CODE FOR NASHVILLE

ELECTRIC SCOOTER ANALYSIS

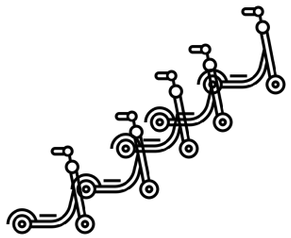
2019-OCT-18

WHY A SCOOTER ANALYSIS

- About Code For Nashville
- Approached by community partner Tony Gonzalez
- Goal: What can the data tell us about the state of Nashville's scooter program?

FOCUS OF SCOOTER ANALYSIS

DATA QUALITY



DENSITY

USAGE

QUICK FACTS ABOUT SCOOTERS

OPERATORS

BIRD
LIME
UBER/JUMP
LYFT
SPIN
BOLT

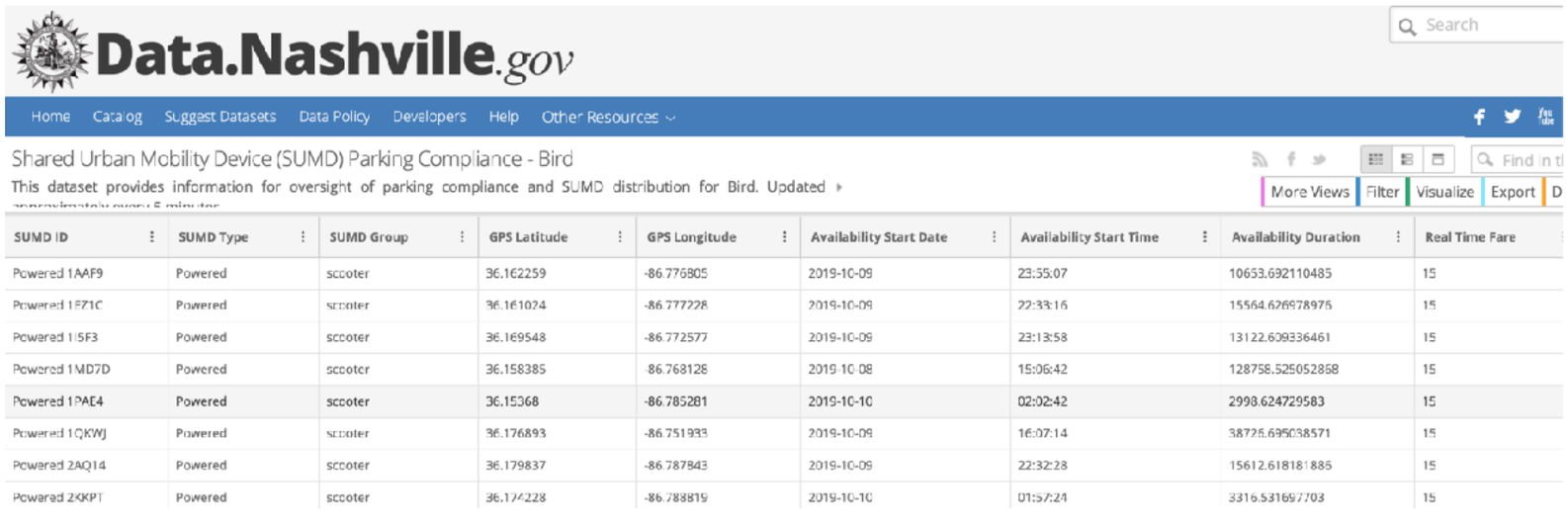
FACTS

15-20 MILE RANGE

THEY NEED TO BE CHARGED

CURFEWS AND GEOFENCING RESTRICT USAGE/PARKING

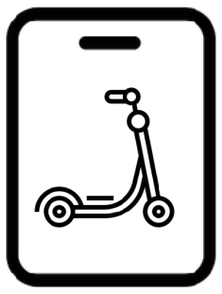
WHAT IS AVAILABLE IN THE PUBLIC DATASET



SUMD ID	SUMD Type	SUMD Group	GPS Latitude	GPS Longitude	Availability Start Date	Availability Start Time	Availability Duration	Real Time Fare
Powered 1AAF9	Powered	scooter	36.162259	-86.776805	2019-10-09	23:55:07	10653.692110485	15
Powered 1FZ1C	Powered	scooter	36.161024	-86.777228	2019-10-09	22:33:16	15564.626978976	15
Powered 1I5F3	Powered	scooter	36.169548	-86.772577	2019-10-09	23:13:58	13122.609336461	15
Powered 1MD7D	Powered	scooter	36.158385	-86.768128	2019-10-08	15:06:42	128758.525052858	15
Powered 1PAE4	Powered	scooter	36.15368	-86.785281	2019-10-10	02:02:42	2998.624729583	15
Powered 1QKWJ	Powered	scooter	36.176893	-86.751933	2019-10-09	16:07:14	38726.695038571	15
Powered 2AQ14	Powered	scooter	36.179837	-86.787843	2019-10-09	22:32:28	15612.618181885	15
Powered 2KKPT	Powered	scooter	36.174228	-86.788819	2019-10-10	01:57:24	3316.531697703	15

Each scooter company's data is published in a separate data feed.

Updated every 5 minutes, the dataset represents the current state of parked scooters.



IDENTIFIER

Unique id for each device

LOCATION

The current latitude and longitude of each scooter

TIME IN LOCATION

The start time in the current location indicating how long a scooter has been in a location, published in UTC time

Code For Nashville began capturing the data every 15 minutes, archiving it for public use at the end of July 2019. This allowed us to review changes over time.

PROBLEMS WITH THE LOCATION DATA

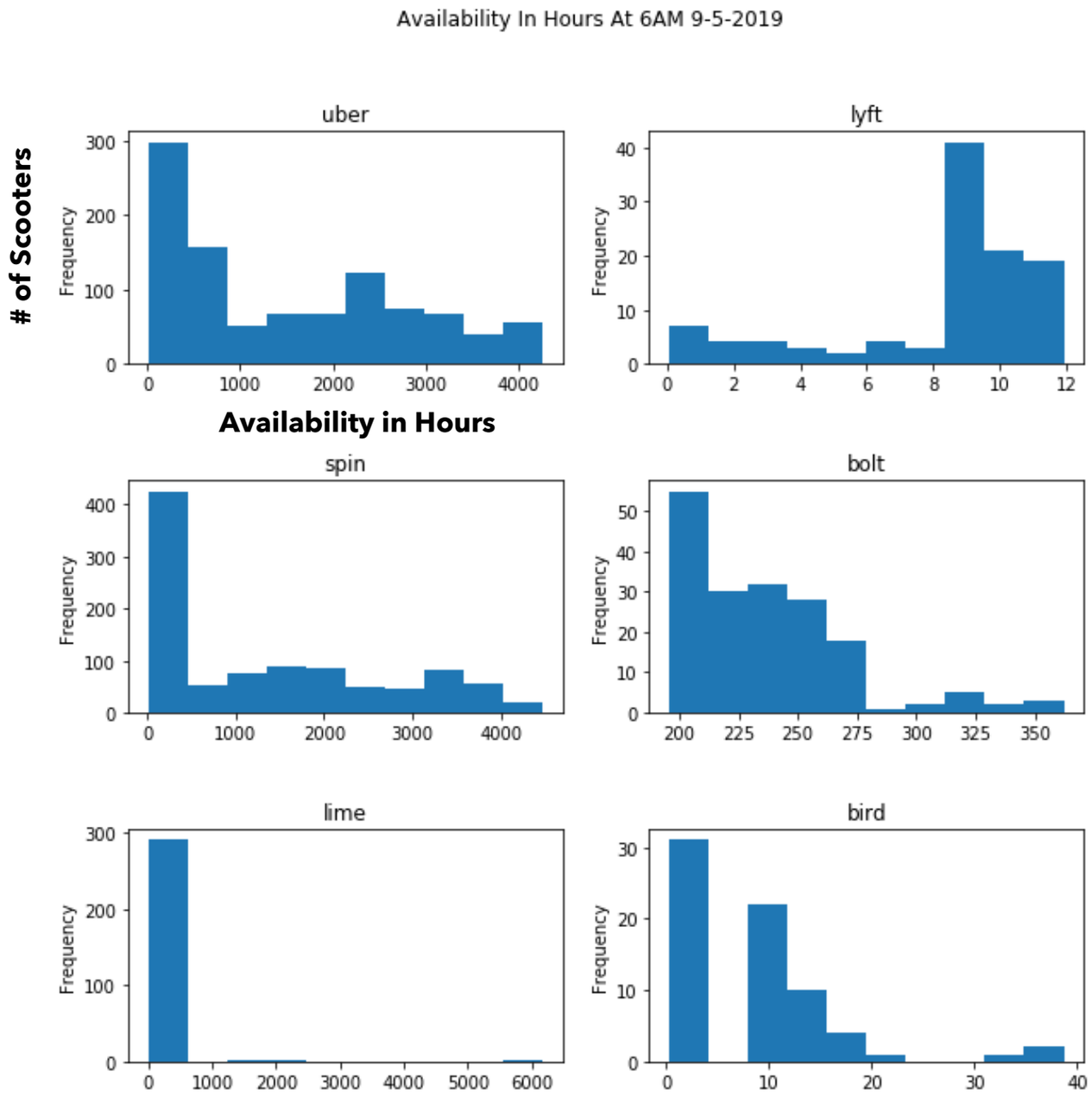
BOLT SCOOTERS

When plotted, Bolt scooters are on the border of Turkey and Syria

OUT OF TOWN SCOOTERS

Companies are publishing the location data for scooters outside of Davidson County

