Nashville Scooter Density

Presented to Metro Nashville
City Planning
September 24.2019

Framing the Question

What is the ideal scooter density in Nashville?

Ideal density should:

- enable scooters to serve Metro Nashville's transportation goals, particularly as regards the Promise Zone.
- discourage scooter overpopulation and attendant problems.

Along the way:

Define Data Quality issues that present challenges to precisely determining current and future scooter use.

Identify patterns in scooter use to help with distribution and density recommendations.

Track trip and stationary data to formulate a plan for scooter density and distribution that accurately reflects how scooters are used in Nashville.

Part 1a: Ordinance Compliance and Data Issues: Trip Duration and Distance

"All permitted operators will first clean data before providing or reporting data to Metro. Data processing and cleaning shall include:

1. Removal of staff servicing and test trips
2. Removal of trips below one minute
3. Trips lengths are capped at 24 hours"

-Second Substitute Bill BL2018-1202 (as amended)

Analysis filtered current data to discover which operators were in compliance with the ordinance, and to what extent, and identified Data Quality issues outside of basic compliance.

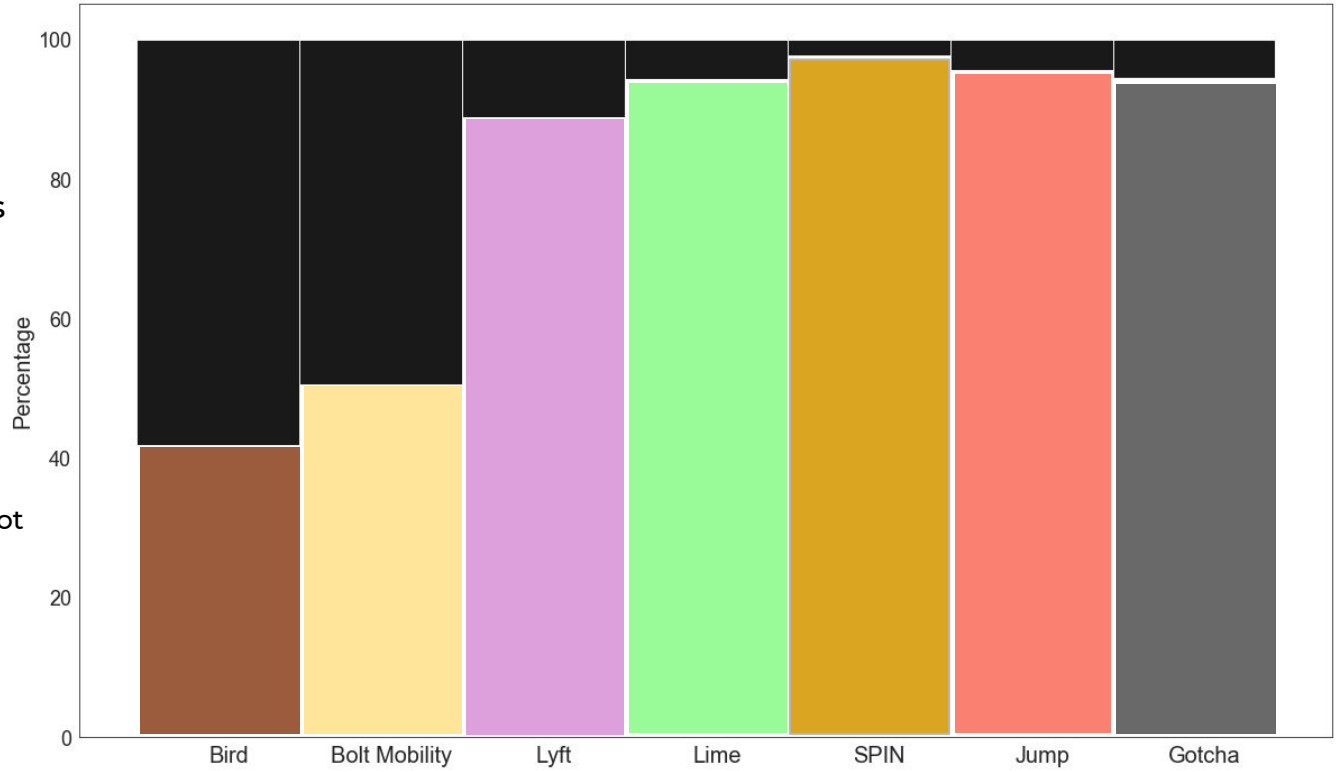
Data Quality: Data Provided vs Ordinance

A sizable number of trips reported by operators ***do not*** meet ordinance requirements.

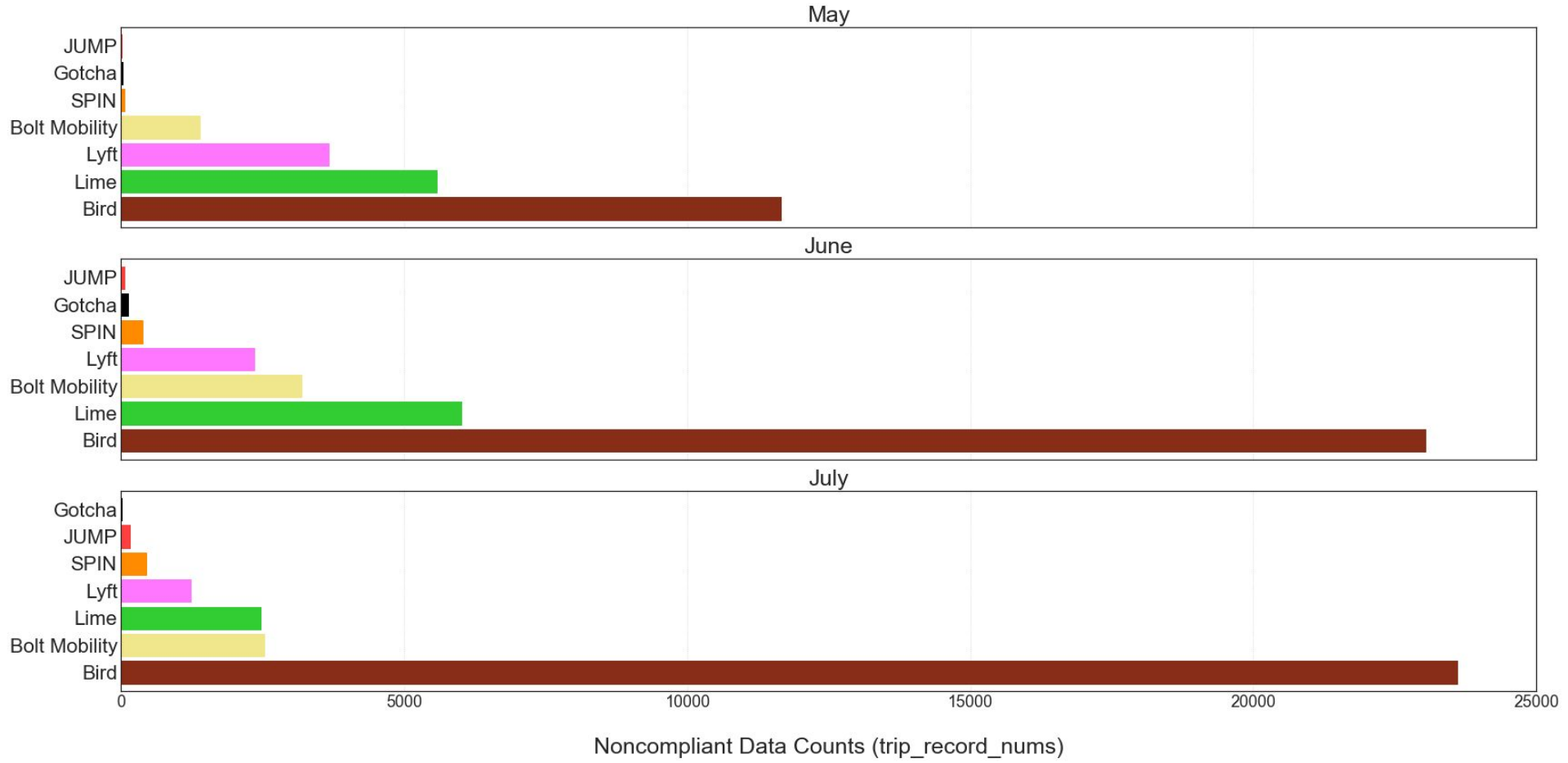
- **6,938** total trips lasted more than 24 hours
- **9,154** total trips lasted less than a minute
- **79,779** total trips have a distance traveled under 3m. *

*as reported under Distance, not necessarily record by GPS starting and ending location, a problem in its own.

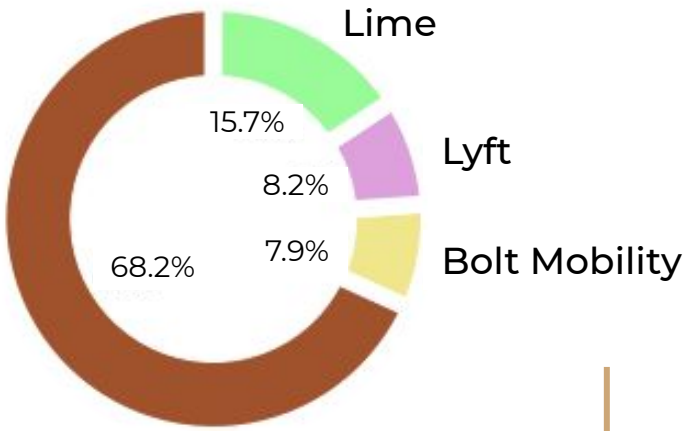
Compliant Trip Data Percentage of Operator's Trip Total



Noncompliant Trip Count by Operator



Proportion of Noncompliant Data by Operator

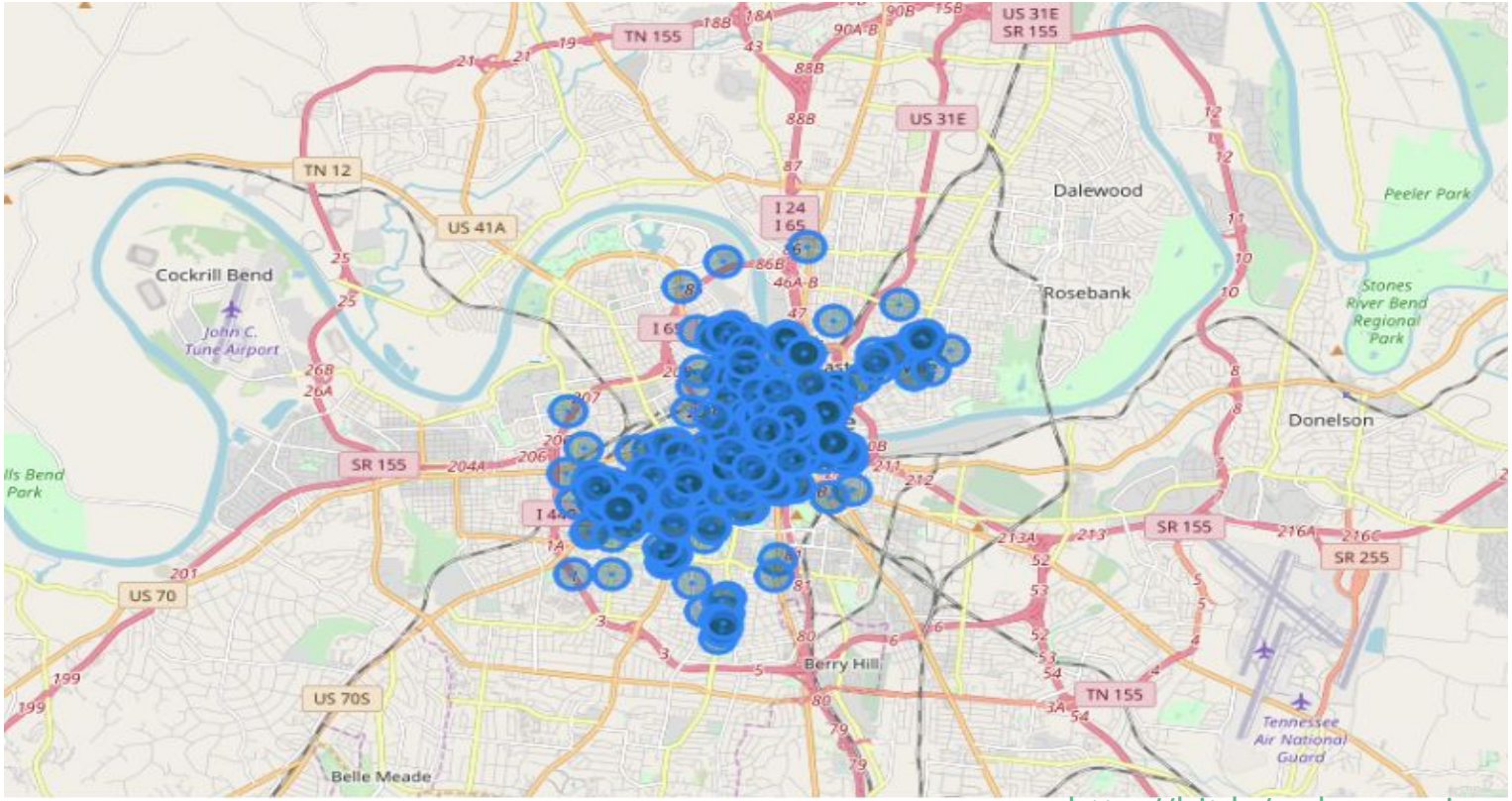


The bulk of Bird's noncompliant data comes from trips with a distance of less than 3 meters.

