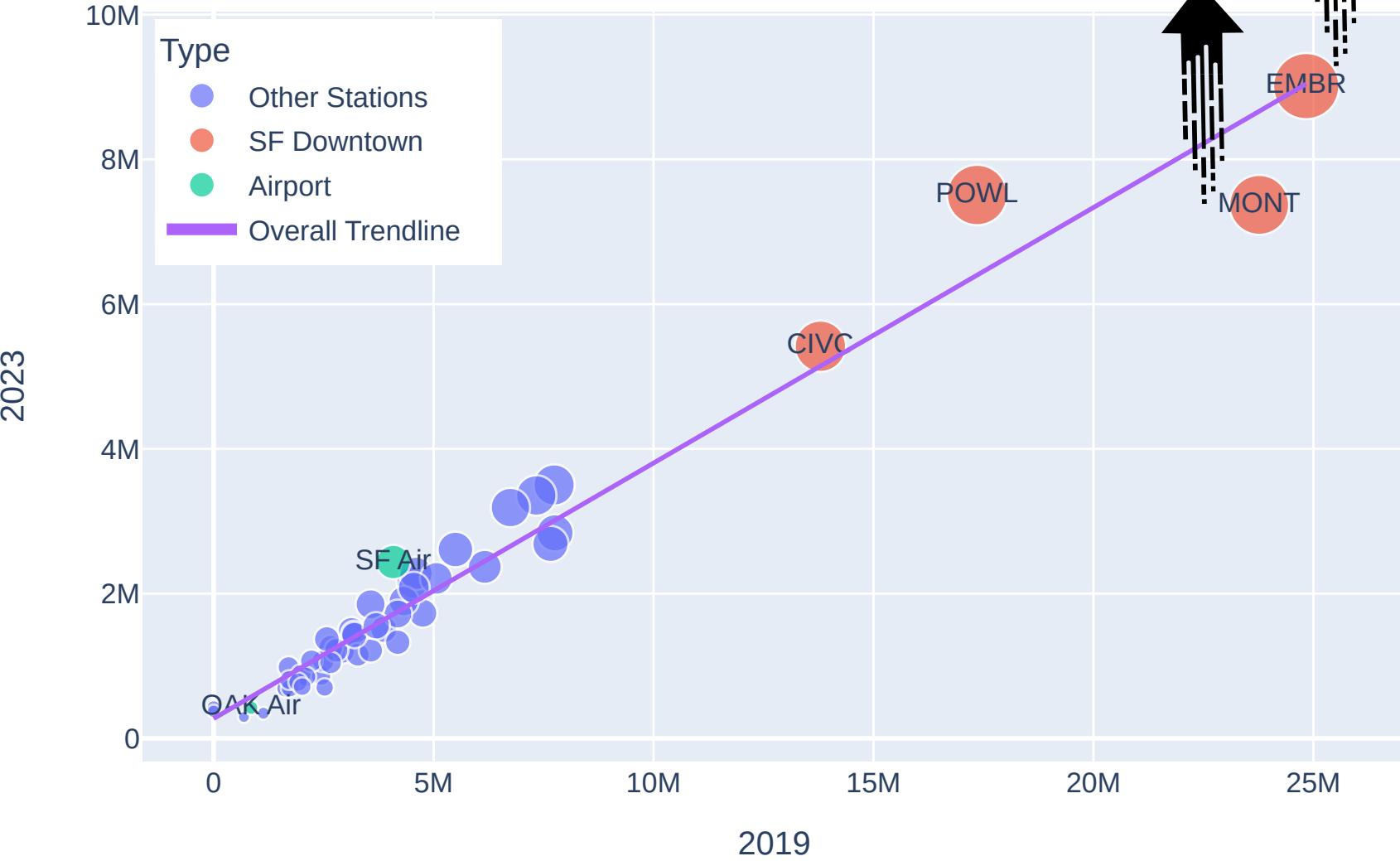


RECOMMENDATIONS

Increase overall downtown ridership by working with employers to sign new spaces or remain downtown.

Enact past strategies akin to waiving payroll tax for employers in opening in development areas.