PROBLEMS WITH THE AVAILABILITY DATA – EXTREME AVAILABILITY

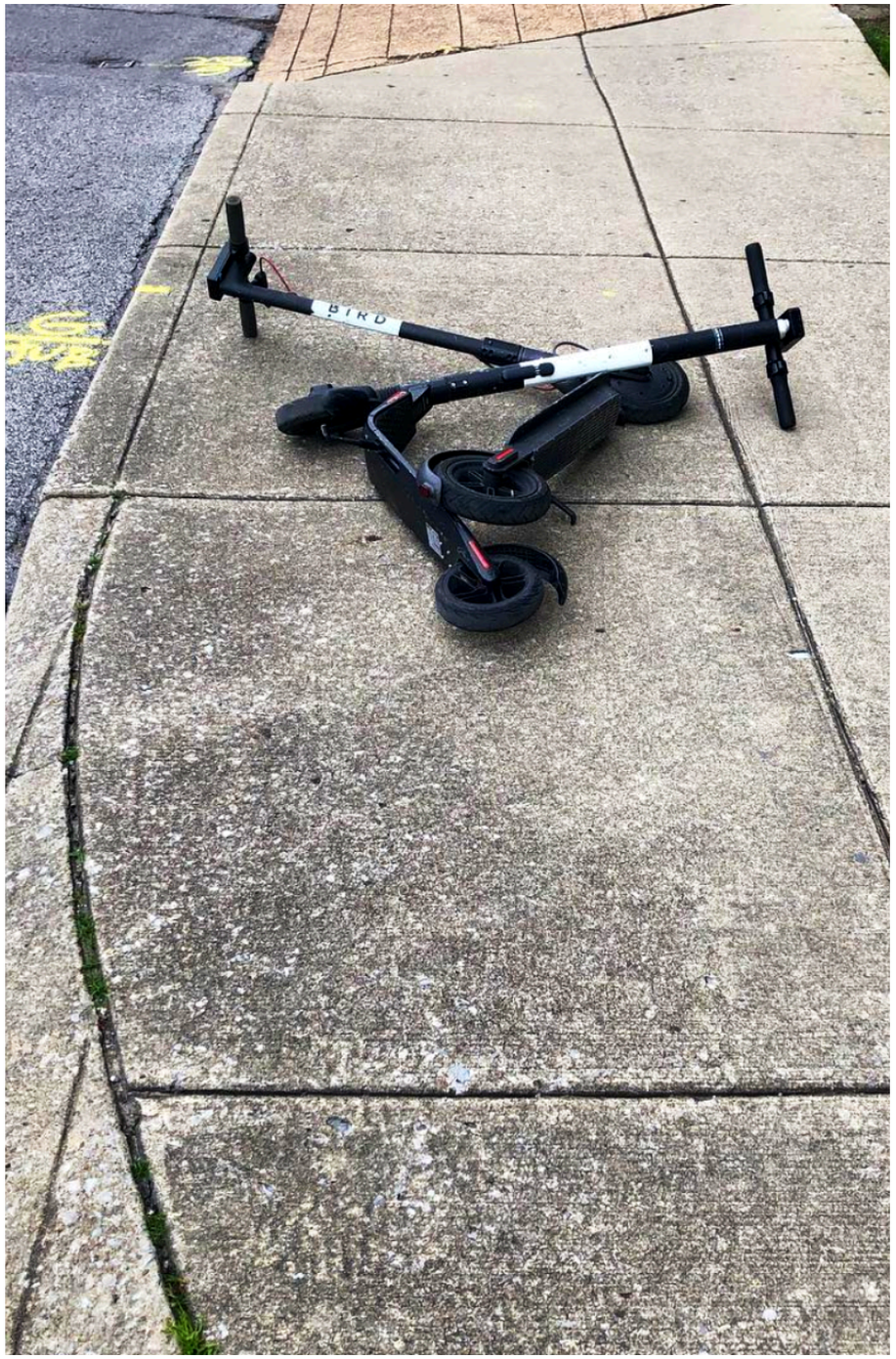


STRATEGIES FOR ELIMINATING DATA ERRORS

1. Remove scooters with availability over 48 hours
2. Focus on scooters within Davidson County - this removes Bolt entirely
3. Focus on ‘active scooters’, those that have shown some movement in the last x days
4. Remove scooter warehouse locations, if known
5. Remove ‘trips’ in excess of x miles

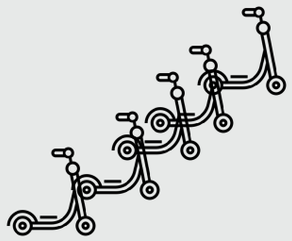
WISHLIST – AREAS OF FUTURE ANALYSIS

- **ADA compliance** - are scooters blocking sidewalks?
  - Data from gyroscopic sensor could detect when a scooter has fallen over
  - We did not leverage the sidewalks inventory data provided by the city due to time constraints
- **Other usage questions:**
  - Why take a scooter vs other forms of transportation including walking?
  - Which paths did scooter riders take?
- **Safety concerns:**
  - Have curfews reduced accidents?



FOCUS OF SCOOTER ANALYSIS

DATA QUALITY



DENSITY

USAGE

SCOOTER LANDSCAPE

	Company	Number Of Published Scooters	Scooters Not Ridden	Active Scooters	Data Quality*
1	**BIRD**	1399	18	1381	**Poor** - missing and non-compliant data
2	**LYFT**	684	28	656	Fair
3	**LIME**	619	24	595	Fair
4	**UBER/JUMP**	1000	614	386	Fair
5	**SPIN**	977	635	342	Fair
6	**BOLT**	193	45	148	**Poor** - inaccurate location data
7	**GOTCHA**	227	207	20	NA - no longer operating in Nashville
		5099	1571	**3508**	

Based on data extracted between 7-22-2019 and 8-5–2019, active scooters are those that had at least one valid trip during time-period

* Subjective measure based on experience and findings by Nashville Software School Data Analysis Cohort 1

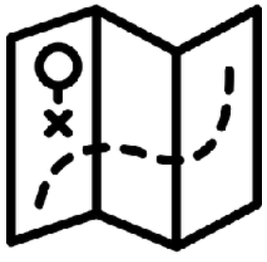
WHAT DETERMINES THE NUMBER OF SCOOTERS IN A LOCATION

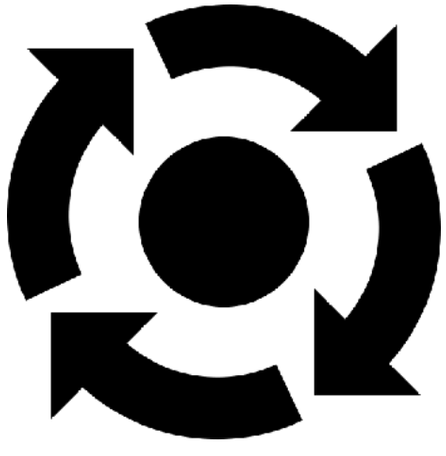
PLACEMENT

Company/charger placement based on expected demand

ROUTING

The companies instruct chargers on where to drop charged scooters



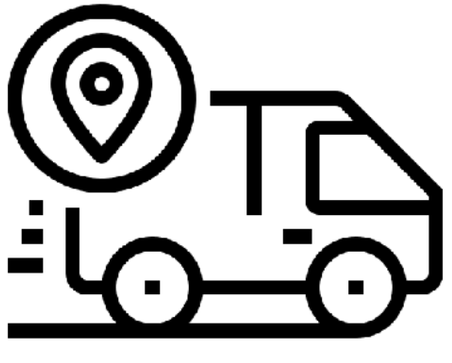


RIDES

Users ride scooters and park them at the destination.