Data Quality: Further Notable Issues

- ★ Trips that do not have any distances:
  - Bird 58,194 / Lime 12,982 / Lyft 6,187 / Spin 761 / Jump 294 / Bolt 161 / Gotcha 64
- ★ There are BIRD scooter entries “PoweredUNKNOWN” in all the months:
  - May: 2,166
  - Jun: 1,120
  - July: 327
- ★ JUMP reported one scooter with an unusually high number of rides in May and June:
  - May: Poweredb671ffe4-2bca-5880-98ec-d36f65aa11a2: 600 rides
  - Jun: Poweredb671ffe4-2bca-5880-98ec-d36f65aa11a2: 1,308 rides
  - July: The scooter did not appear in the July data

Data Quality: Bird's PoweredUNKNOWN ID in June



http://bit.ly/unknown-june

Data Quality Take-Aways

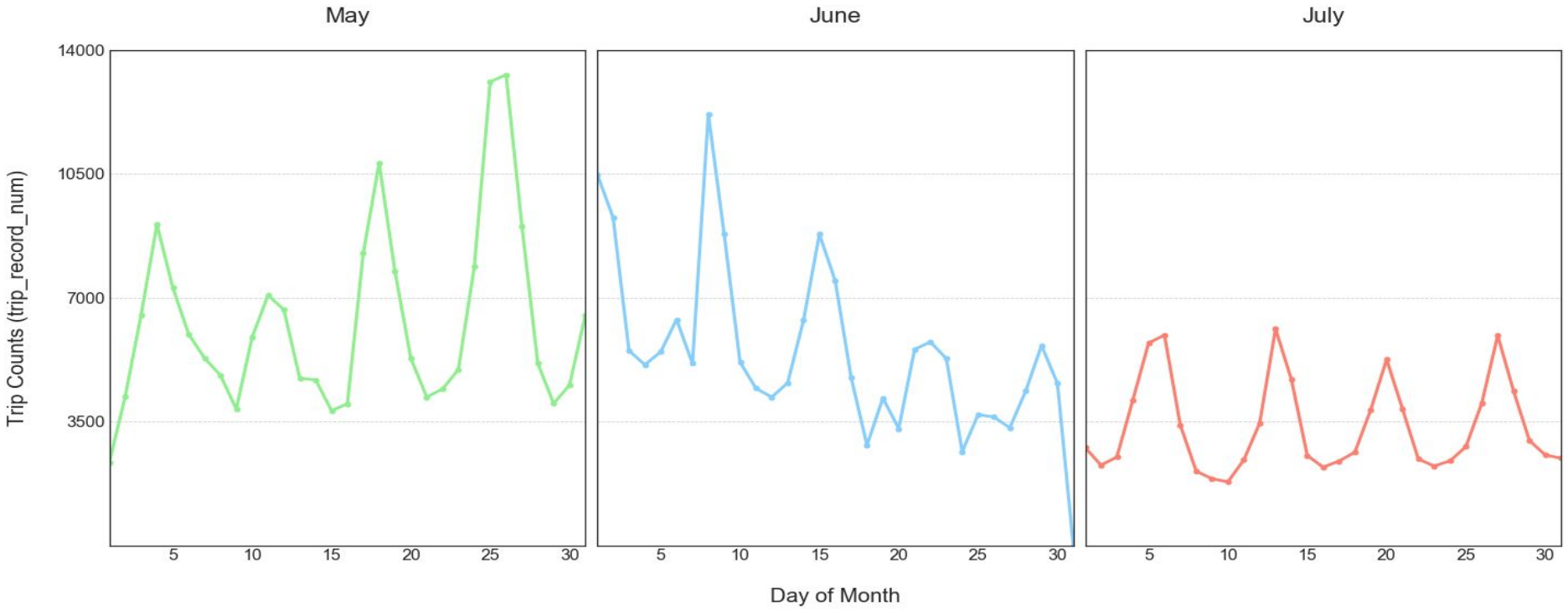
- ★ Two operators need to address ID number issues for data clarity.
  - Bird
  - Jump
- ★ Operators need to improve data cleaning protocols to remove trips
  - less than 1 minute,
  - over 1440 minutes (24 hours), and
  - under 3 meters distance (minimum trip distance as defined by Metro)
- ★ The three cleanest trip datasets belong to Lime, SPIN, and Jump. Moving forward, they may be the easiest with which to partner as their data is in near-compliance with the new ordinance.

Part 2: Current Scooter Use Analysis

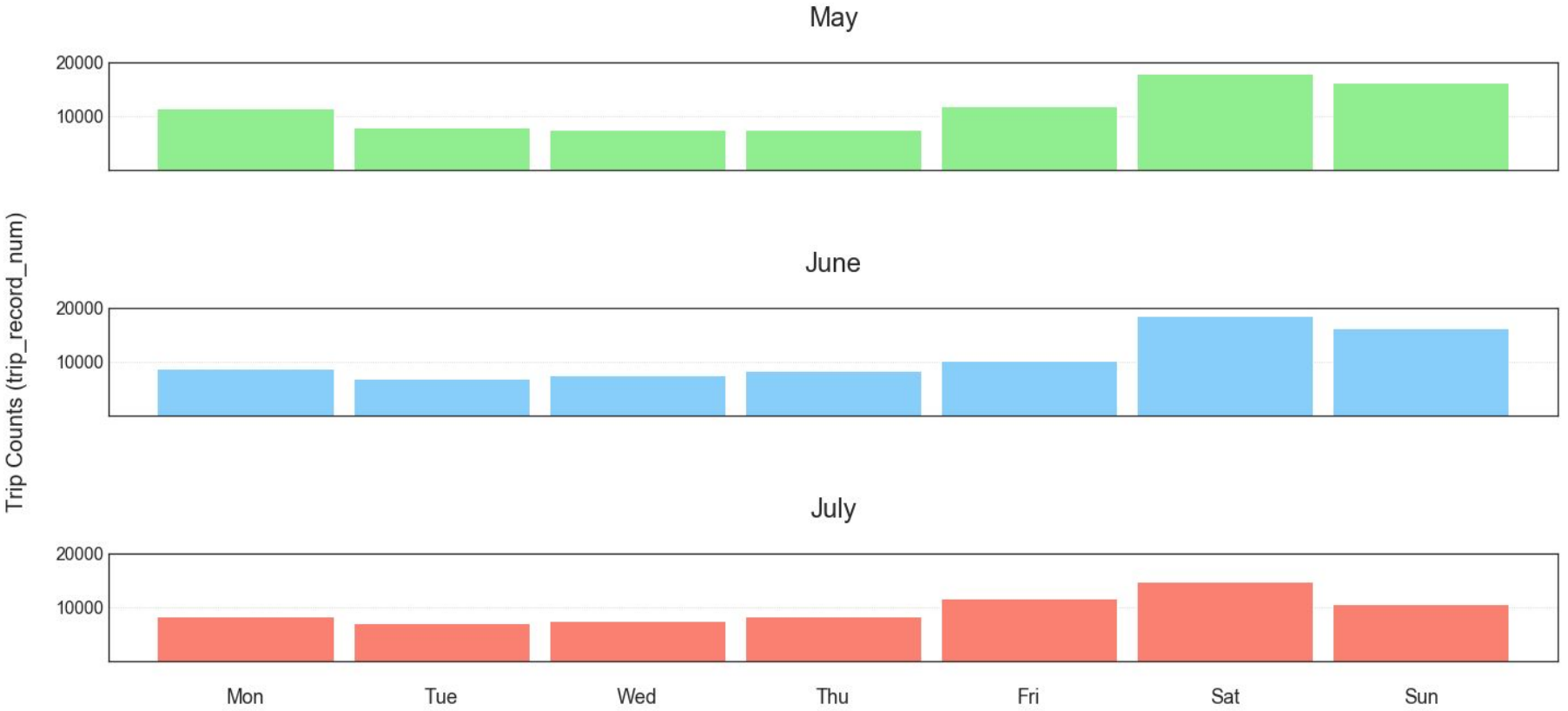
Analysis of trip data gave an interesting picture of when and where scooters were used.

Includes: Use over certain time periods, and snapshots of use over holidays/special local events vs. normal days.

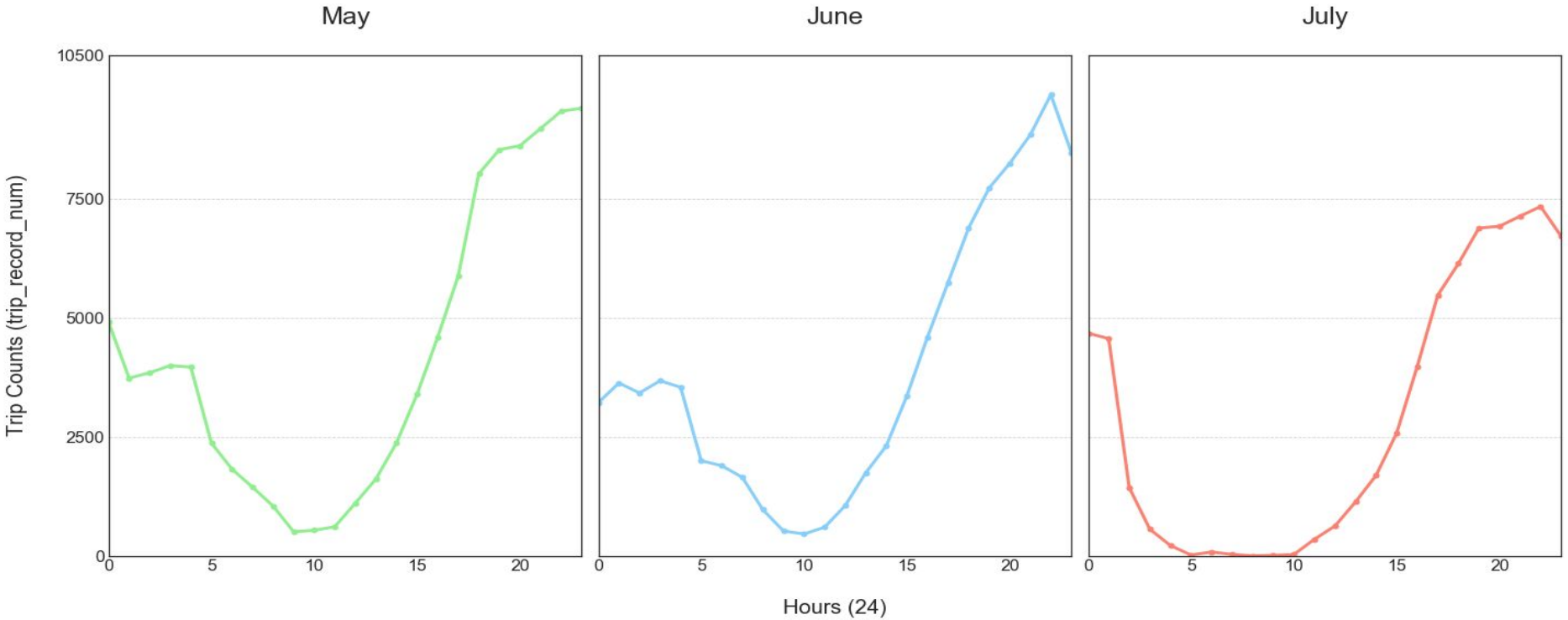
Trip Record Distribution By Day of Month