2022 vs 2019 Ridership by Station

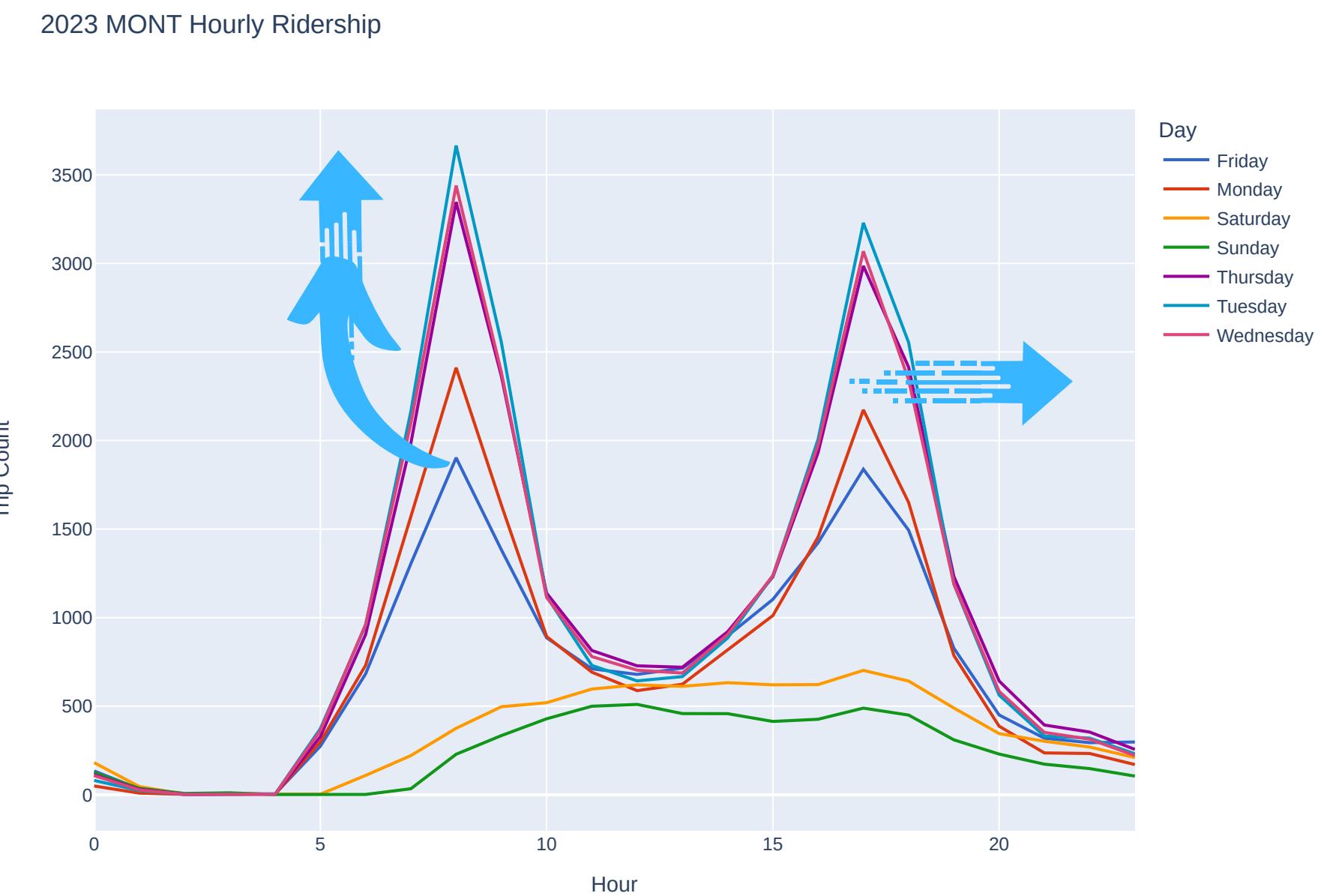


RECOMMENDATIONS

Increase and Friday inbound to Downtown ridership by working with restaurants and retail to provide after work attractions.

Restaurant participation could include Friday Happy Hours (recommended hours 2-6pm) or speciality Friday, Saturday, and Sunday menus.

City sponsored initiatives like summer night markets, pedestrian only night areas, could increase overall foot traffic for downtown.