CHARGING

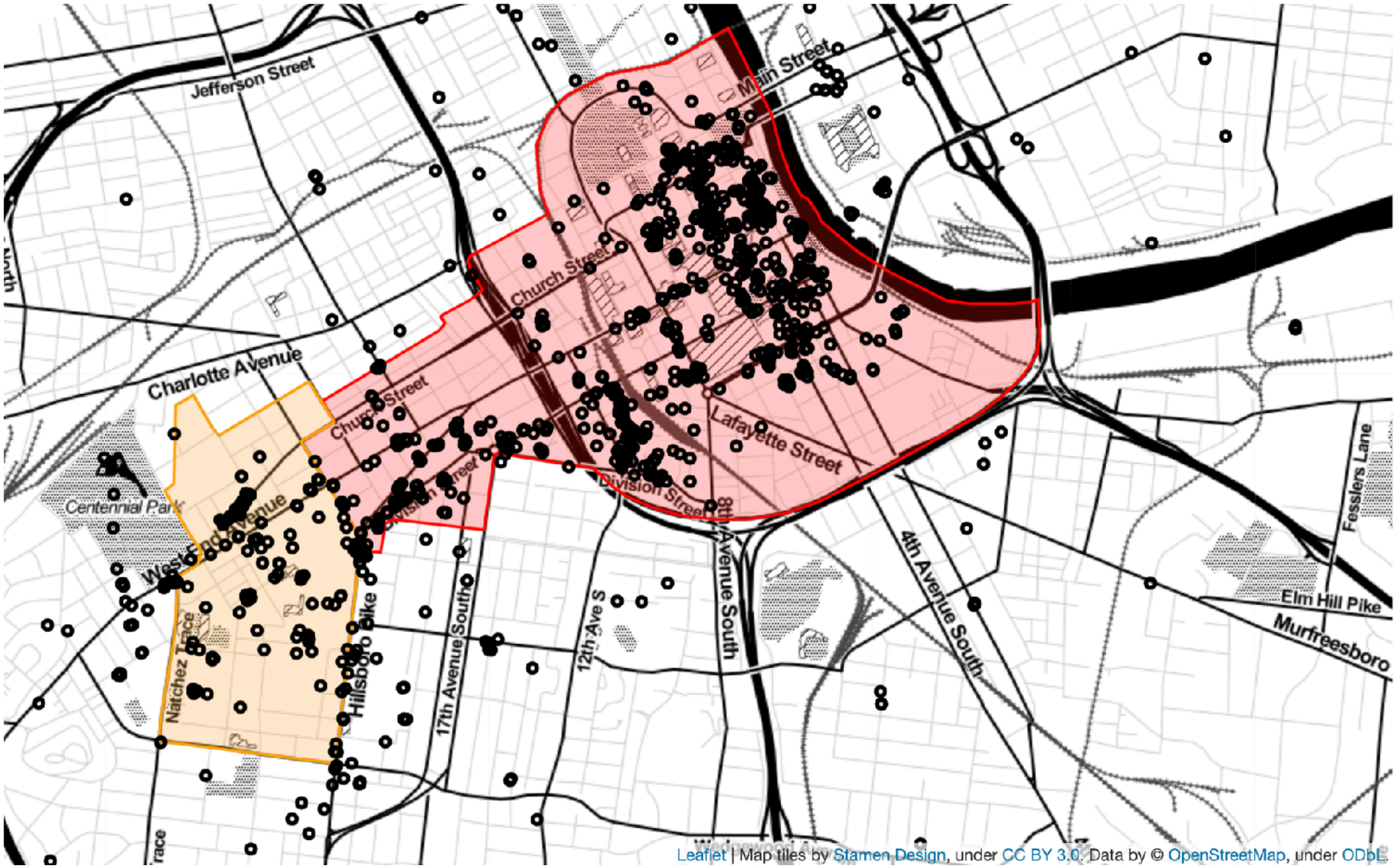
Chargers take scooters ‘home’ to charge



PICK-UP

Two types: **company redistributes** scooters throughout city and **chargers pick up scooters to charge**

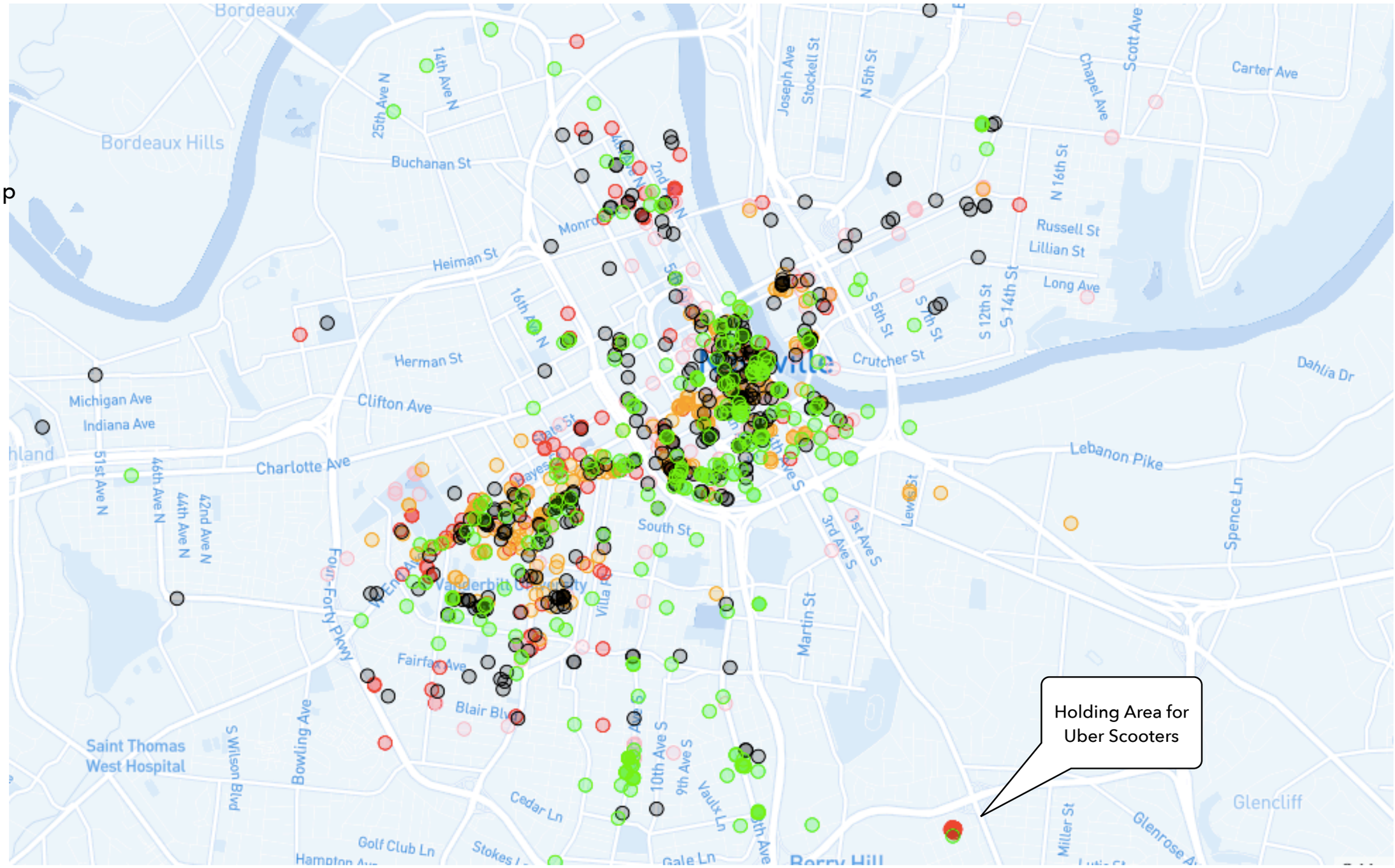
DOWNTOWN AND WEST END CONTAIN THE MAJORITY OF SCOOTERS



For example, on **2019-08-19 11:00:08** - 70% of parked scooters (represented by black circles) were in the two tracts outlined in red and orange below