Trip Record Distribution by Day of Week



Trip Record Number Distribution by Hour of Day



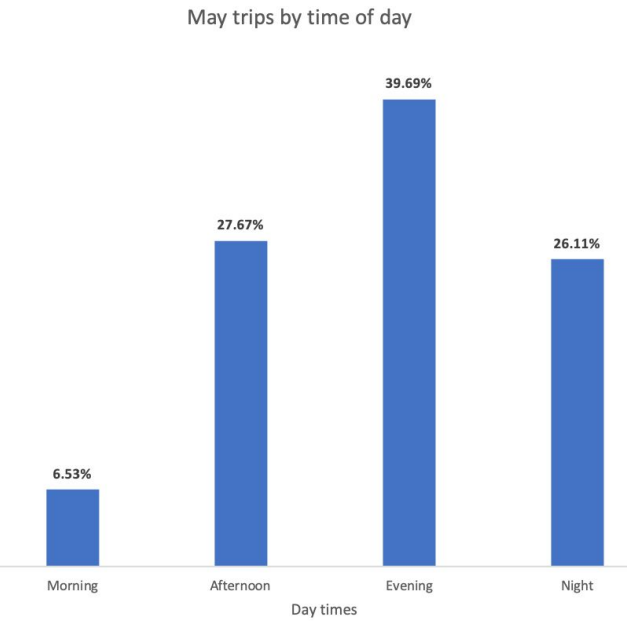
Trips decreased by 34% from June to July
Trips were concentrated on the weekend

	June	% Total	July	% Total	Change Inc / (Dec)	Change %
Mon	21,467	10.4%	16,875	12.5%	(4,592)	-21.4%
Tue	19,299	9.4%	14,600	10.8%	(4,699)	-24.3%
Wed	21,497	10.5%	14,835	11.0%	(6,662)	-31.0%
Thu	21,747	10.6%	15,367	11.4%	(6,380)	-29.3%
Fri	26,327	12.8%	22,325	16.5%	(4,002)	-15.2%
Sat	52,567	25.6%	30,165	22.4%	(22,402)	-42.6%
Sun	42,723	20.8%	20,759	15.4%	(21,964)	-51.4%
Total	205,627	100.0%	134,926	100.0%	(70,701)	-34.4%
Fri - Sun	121,617	59.1%	73,249	54.3%		

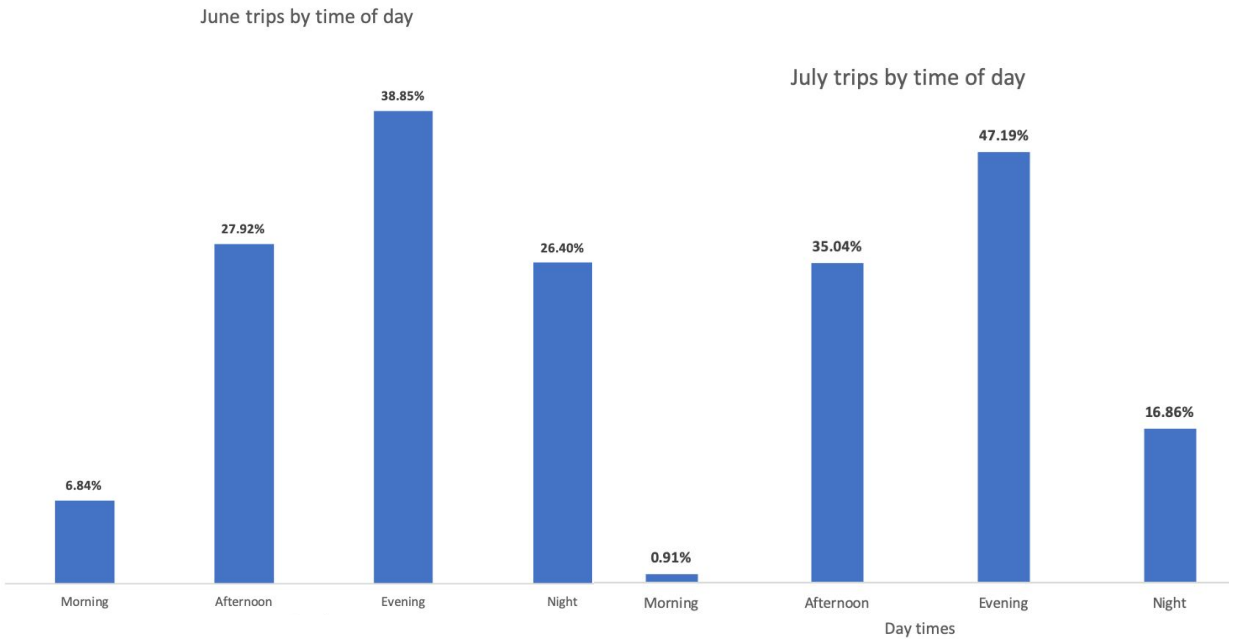
Trips during times of day

Morning: 5am - 12pm
Afternoon: 12:00pm - 5pm
Evening: 5pm - 11:59pm
Night: 12am- 5am

May



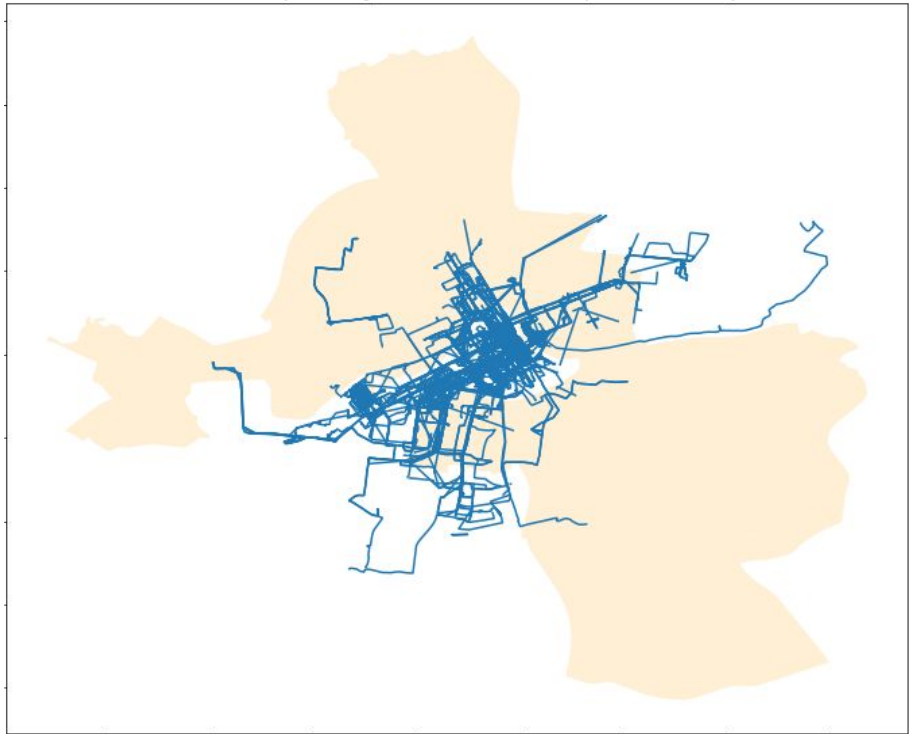
June



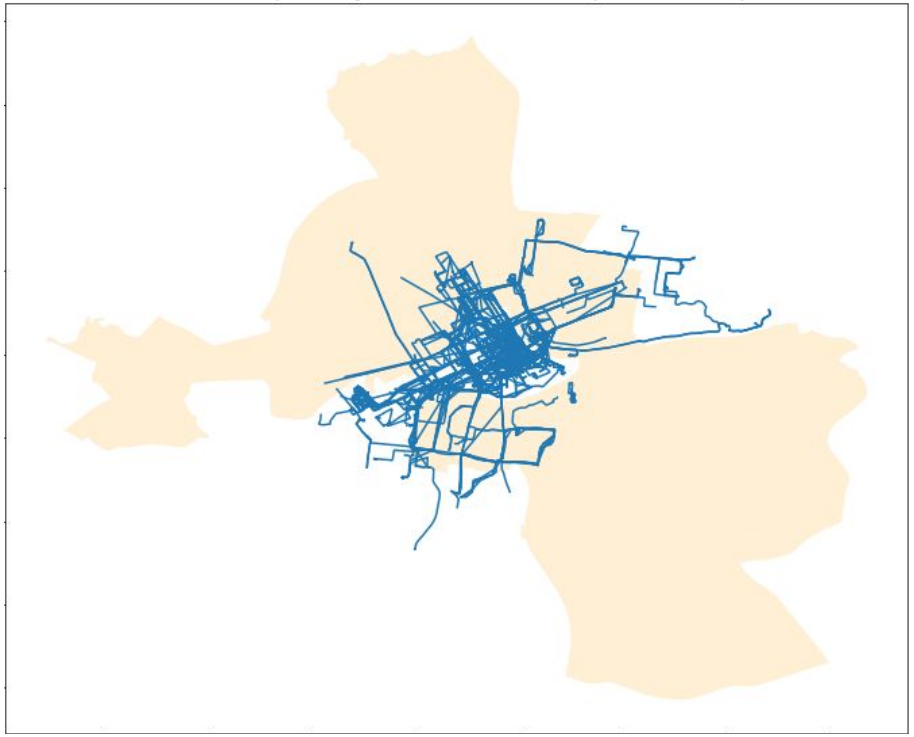
July

Comparison of Scooter Use: May 5 (Cinco de Mayo) vs. May 12

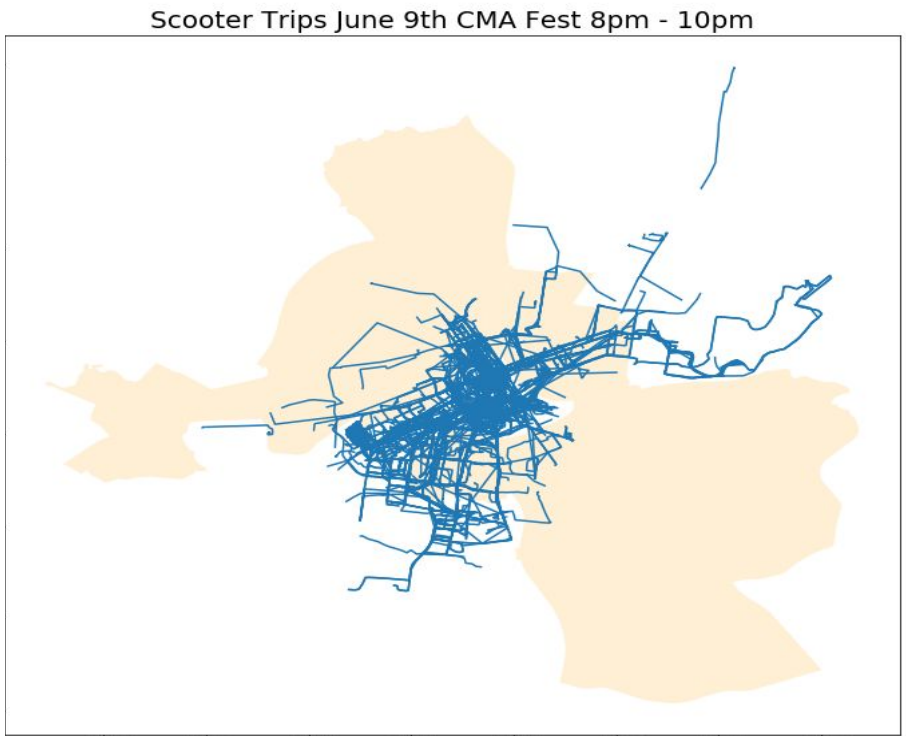
Scooter trips May 5th between 8pm and 10pm