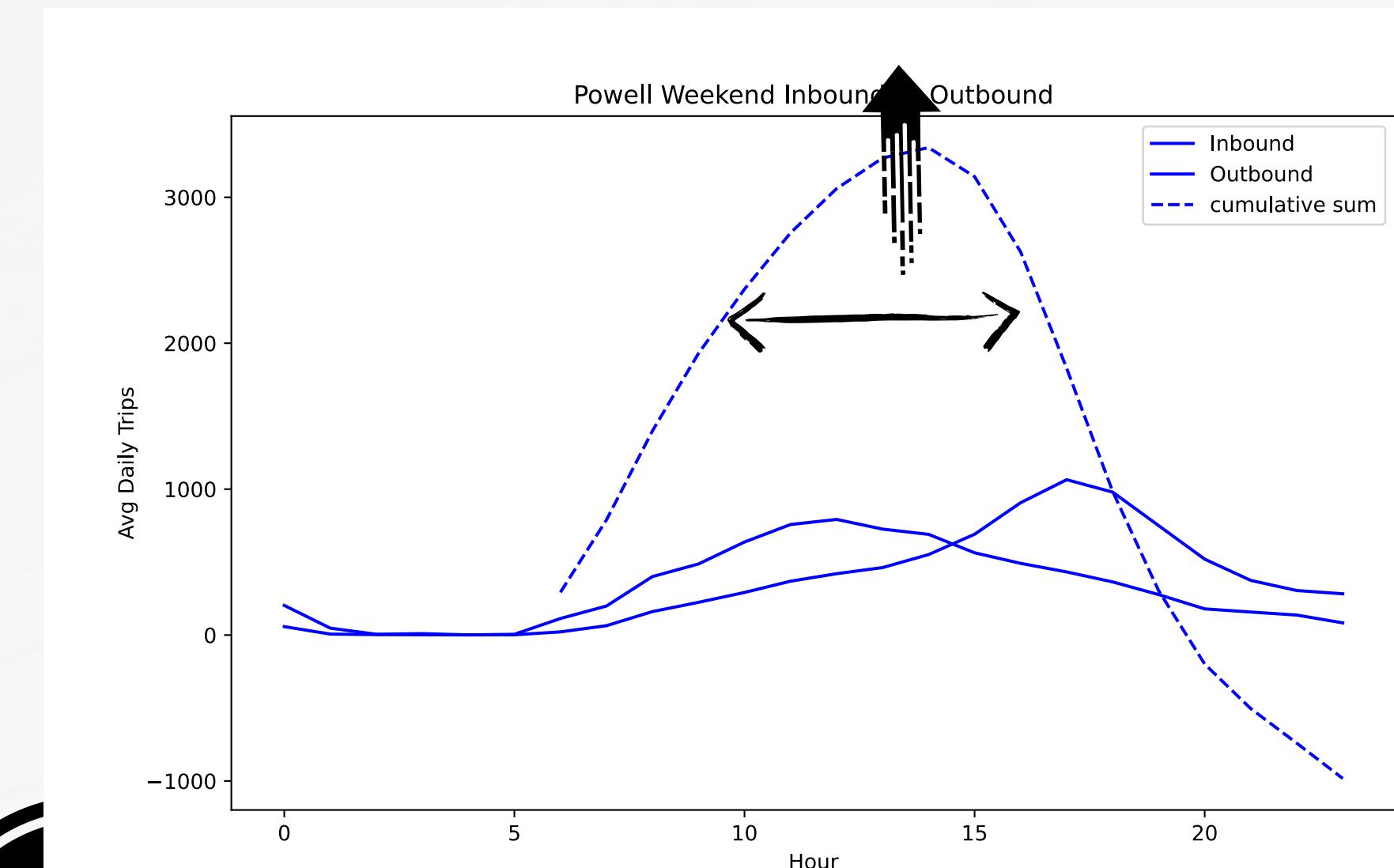


RECOMMENDATIONS

Increase weekend traffic and interest by maintaining storefronts, growing retail and hosting events

Ensure that empty storefronts are filled, even temporarily, with installations or short term leases that engage foot traffic to maintain downtown interest. Low barriers to entry for small business.

Host events in open air spaces to draw people in. Event days are recommended for Saturday and Sunday from 11pm-3pm. Peak audience hour at 1pm-2pm.



Final reflections and future steps

In investigating BART ridership from 2011 to 2024, we charted the historical and current state of ridership through the launch of ride share and through the pandemic.