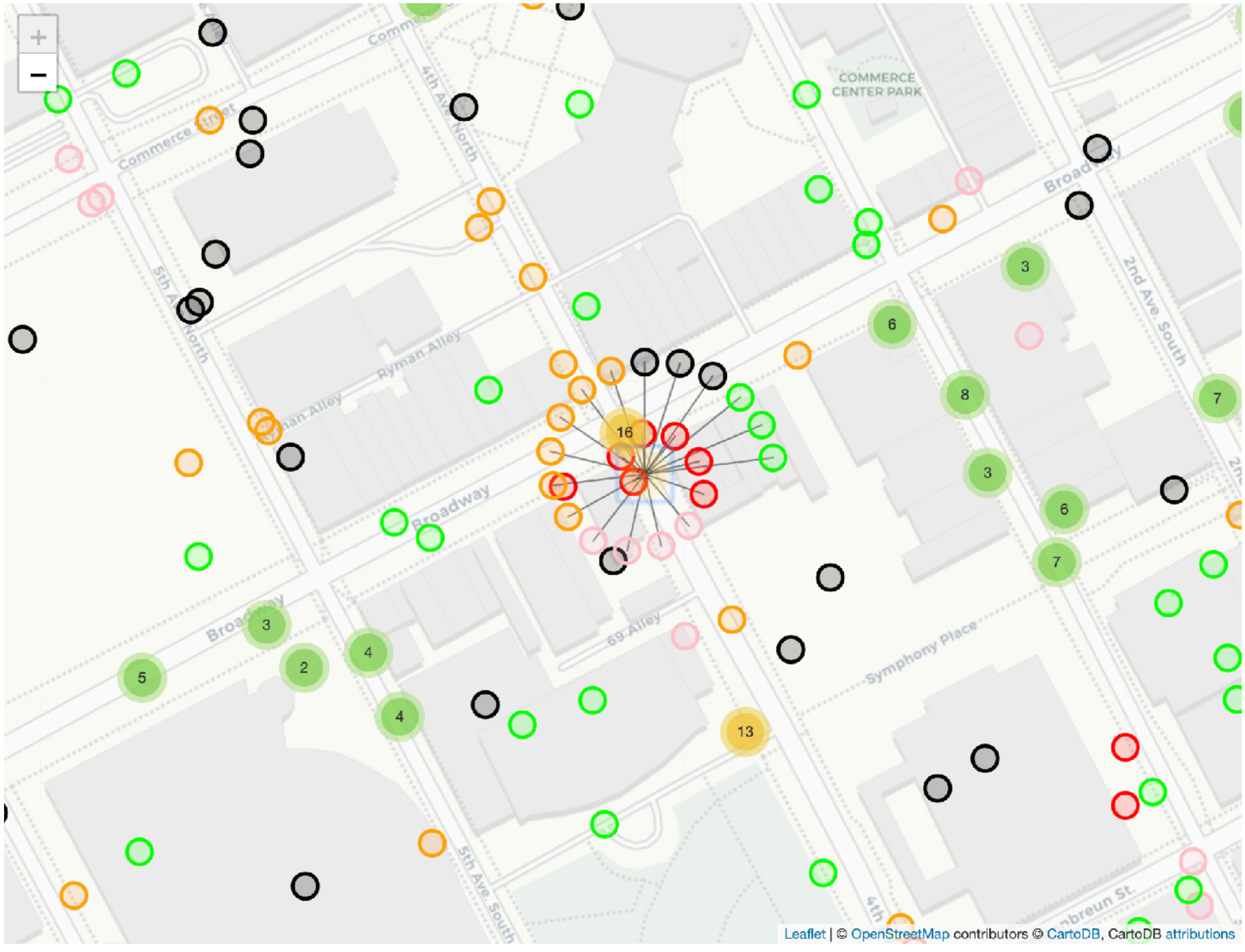
COMPANIES ARE OPERATING IN THE SAME AREAS

- Lime
- Bird
- Uber/Jump
- Lyft
- Spin
- Bolt (not pictured)