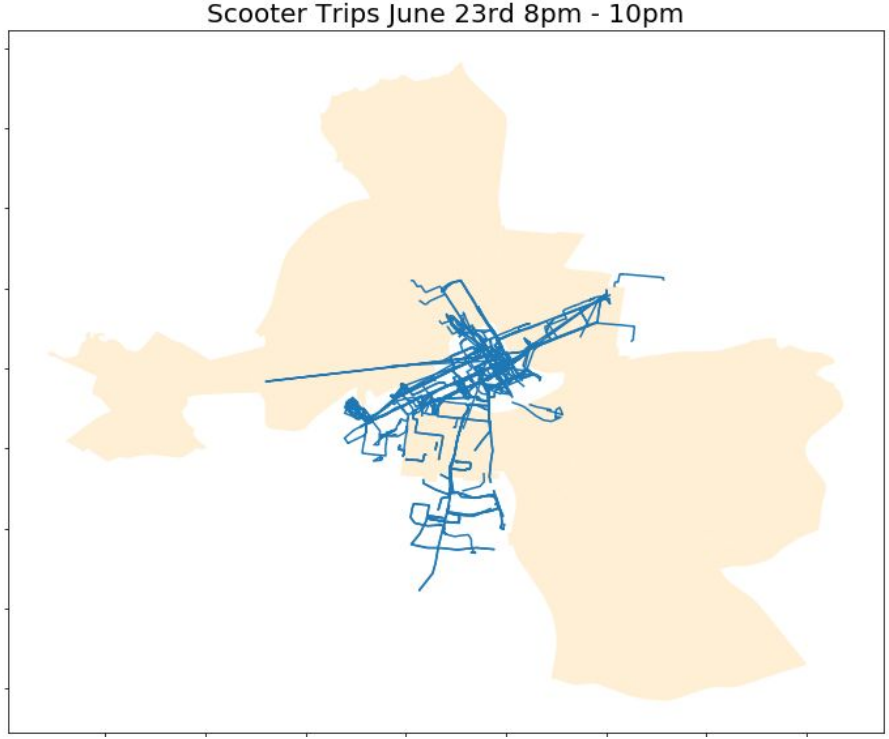


Scooter trips May 12th between 8pm and 10pm



Comparison of Scooter Use: June 9 (CMA Fest) vs. June 23

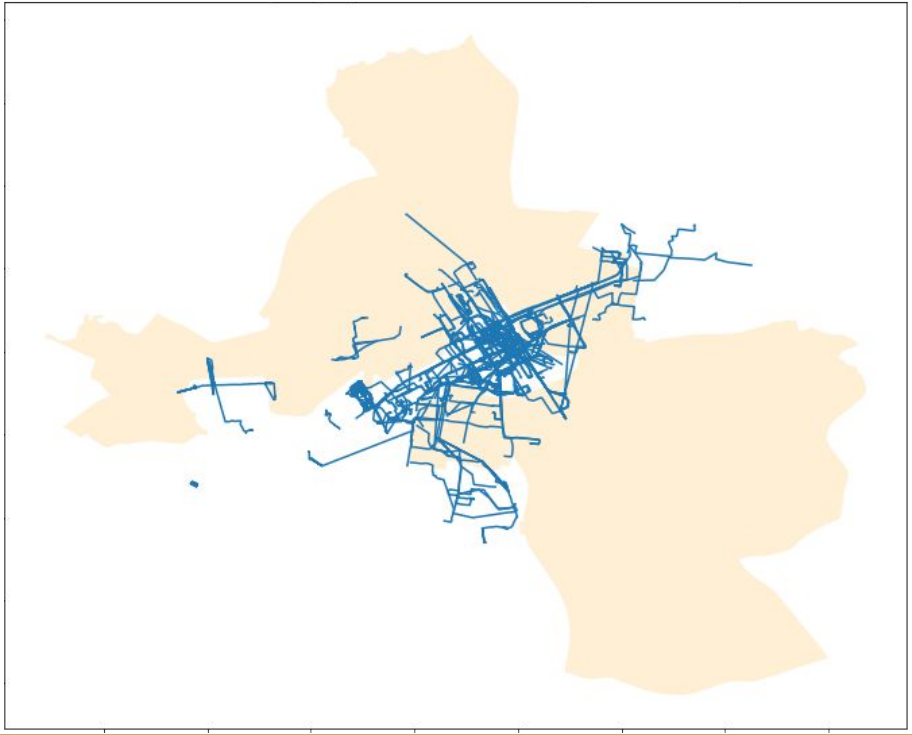


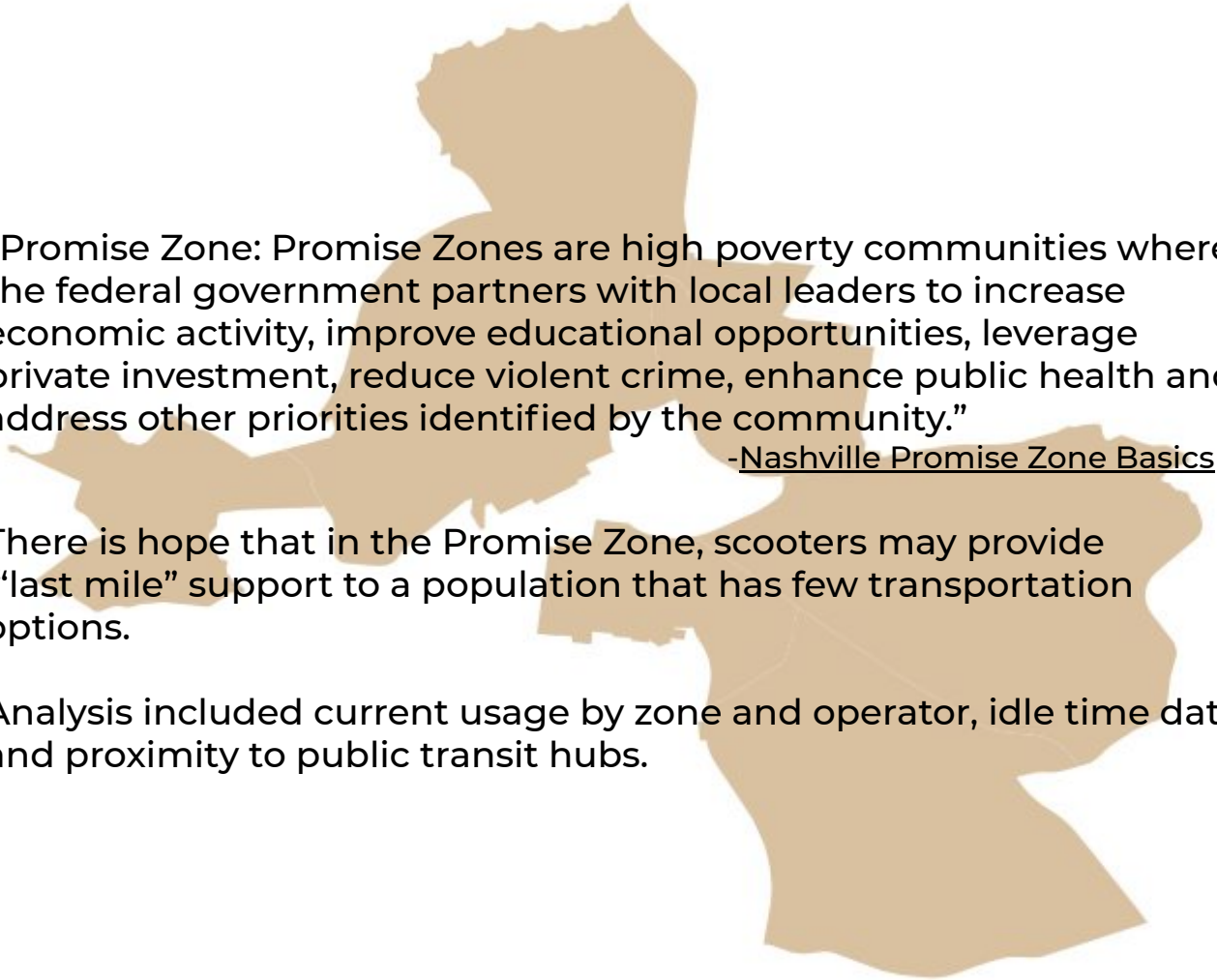


Comparison of Scooter Use: July 4 (Independence Day) vs. July 11

Scooter trips July 4th between 8pm and 10pm

Scooter trips July 11th between 8pm and 10pm





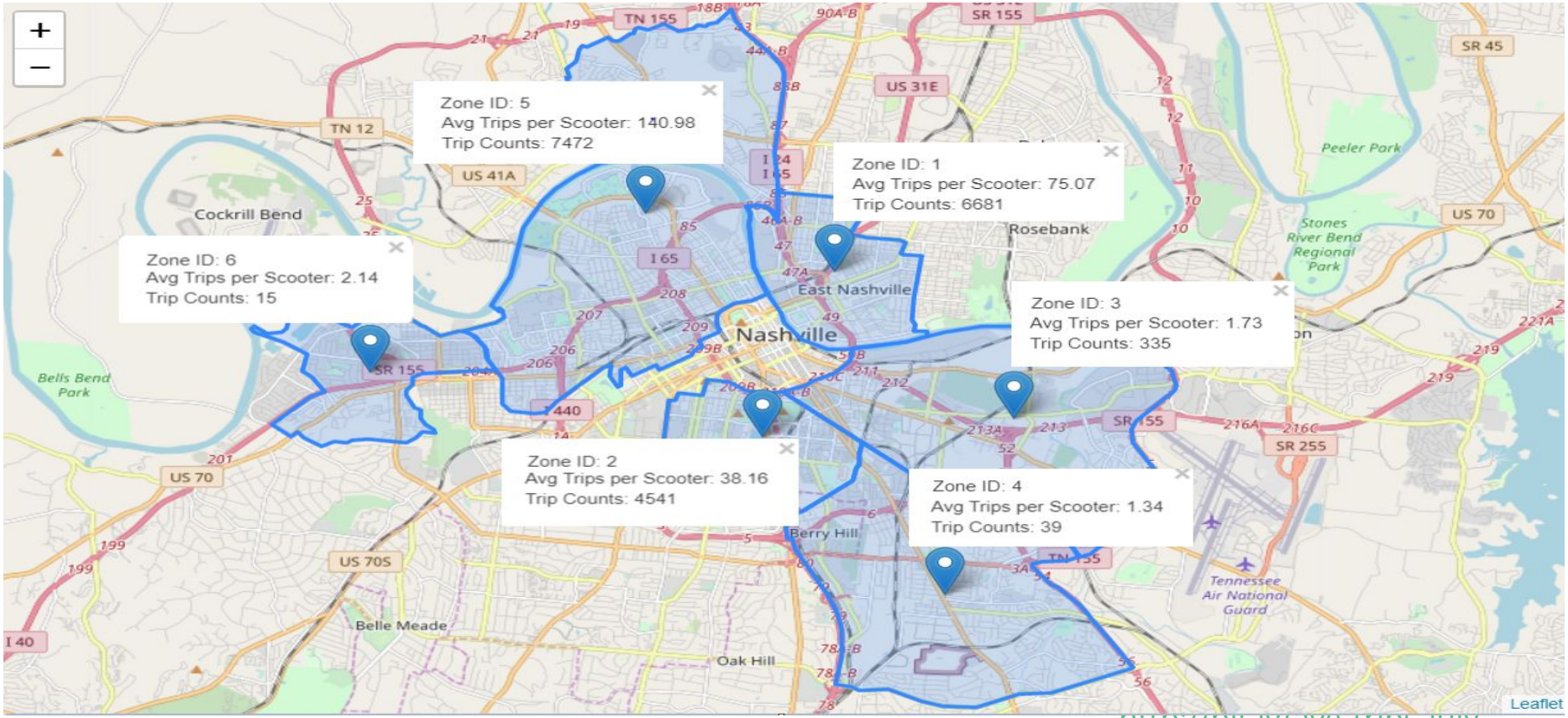
“Promise Zone: Promise Zones are high poverty communities where the federal government partners with local leaders to increase economic activity, improve educational opportunities, leverage private investment, reduce violent crime, enhance public health and address other priorities identified by the community.”