Perhaps, more importantly, we have unearthed the indelible changes of the pandemic, and how San Francisco and its neighboring 5 counties are choosing to gather. As in person work and commutes change, San Francisco may have to plan for a vibrant Downtown by changing its existing use and purpose.

Future research should be completed to corroborate these findings. SF Muni, Uber, and Lyft Data should investigate overall commute patterns.

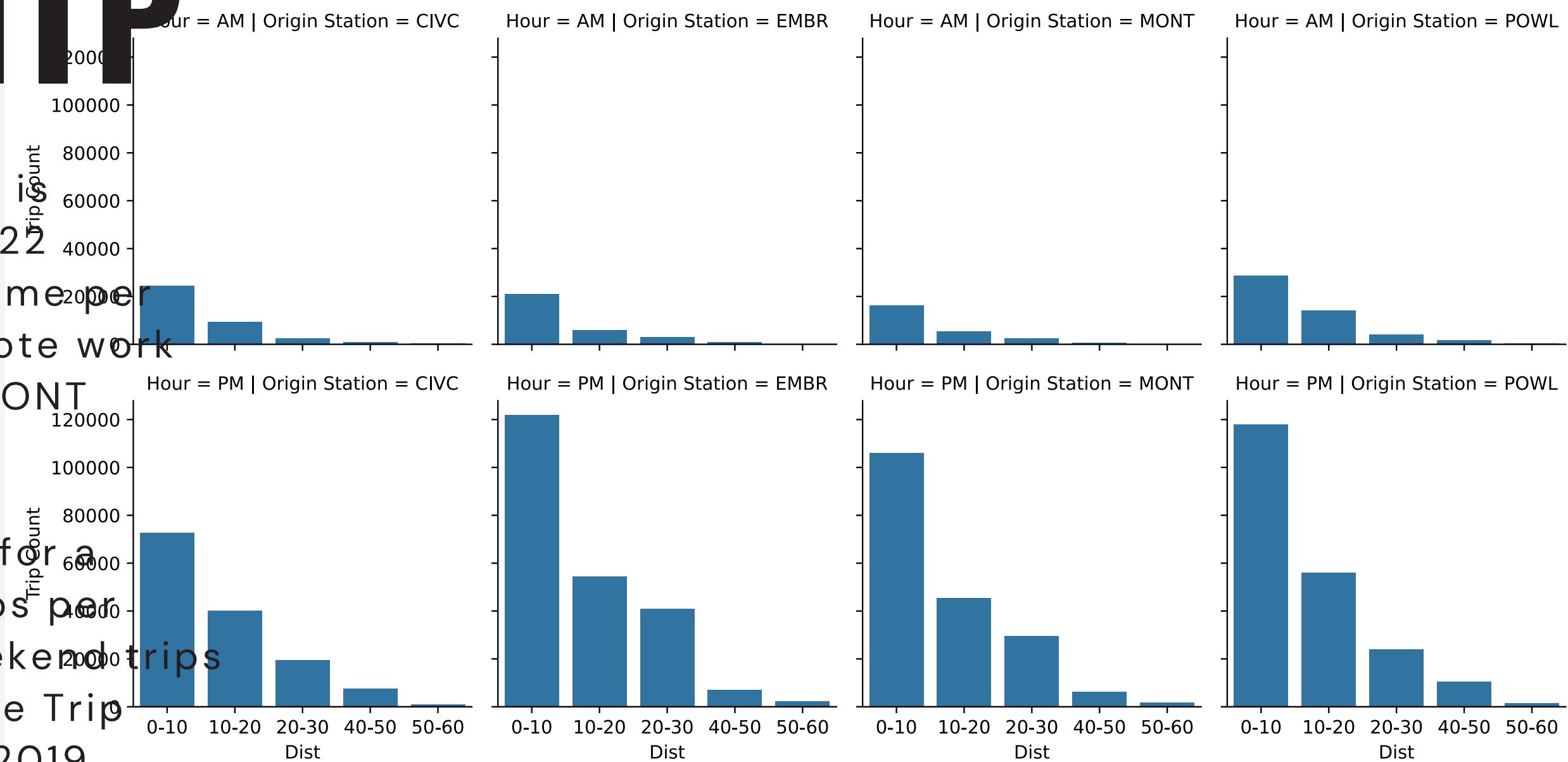




THANK'S FOR
WATCHING

2019 V 2022 RIDERSHIP