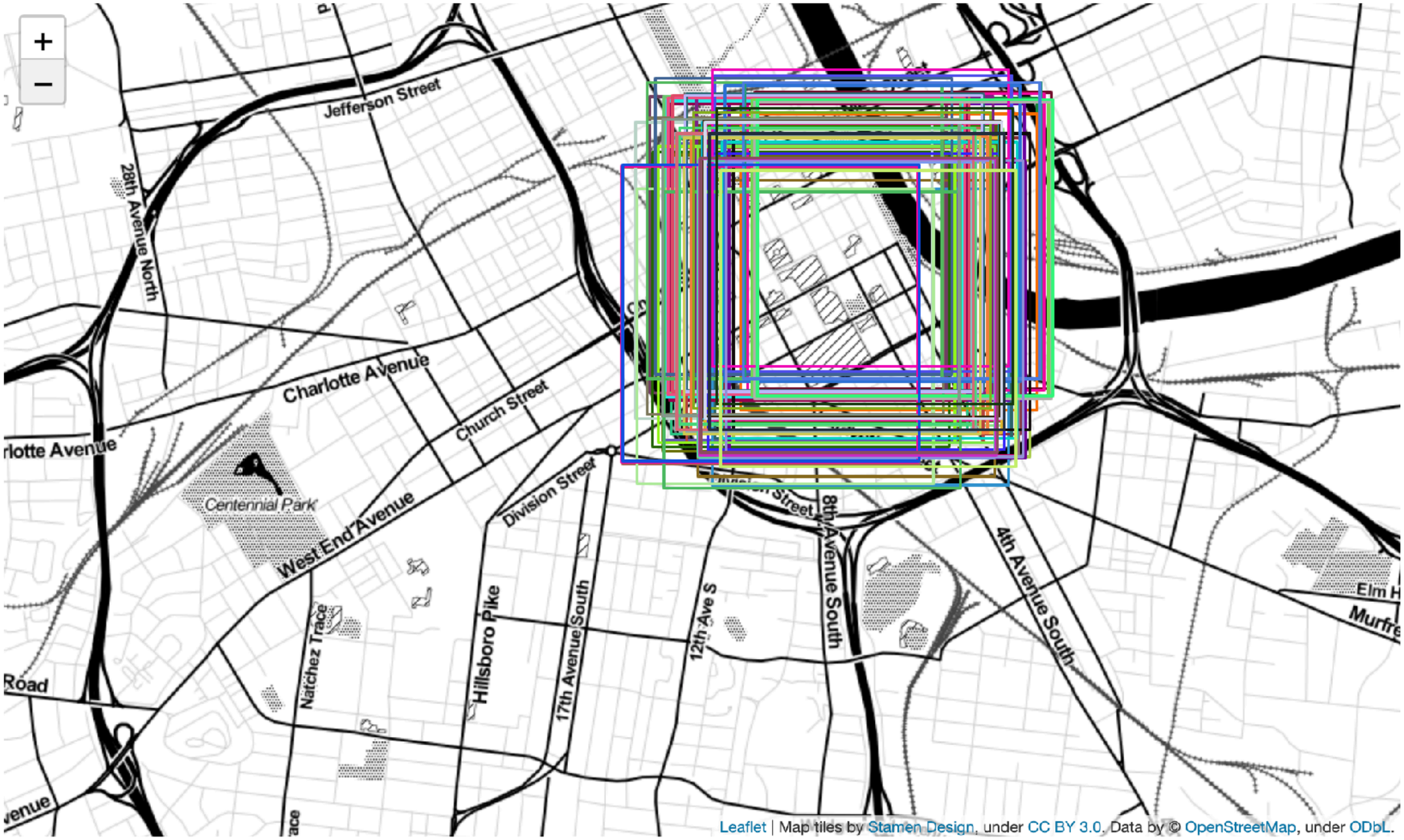
Does not include Bolt Scooters

POPULAR CORNERS CAN CONTAIN 20+ SCOOTERS



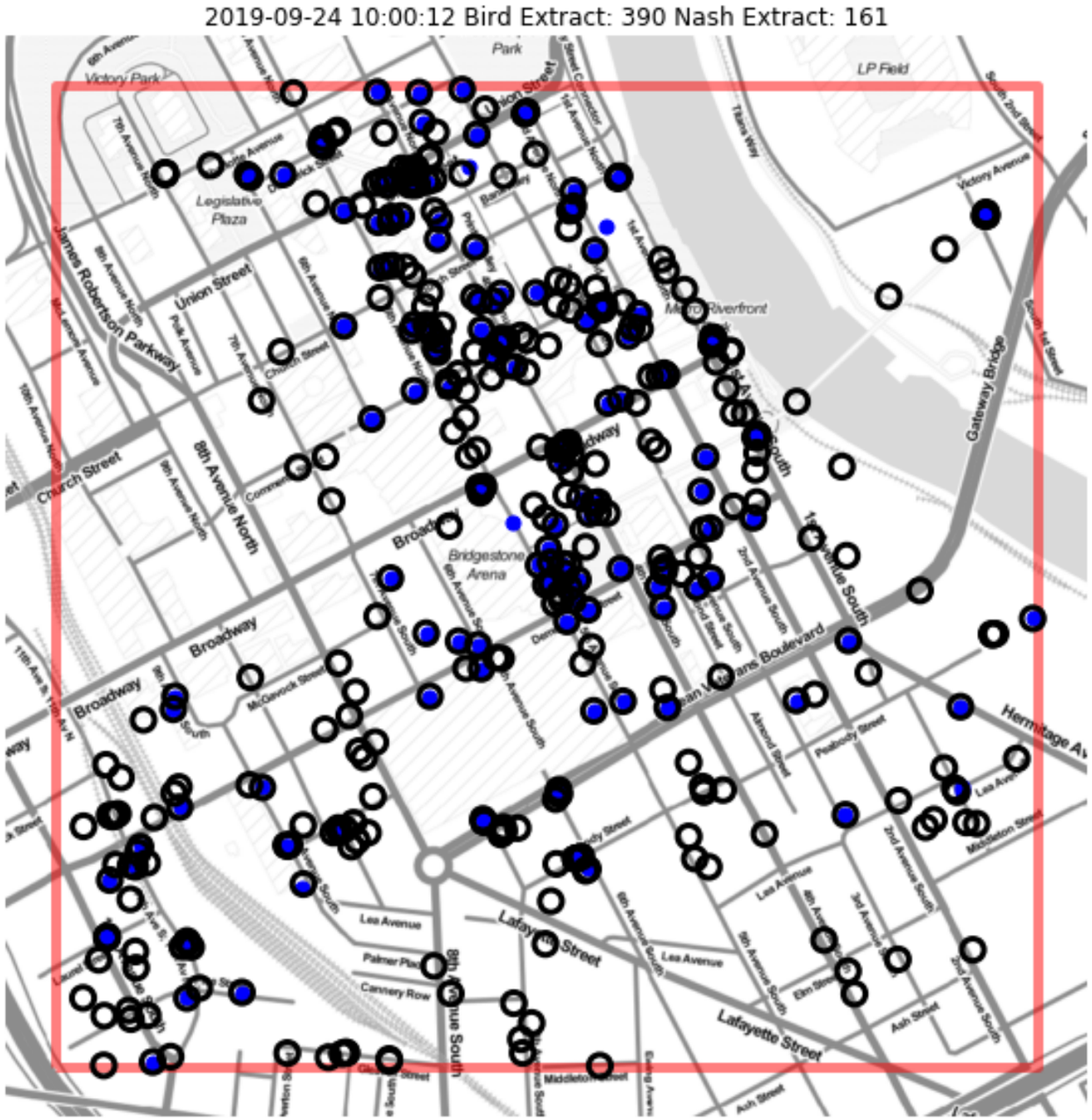
From snapshot on 9/9/2019

CLUSTERS OF 340 OR MORE SCOOTERS OCCURRED DOWNTOWN



Section 12.62.080 – Number of Shared Urban Mobility Devices allowed
H. All permitted operators shall have systems with service areas that do not exceed 340 of each type of SUMDs per square mile. The **MTLC** shall designate the location of the square mile locations in relation to service areas.

ONLY BIRD HAD > 340 SCOOTERS IN A SQ MILE AT ANY TIME



Black circles are Bird scooters from Bird app, blue dots are Bird scooters from data.nashville extract

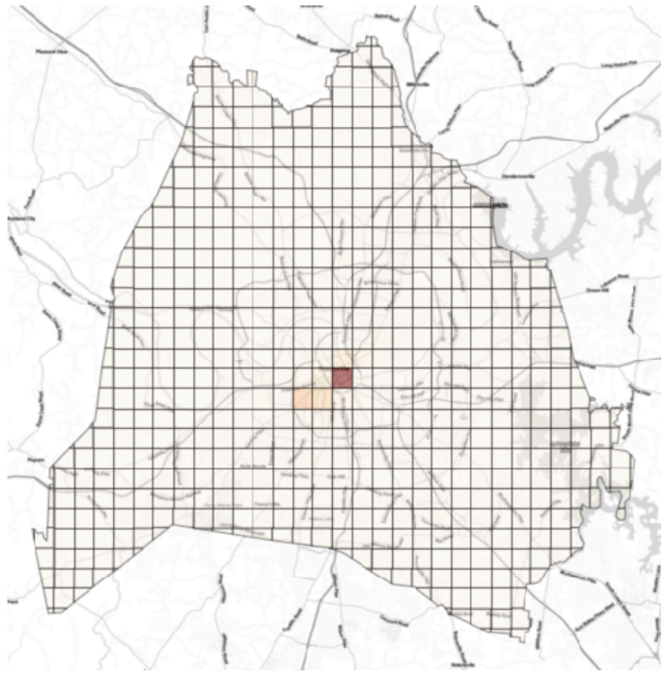
Based on our sample of 1,334 time periods, Bird had > 340 scooters during 37 time periods (2.7% of time periods)

However, we often find missing Bird scooters in the extract. The graph to the left illustrates the overlap between Bird scooters from the Bird app against Bird scooters from data.nashville.gov at during the same time period.

Between 9/24 to 10/13:
52 of 144 hourly snapshots had sq miles with > 340 bird scooters, which suggest bird is violating the clustering rule more often than the data.nashville data suggests (36% of hours)

RECOMMENDATIONS FOR IDENTIFYING CLUSTER VIOLATIONS

- Focus on Downtown, census tracts 019500 and 016500
- Code for Nashville took two approaches:
  - Randomly select scooters and draw a one sq mile box around them and count scooters in the surrounding area
  - Create a grid for the city and count scooters within ‘blocks’, but keep high density areas together



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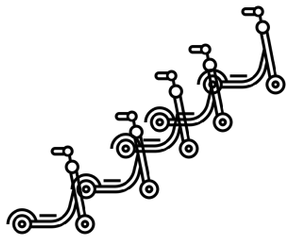
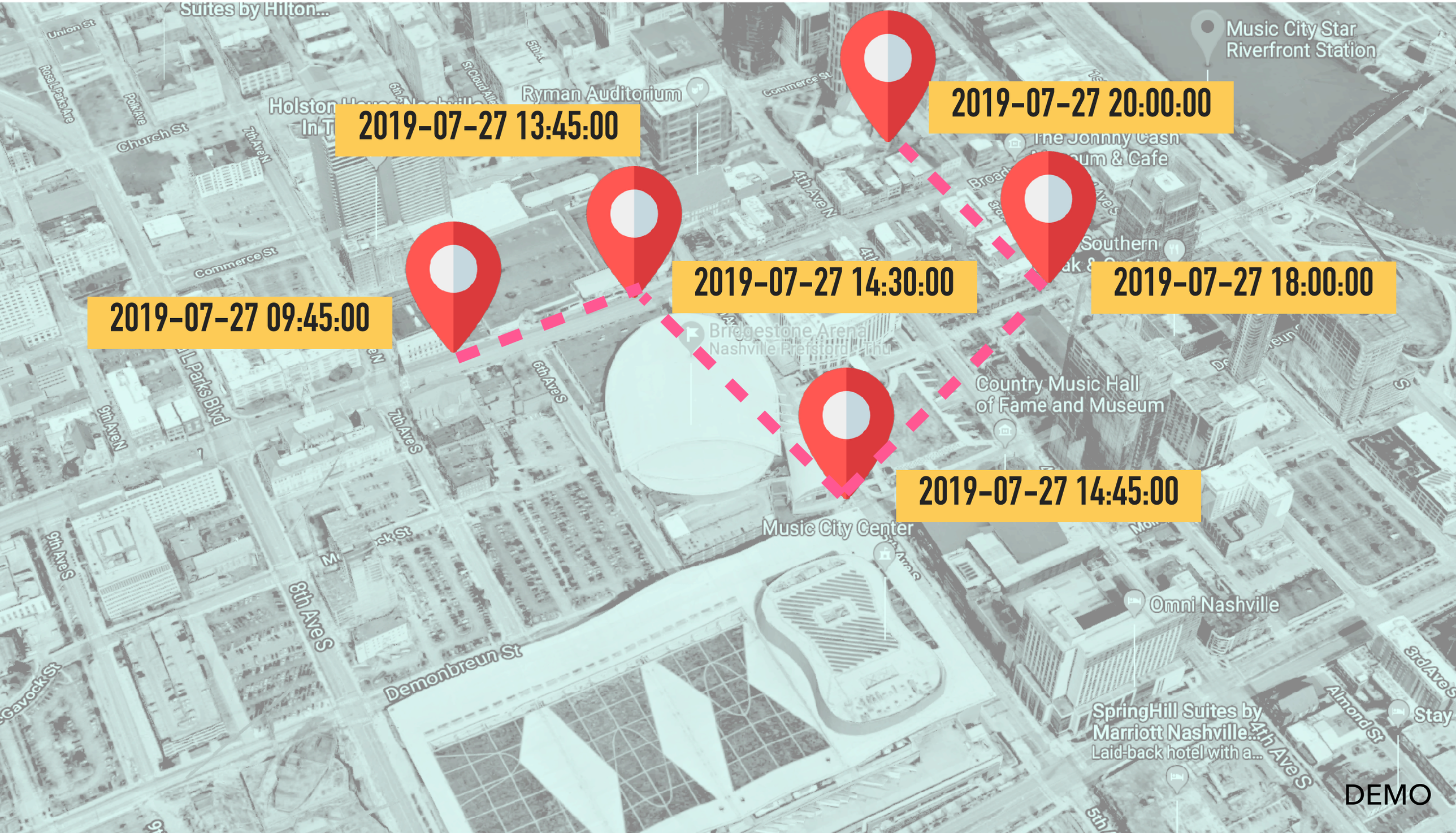