-Nashville Promise Zone Basics

There is hope that in the Promise Zone, scooters may provide “last mile” support to a population that has few transportation options.

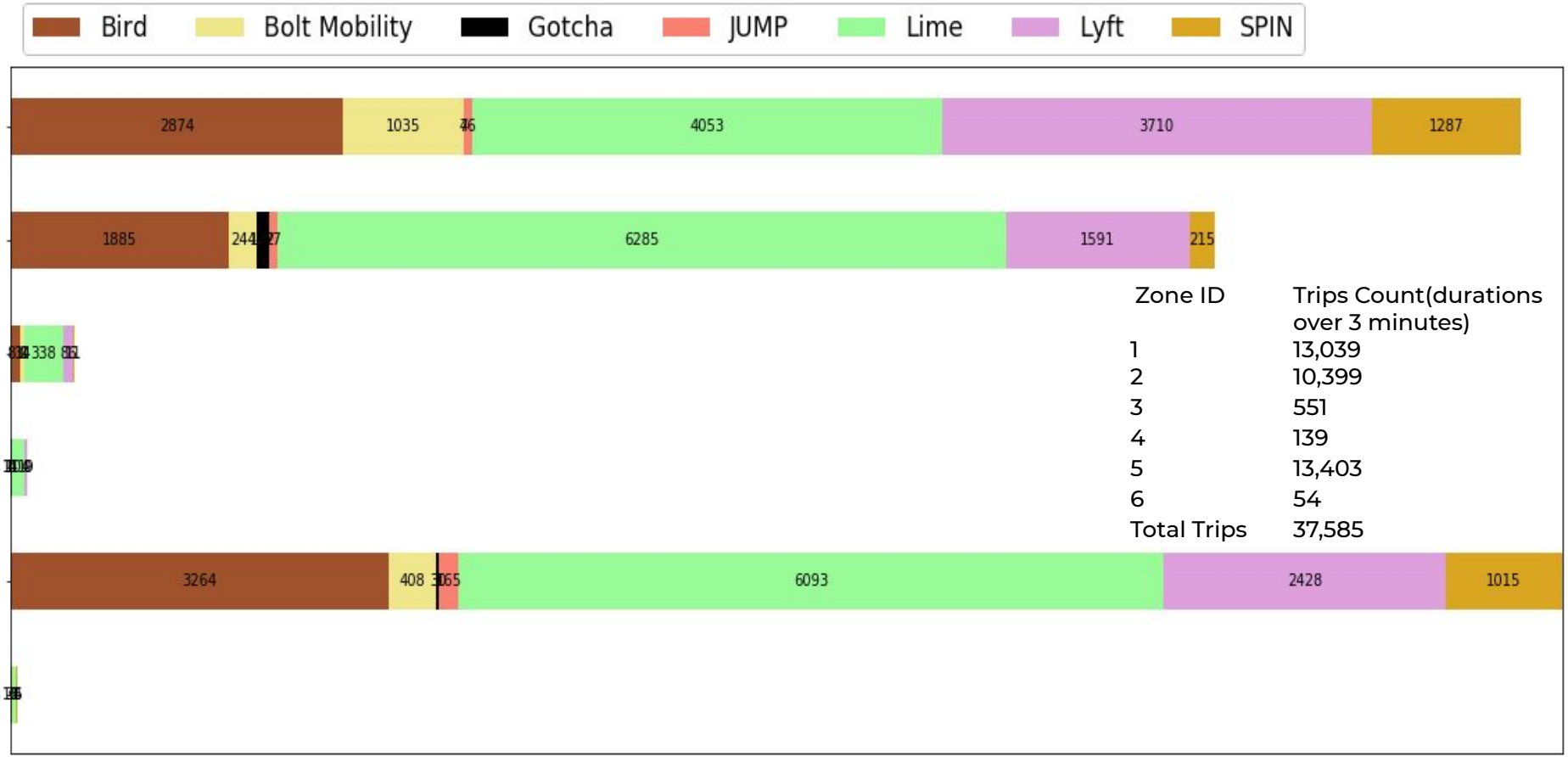
Analysis included current usage by zone and operator, idle time data, and proximity to public transit hubs.

Average and Total Trips per Scooter - July



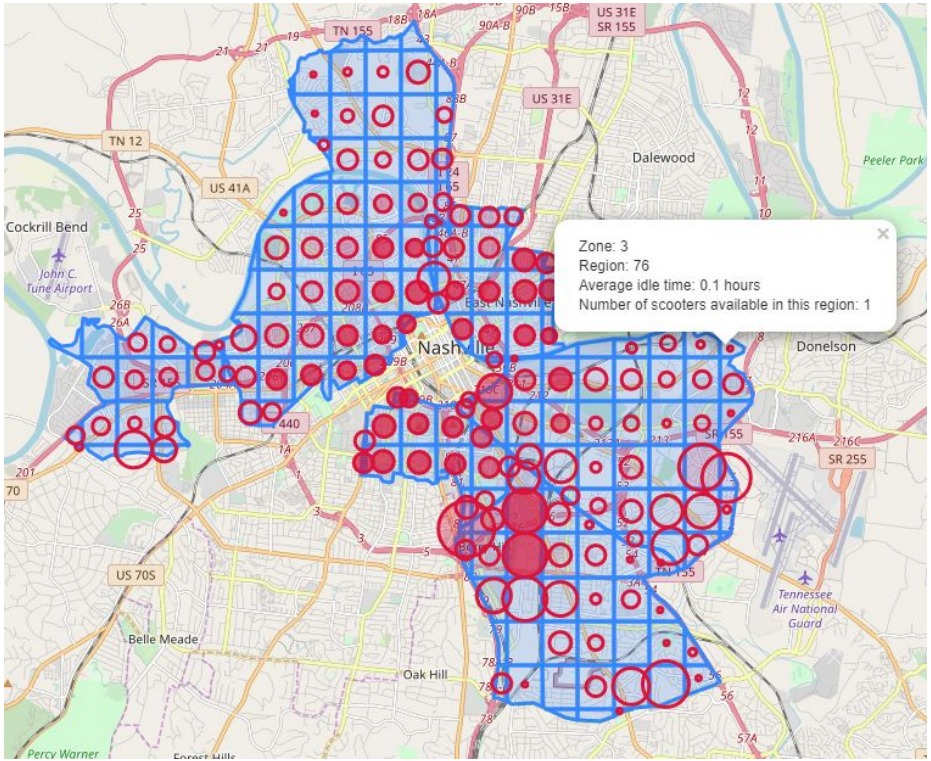
http://bit.ly/avg-trips-july

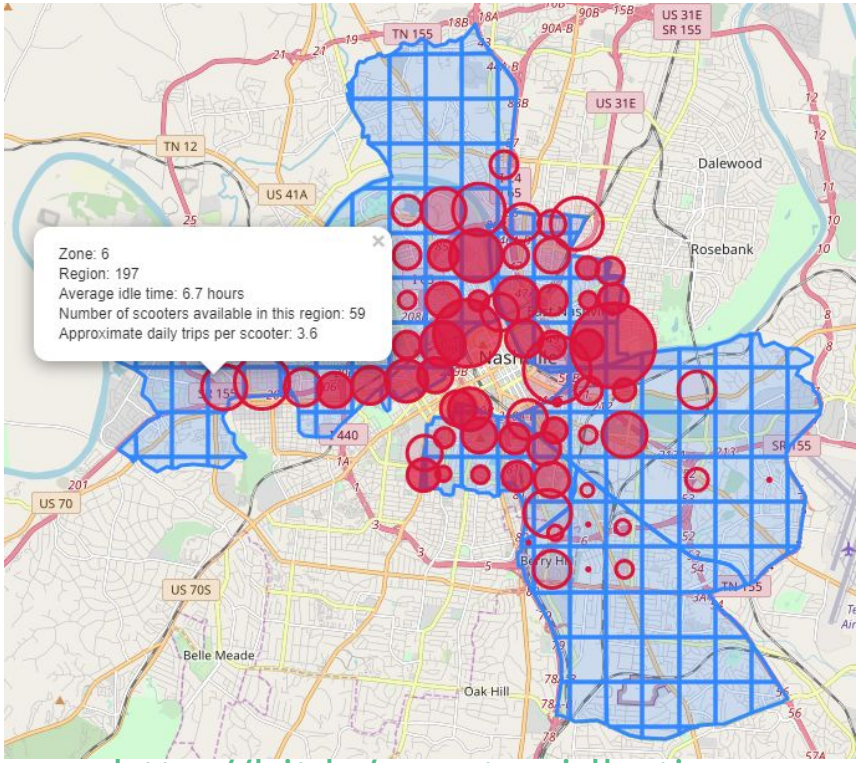
Trips for June by Promise sub-Zone and Operator



Zone ID	Trips Count(durations over 3 minutes)
1	13,039
2	10,399
3	551
4	139
5	13,403
6	54
Total Trips	37,585

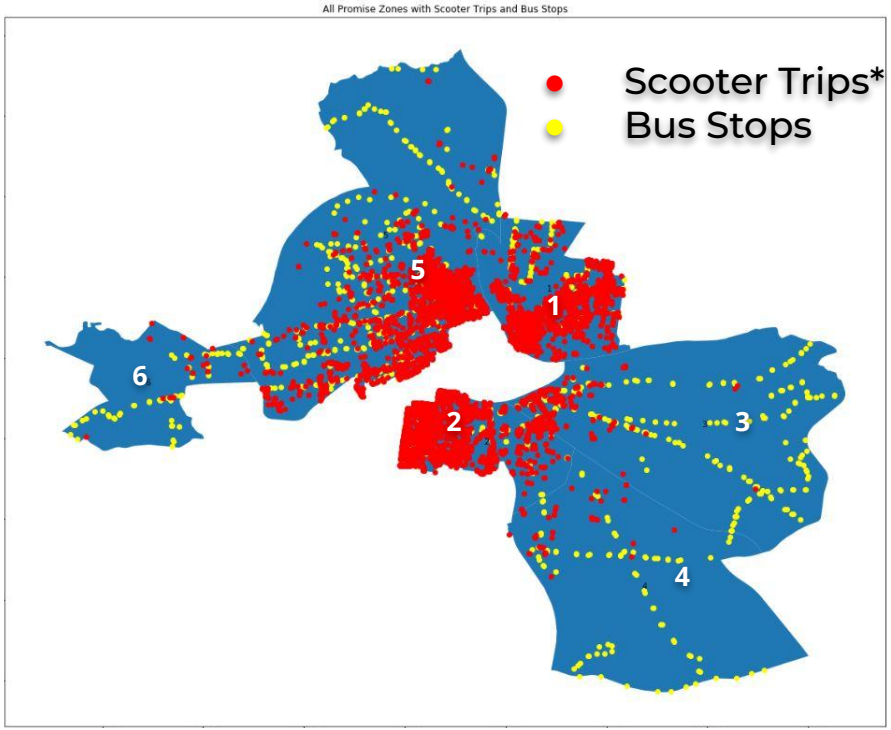
Average idle time and approximate daily trip counts per scooter - May





http://bit.ly/scooter-idle-times

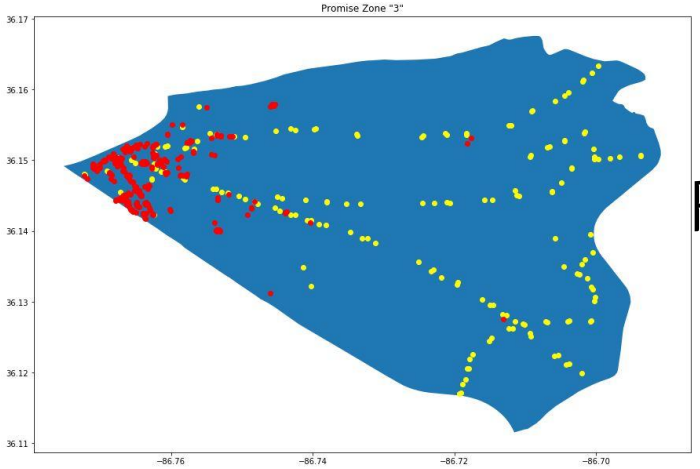
Promise Zones and Bus Stops



There are large areas of sub-zones 3, 4, and 6 which have many bus stops and very little scooter activity.