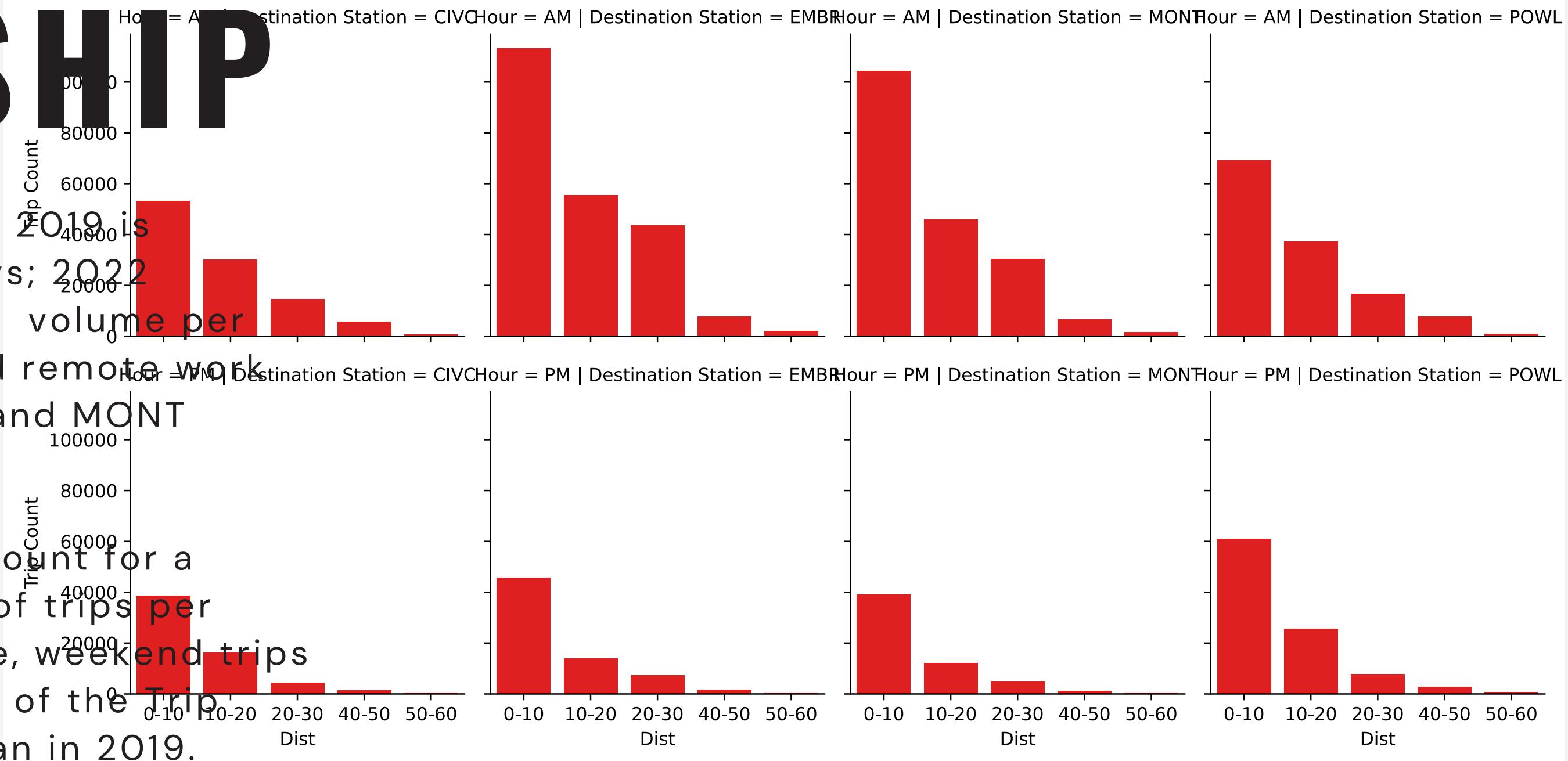
- Weekday commute 2019 is uniform across days; 2022 commute differs in volume per type of day. Hybrid remote work introduced. EMBR and MONT impacted.
- Weekend Trips account for a larger percentage of trips per station. On average, weekend trips represent 5% more of the Trip Volume in 2022 than in 2019.



2019 V 2022

RIDERSHIP

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2019 v 2023 WEEKEND GROWTH

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