DENSITY

USAGE

ESTIMATING TRIP MOVEMENT FROM SNAPSHOTS



MEET POWEREDETXRSMCKYBUXI – 214 TRIPS BETWEEN 7/21 AND 9/15

TRIP DATA

Data cleansed to remove:

- Very short trips including zero distance trips
- Long trips < 10000 seconds or 2.7 hours

Shortcomings:

- Rebalancing trips might remain in the dataset
- Pathways are not available from static dataset, distance is a straight line

What could we determine?

Frequency of usage, popular usage times, popular origins and destinations

BIRD, LIME, UBER MOST POPULAR WITH RIDERS

Companies are falling short of 3 trips per scooter goal

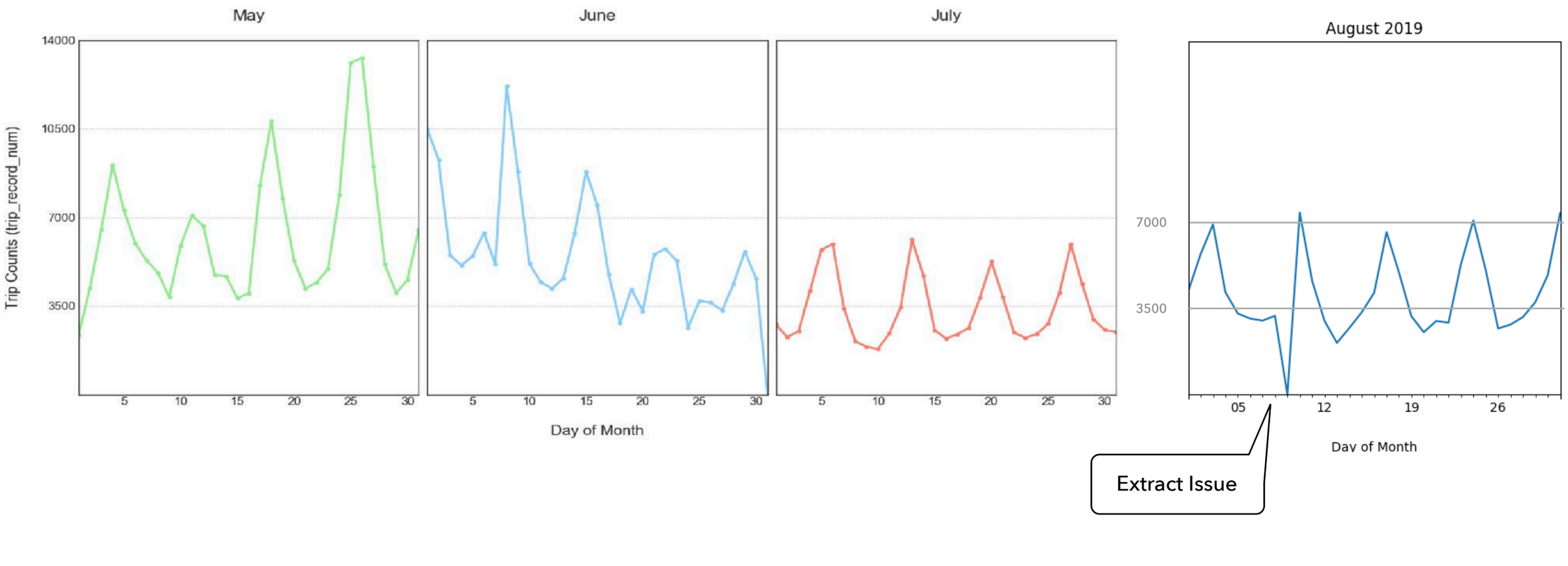
	Company	Total Rides	Number Of Scooters	Scooters Not Ridden	Active Scooters	Rides Per Day Per Active Scooter (15 days)
0	BIRD	34,163	1,399	18	1,381	1.65
1	LIME	18,226	619	24	595	2.04
2	UBER	9,173	1,000	614	386	1.58
3	LYFT	4,897	684	28	656	0.50
4	SPIN	4,384	977	635	342	0.85
5	BOLT	449	193	45	148	0.20
6	TOTAL	71,292	4,872	1364	3,508	1.35

4,733 rides per day

Based on data collected July 22-August 5

Notes: Results are consistent with NSS study when normalized for scooter count. Average 0.80 per scooter based on 5,600 scooters is equivalent to 1.33 per scooter for 3,500 scooters

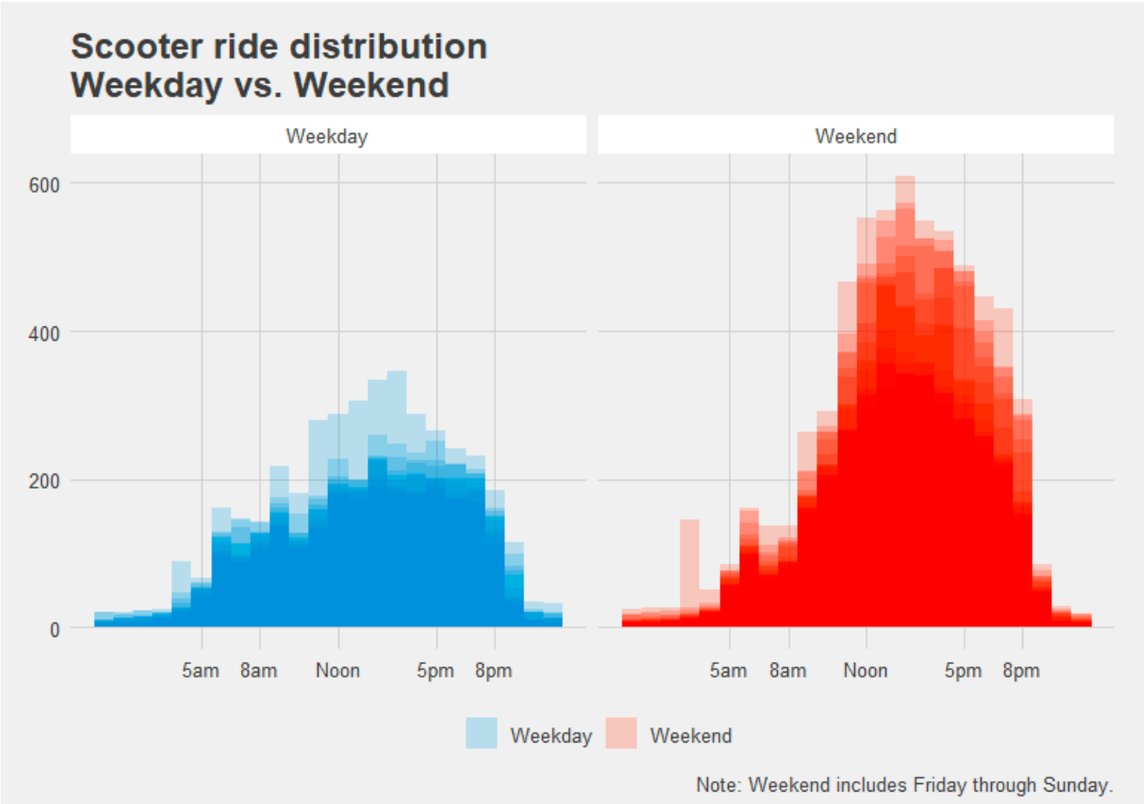
TRIPS PER DAY



Analysis provided by Nashville Software School Data Analysis Cohort 1, instructor: Mary van Valkenburg