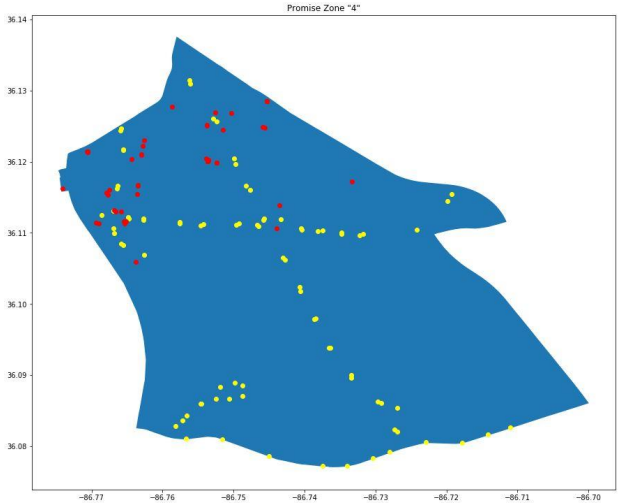
*plotted by trip start location

Promise subzones and Bus Stops (CONTINUED)



Sub-zone 3

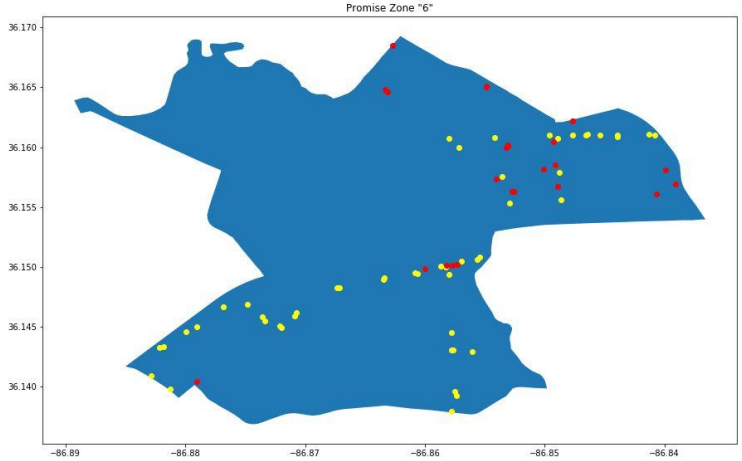
Sub-zone 4



Scooter Trips

Bus Stops

Sub-zone 6



Part 3: Scooter Density: Current and Proposed

Analysis of current scooter density and distribution, as well as calculated recommendations for future density and distribution by geographic location.

Efficient Scooter Utilization : Definitions

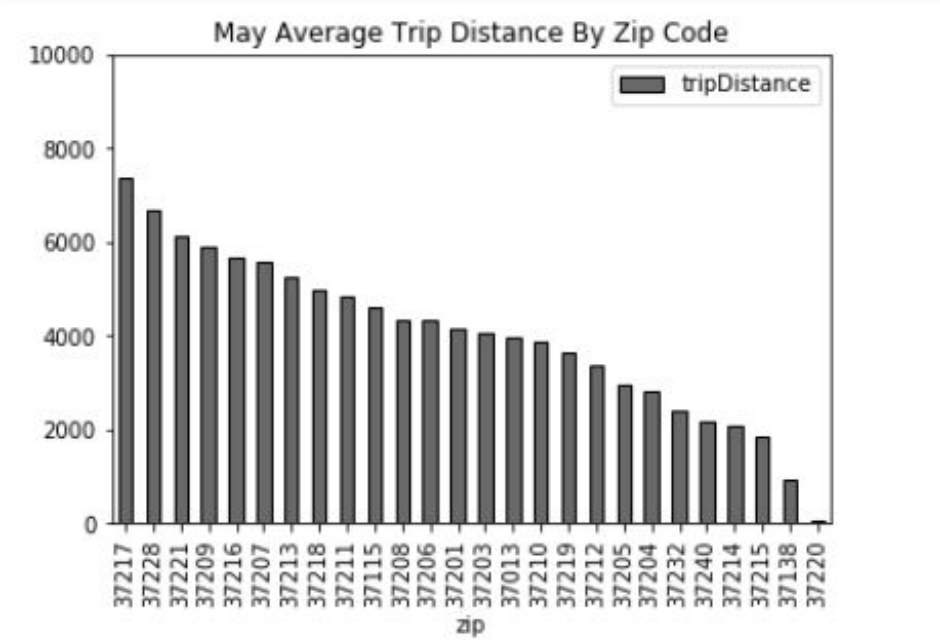
"The MTLC shall determine the average utilization threshold for SUMDs for each type of Vehicle after gathering information and consulting appropriate entities. The average utilization shall only be determined after notice and a hearing of the MTLC. Until the MTLC determines the average utilization threshold, the threshold for SUMDs shall be as follows:

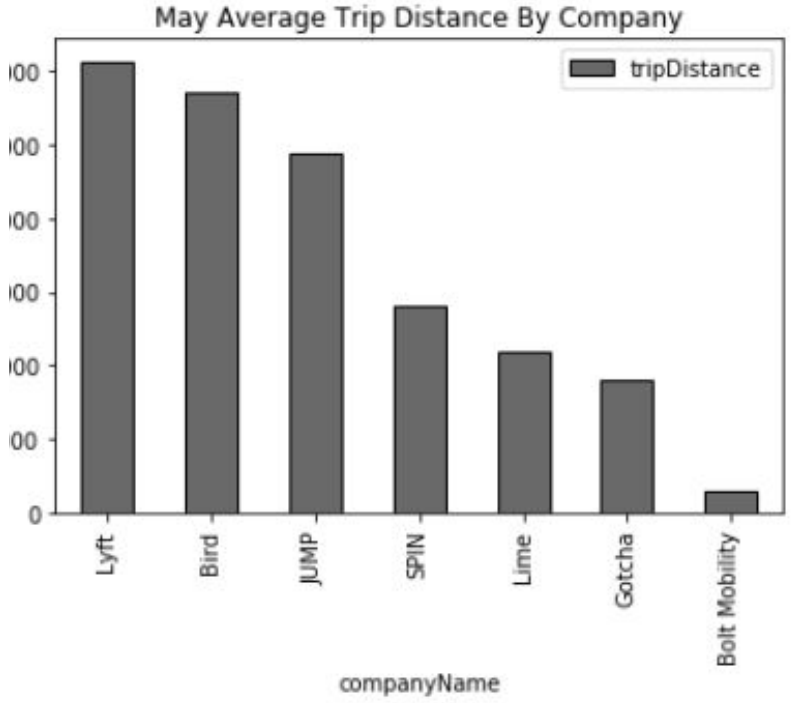
1. For scooters the average trip per scooter during the prior month shall exceed 3 trips per day;"

-Second Substitute Bill BL2018-1202 (as amended)

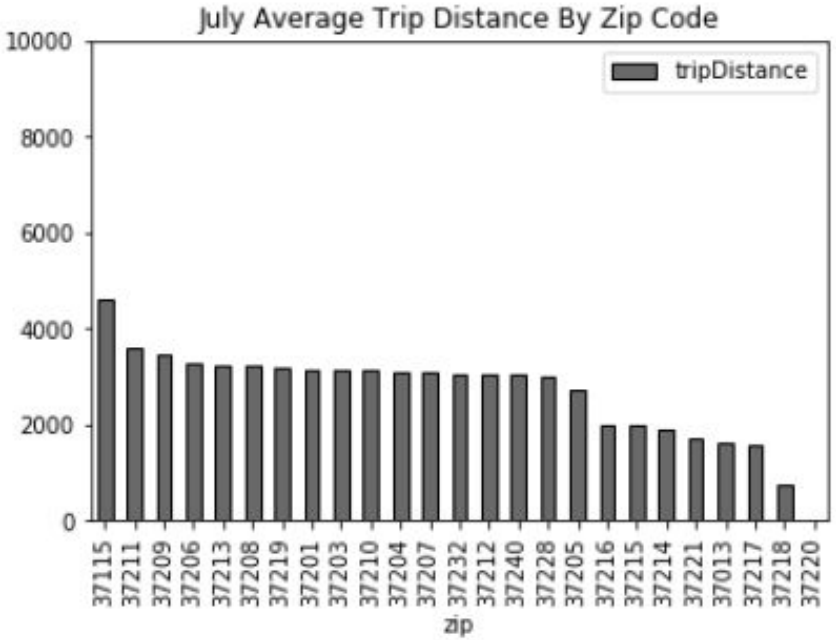
"Trip": Distance traveled during trip is greater than 3 meters.