August added by Code For Nashville team based on 15 minutes snapshots of the availability data

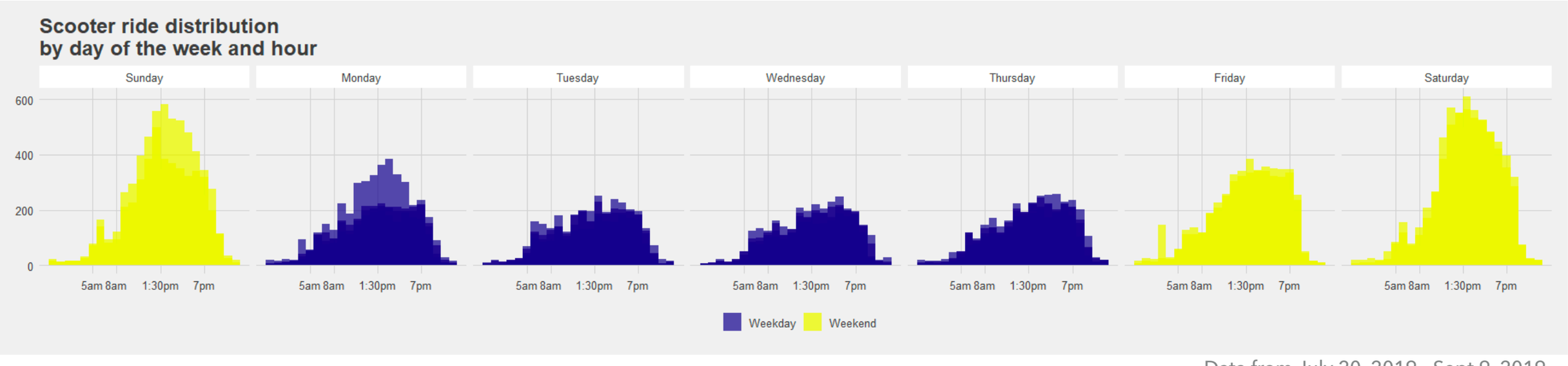
SCOOTER ACTIVITY DOUBLES ON WEEKENDS



Significant difference in how scooters are utilized by hour and by day of week.

Few trips occur after curfew.

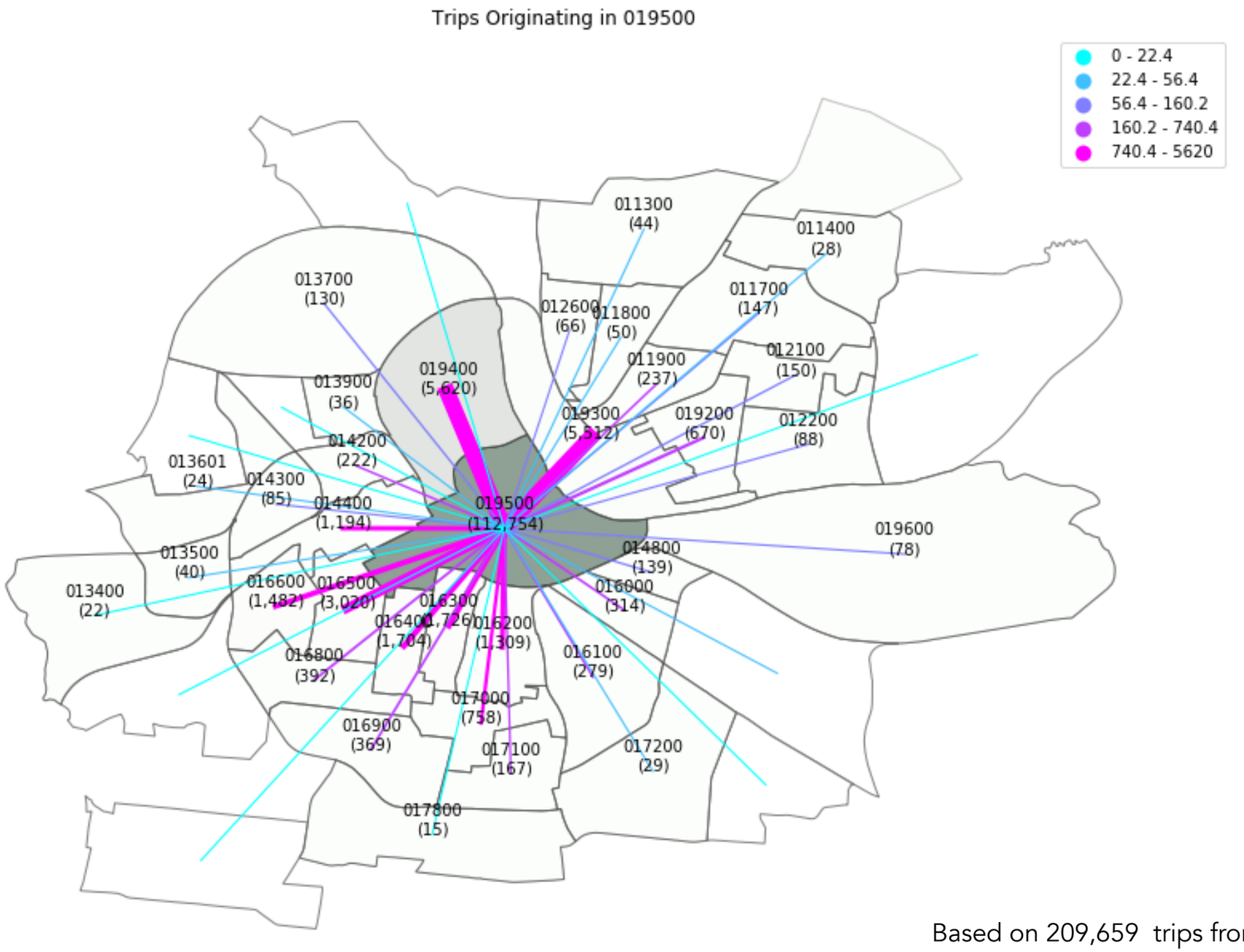
Difficult to tell which post-curfew trips are ‘charging’ trips and which are by riders.



Data from July 20, 2019 - Sept 9, 2019

53% OF TRIPS STARTED AND ENDED WITHIN DOWNTOWN IN TRACT 019500

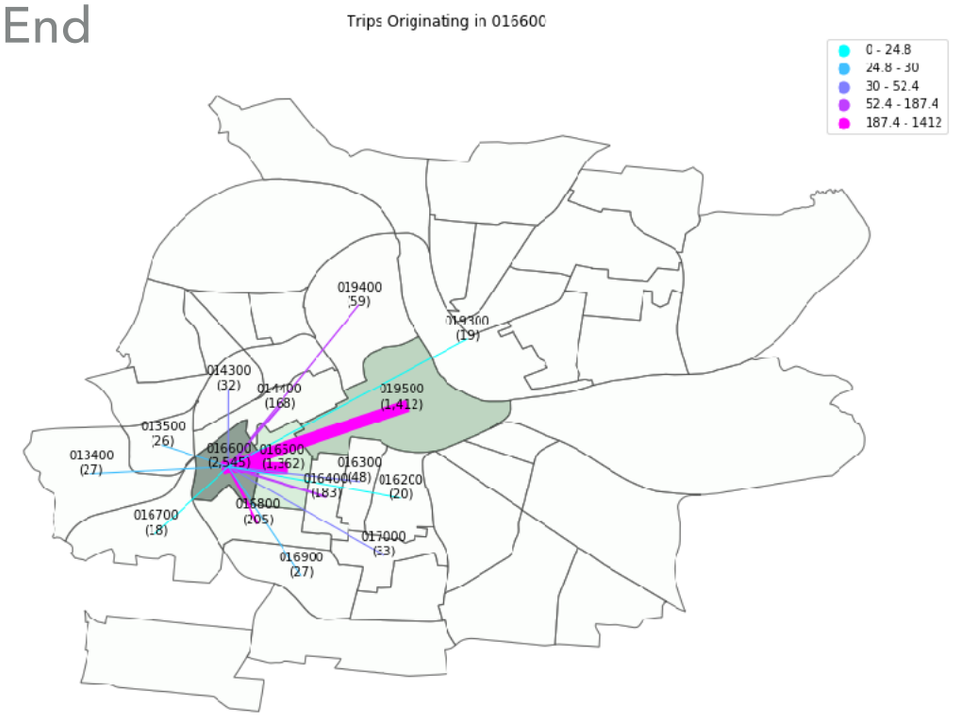
64% of all trips ended in tract 019500.