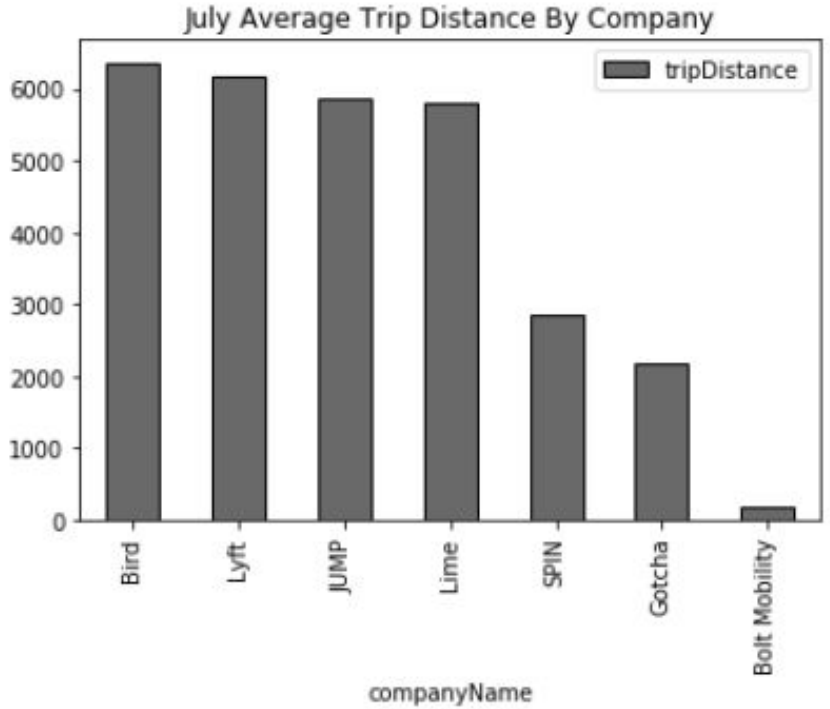
May Average Trip Distance By Zip Code



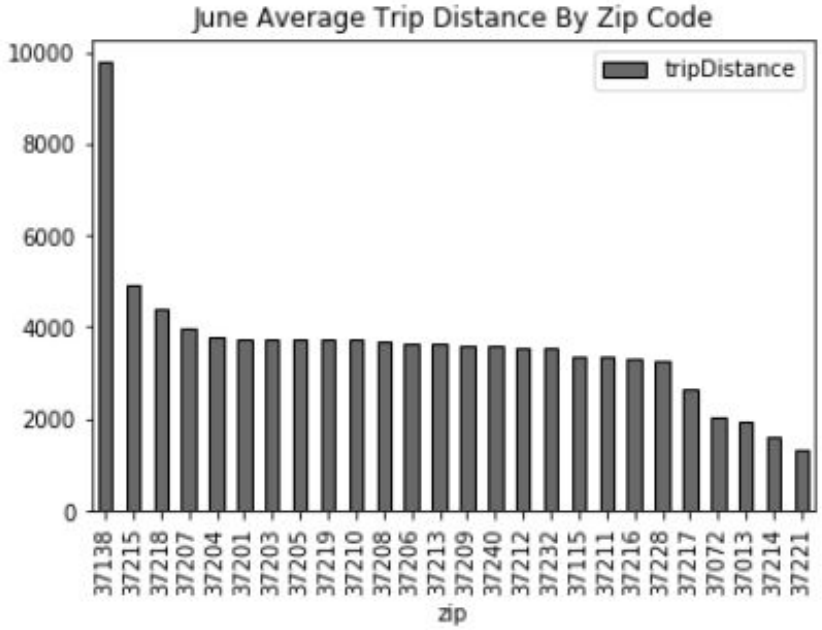


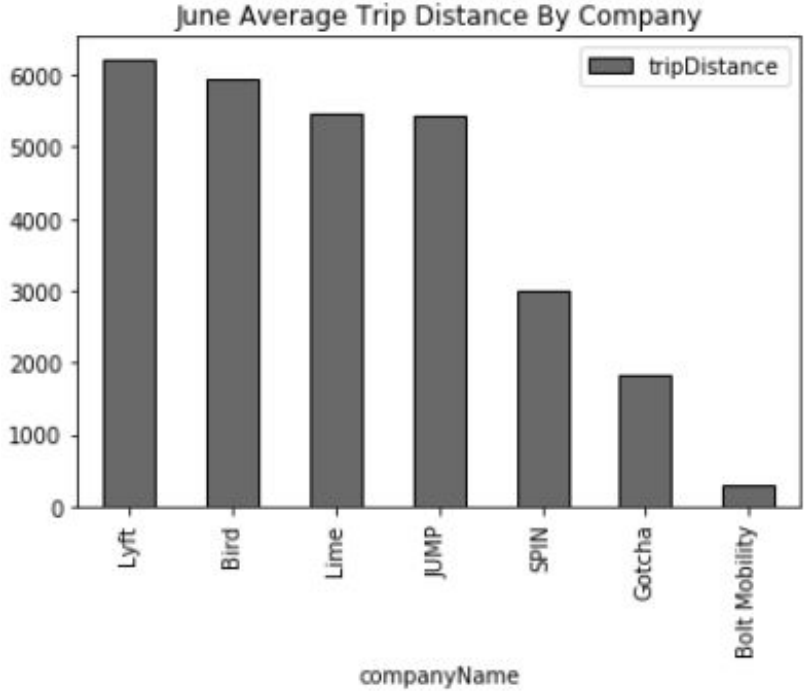
July Average Trip Distance By Zip Code



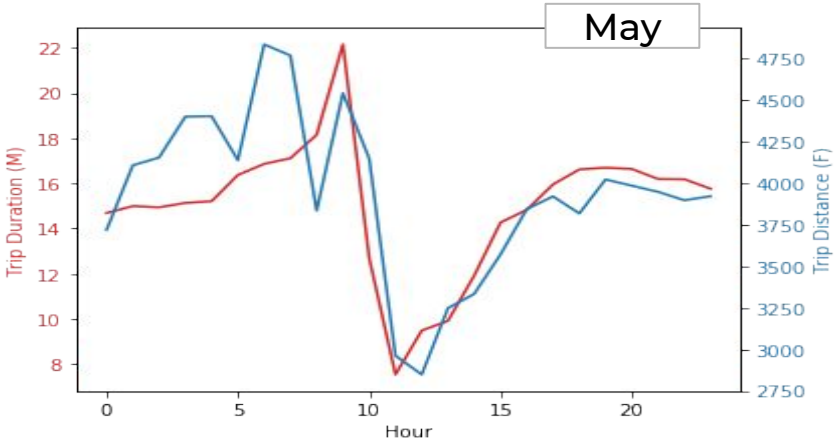


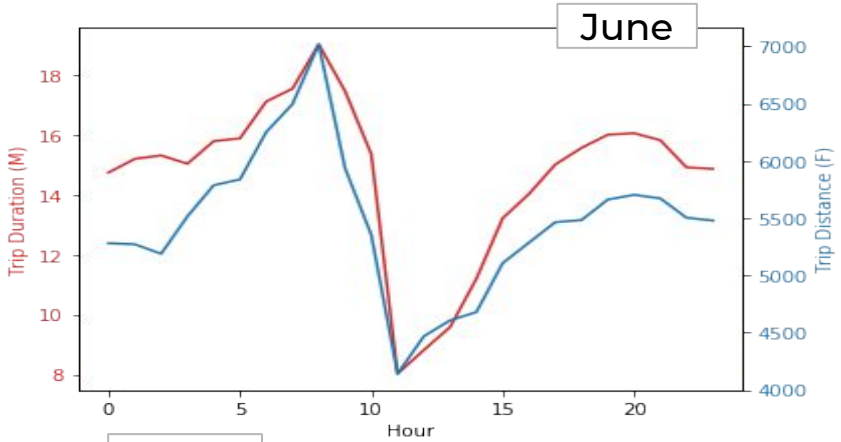
June Average Trip Distance By Zip Code

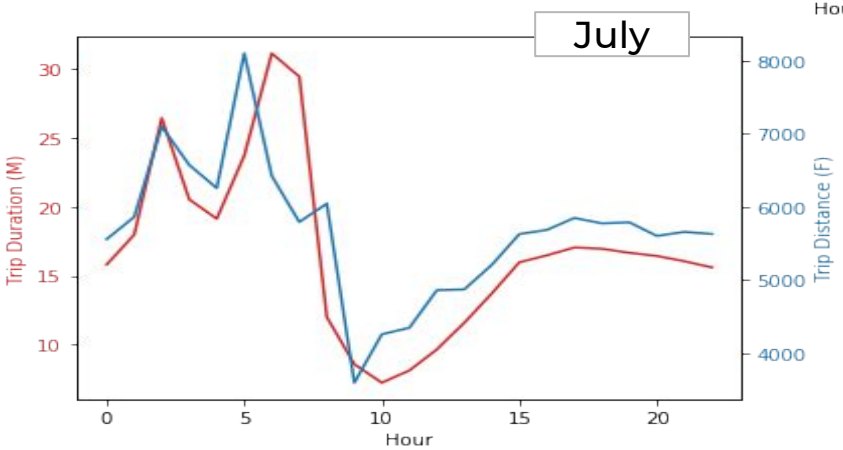




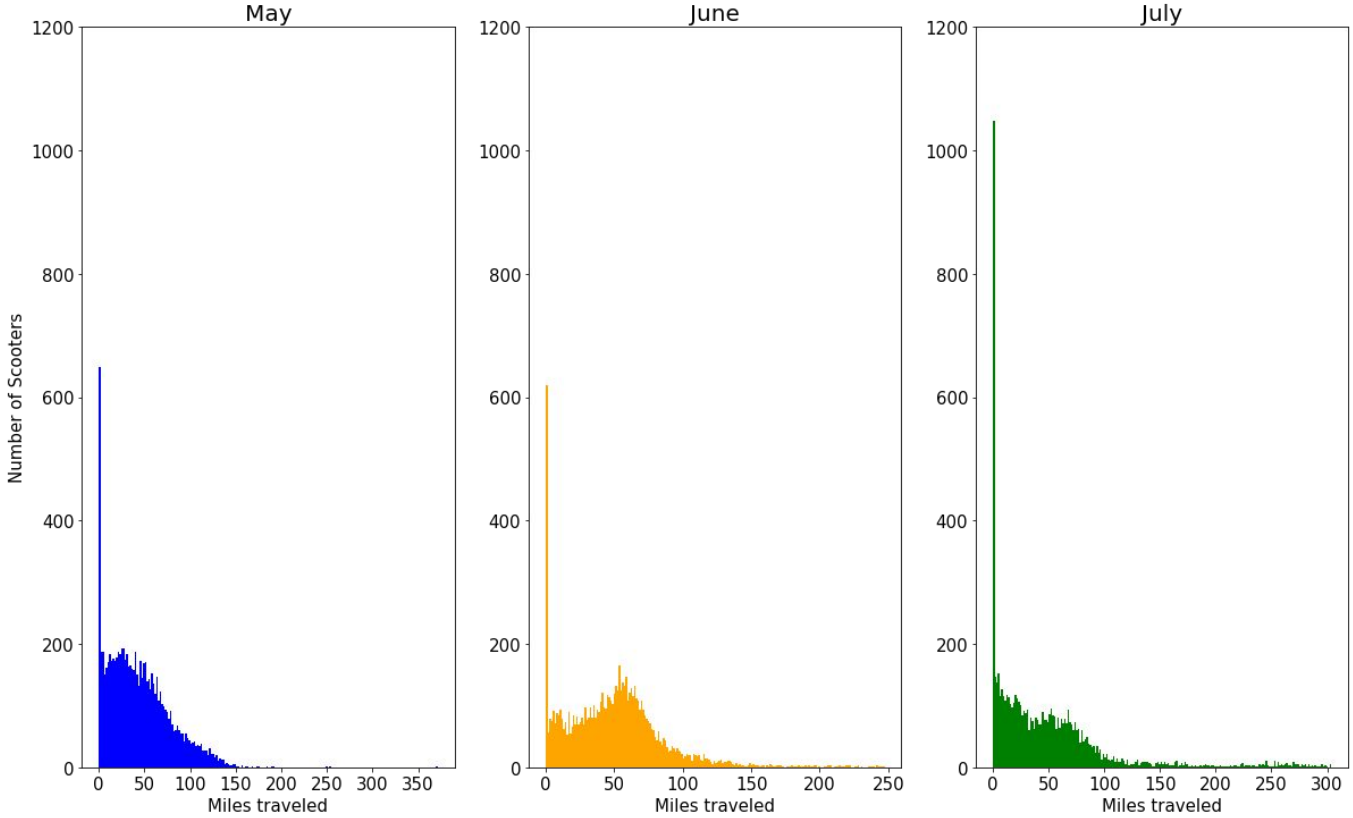
Trip Durations and Distances by hour for each Month





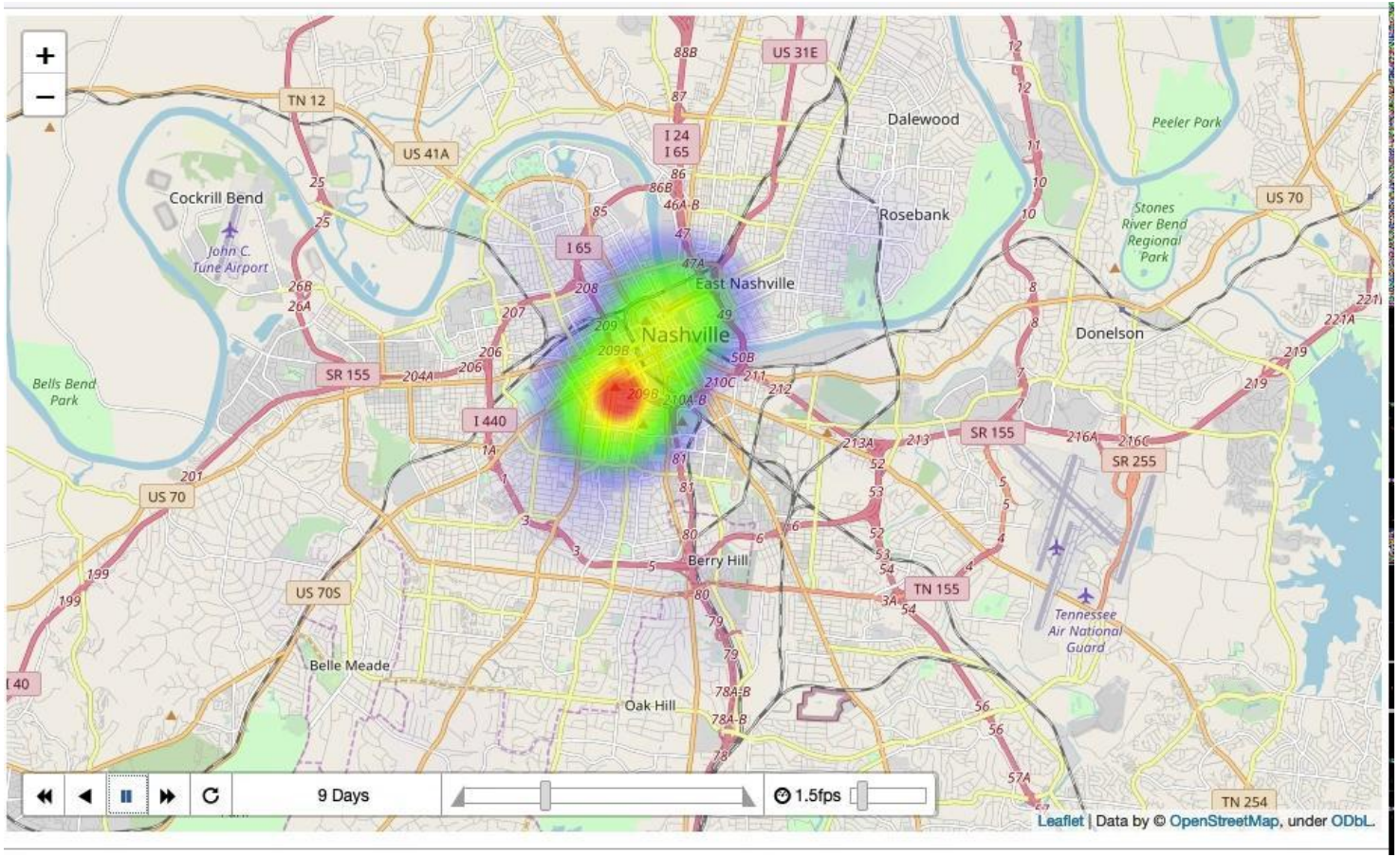


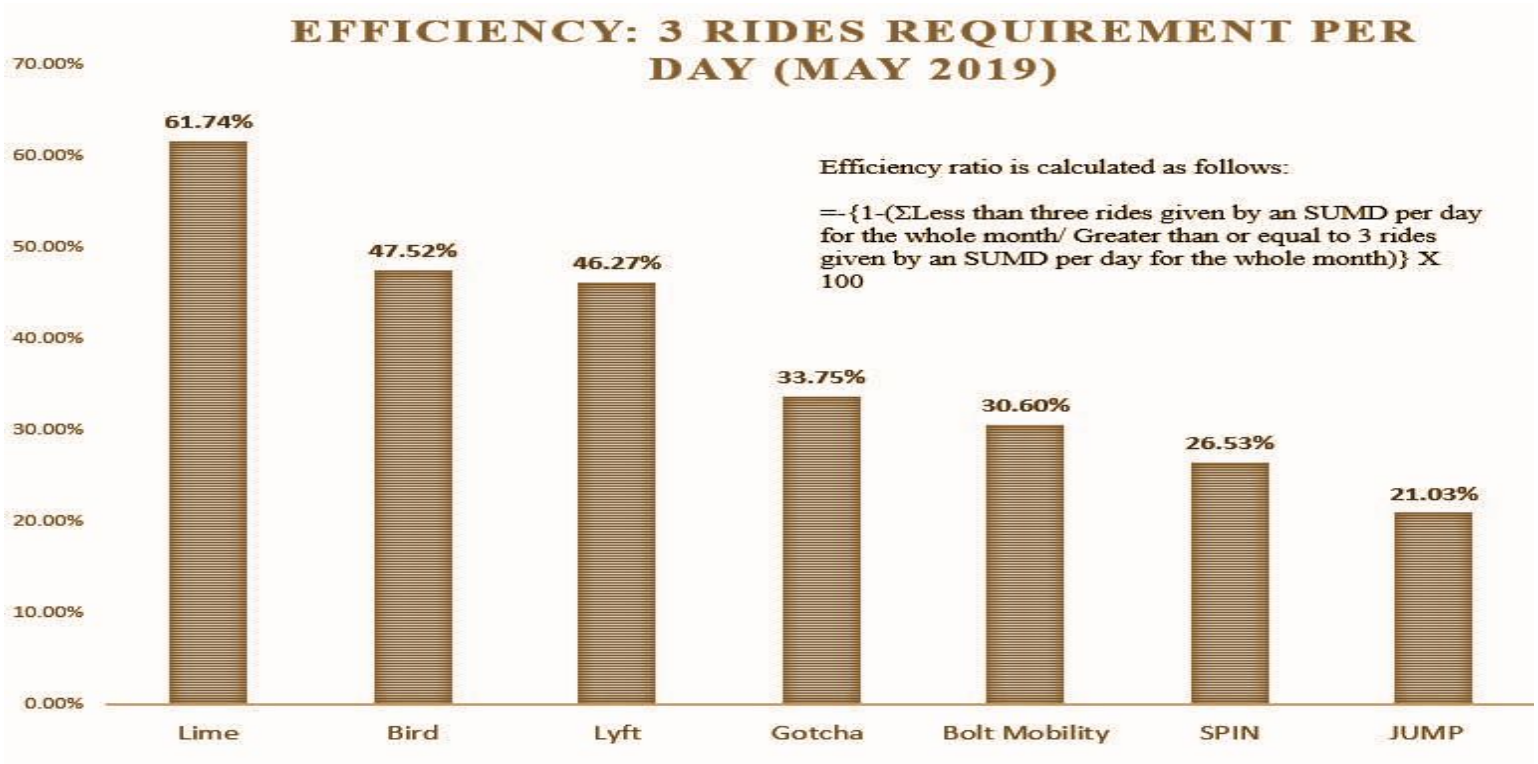
Distribution of Total Distance Traveled by Unique Scooter



These graphs are sourced from the original data which housed a large number of scooter IDs that had either no distance travelled, or a very small distance.

Usage of Scooters by Area in May




EFFICIENCY: 3 RIDES REQUIREMENT PER DAY (MAY 2019)
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
61.74%
47.52%
46.27%
33.75%
30.60%
26.53%
21.03%
Lime
Bird
Lyft
Gotcha
Bolt Mobility
SPIN
JUMP
Efficiency ratio is calculated as follows:
=-{1-(ΣLess than three rides given by an SUMD per day for the whole month/ Greater than or equal to 3 rides given by an SUMD per day for the whole month)} X 100

Current Scooter Utilization

The goal of Metro Nashville is to have each scooter used a minimum of 3 times per day. Current scooter utilization is far below this goal, as evidenced by the data below:

MAY

0.96

rides per scooter per day

JUNE

0.84

rides per scooter per day

JULY

0.60

rides per scooter per day

AVERAGE

0.80

rides per scooter per day (out of 5860 unique IDs)

Density Recommendations

Based on the average usage per scooter in Nashville, the recommended total number of available scooters is:

2,220 Scooters

Formula = (% of Total Rides Given By Each Zip Code) x (Approx. Number of Scooters Needed for Current Usage) x (Total Number of Scooters Needed To Hit One Ride Per Scooter Per Day) x 3

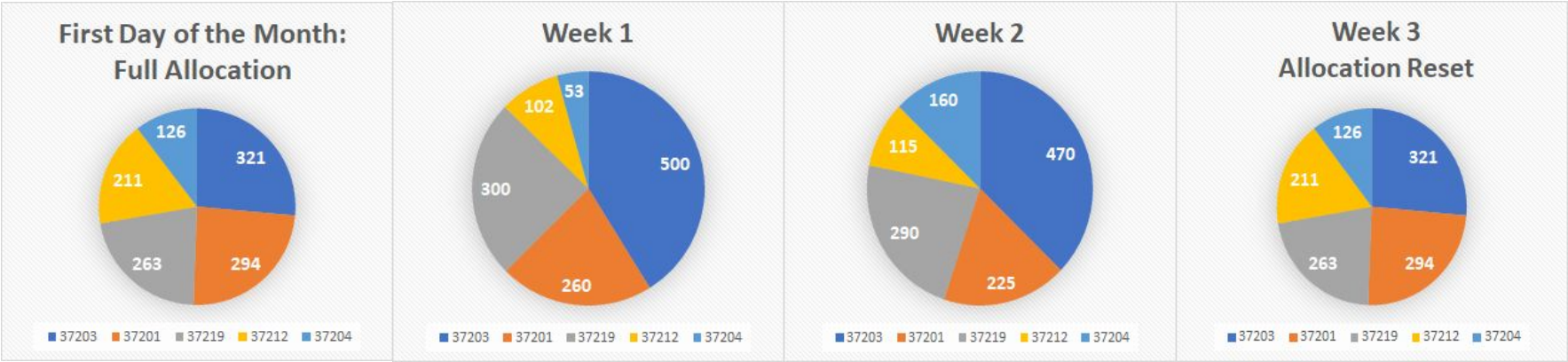
- **This will achieve the 3 per day scooter usage proposed by Metro Nashville**
- Five zip codes accounted for 83% of all scooter rides from May to July
- Recommended scooter allocation by zip code listed

Zip Code	% of Total Rides	Recommended Scooters Per Zip Code	Area in Square Miles	Recommended Scooters Per Square Mile
37203	**45%**	**321**	**6.7**	**48**
37201	**18%**	**294**	**0.6**	**478**
37219	**8%**	**263**	**0.4**	**725**
37212	**7%**	**211**	**4.1**	**52**
37204	**6%**	**126**	**11.1**	**11**
37208	4%	202	7.1	29
37206	4%	177	12.2	14
37213	4%	189	1.3	146
37210	2%	169	14.6	12
37240	1%	84	0.2	536
37232	1%	49	0.1	372
37207	1%	56	62.3	1
37209	0%	40	55.2	1
37215	0%	5	23.4	0
37228	0%	12	2.6	5
37216	0%	10	10.4	1
37205	0%	6	22.1	0
37211	0%	3	33.1	0
37217	0%	1	28.5	0
37013	0%	1	63.3	0
37214	0%	1	37.2	0
37218	0%	1	59.2	0
37115	0%	1	33.0	0
37221	0%	0	69.7	0
37138	0%	0	22.0	0
37220	0%	0	13.0	0
37072	0%	0	93.0	0

Keeping The Allocation in Balance

If this allocation is chosen, we recommend that a period of time be chosen that dictates when the scooters need to be “rebalanced” back to the original allocation.

Example below:



Additional Allocation Recommendations

Based on the previous findings, these potential factors can be woven into the eventual Metro Nashville charter for scooter companies

- The allocation of scooters can fluctuate by
  - Time of the day
  - Day of the week
  - Holidays
  - Location (if driving to achieve a specific metric or availability percentage, i.e., bus stop placement within the Promise Zone)
- Additional metrics can be added to the 3 use per day goal
  - Minimum total distance traveled on a monthly basis
  - Promise Zone utilization