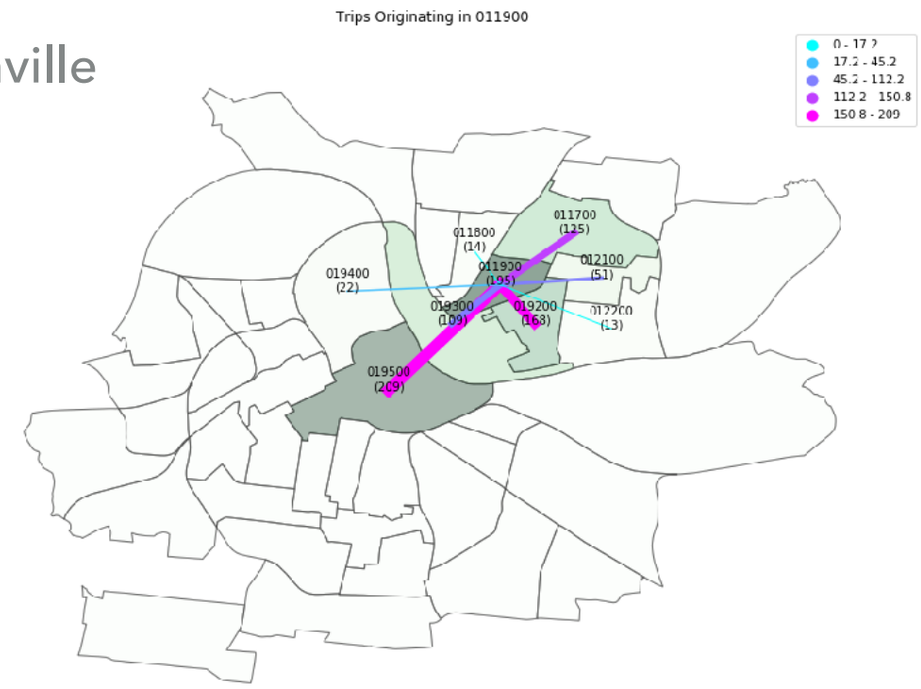
Based on 209,659 trips from 2019-07-21 to 2019-09-15

IN GENERAL, SHORT RIDES < 15 MINUTES, < 1.5 MILES

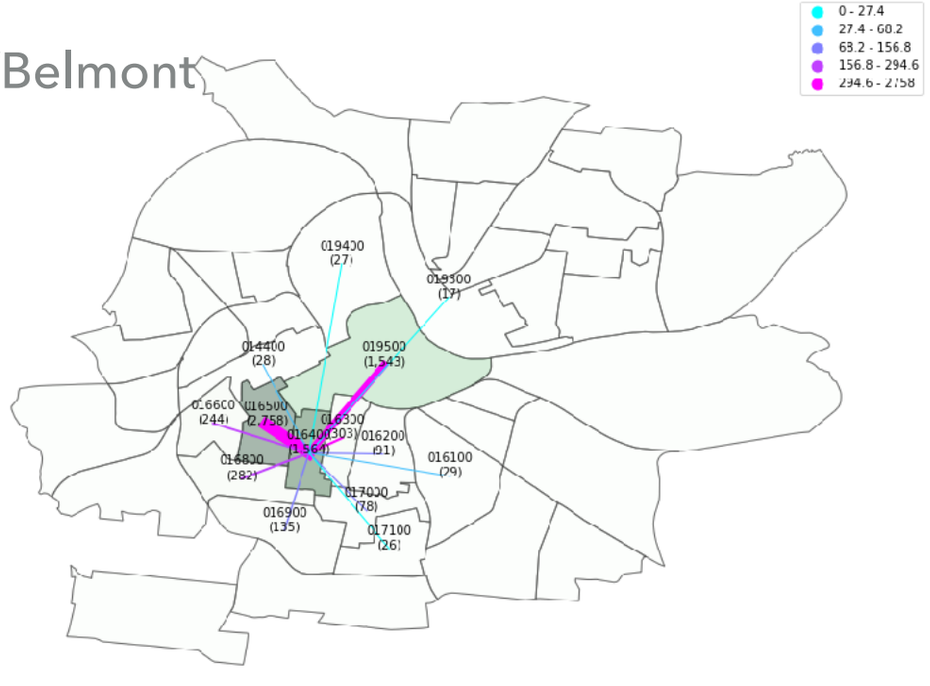
West End



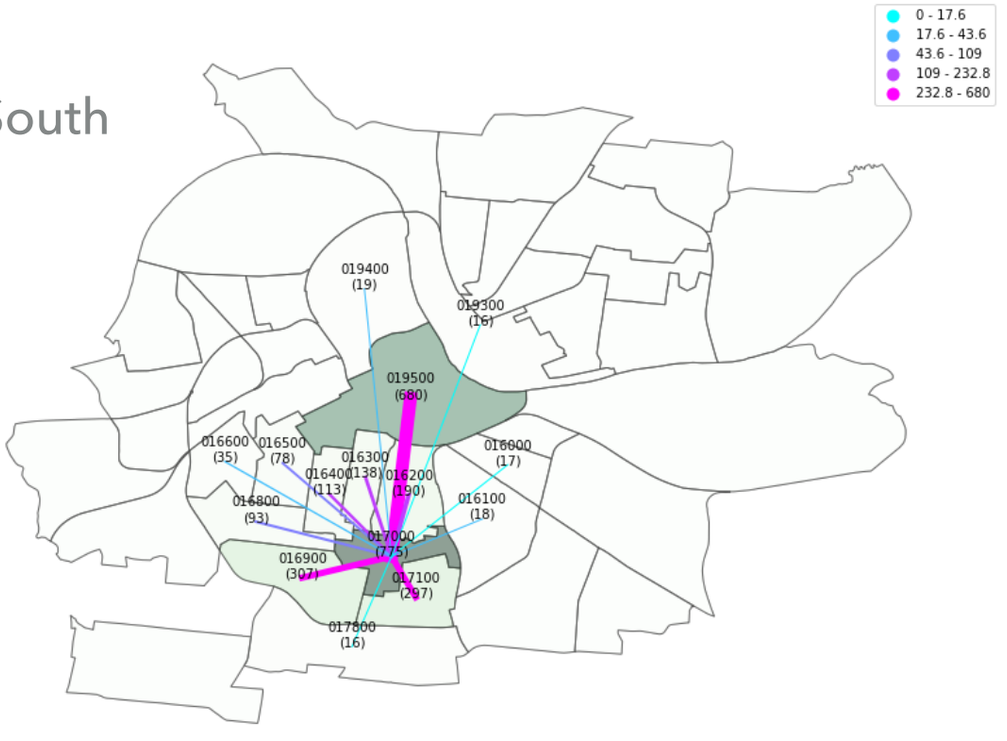
East Nashville



Vandy/Belmont



12th South



OVERALL CONCLUSIONS

Upside

- Riders are accessing scooters throughout the city, primarily downtown, 3,000-7,000 rides/day
- Violations of clustering rules are infrequent

Downside

- Difficult to discern a commuter pattern - would need to be within 1-2 miles of destination
- Are scooters replacing other forms of travel? Maybe…but it's most likely walking vs taking a scooter
- Not all parts of the city are benefiting equally*

Recommendations

- Enhancing data quality could enable more frequent analysis and on-going learning
- Leveraging the available scooter data to publish a web based map to make locating scooters easier for riders

* The NSS study reviews promise zone usage in detail.

THANK YOU