Battle of the Neighborhoods
Where to Open a new Bicycle Shop in Raleigh NC?

Cindy High
July 14, 2021

1. Introduction

1.1 Background

Bicycling is popular in the Raleigh NC. There are many greenway trails near Raleigh, but finding a good bicycle shop with easy access to a neighborhood is a challenge. This project is to help a group of stakeholders who want to open a bicycle shop in an ideal Raleigh NC location. They are passionate about serving a community with their shop, and their previous experience shows that a bicycle shop in high density areas draws much of their business from within the neighborhood on bike or on foot.

They want to learn about existing bicycle shops in the Raleigh area and which neighborhoods have the highest density per square mile. They want to focus inside the inner beltline of Raleigh. There are several universities and colleges as well as high population areas with apartments, condominiums, and homes.

1.2 Problem

This project will pull information on existing bicycle shops to understand where the competition is already open. The project will provide insights into the Raleigh neighborhood populations per square mile to help choose which neighborhoods have larger customer bases. It will also evaluate the median income per household to support a location plan. Additionally, we will look at the surrounding colleges and universities that can bring in additional customers who frequently use bicycles for transportation.
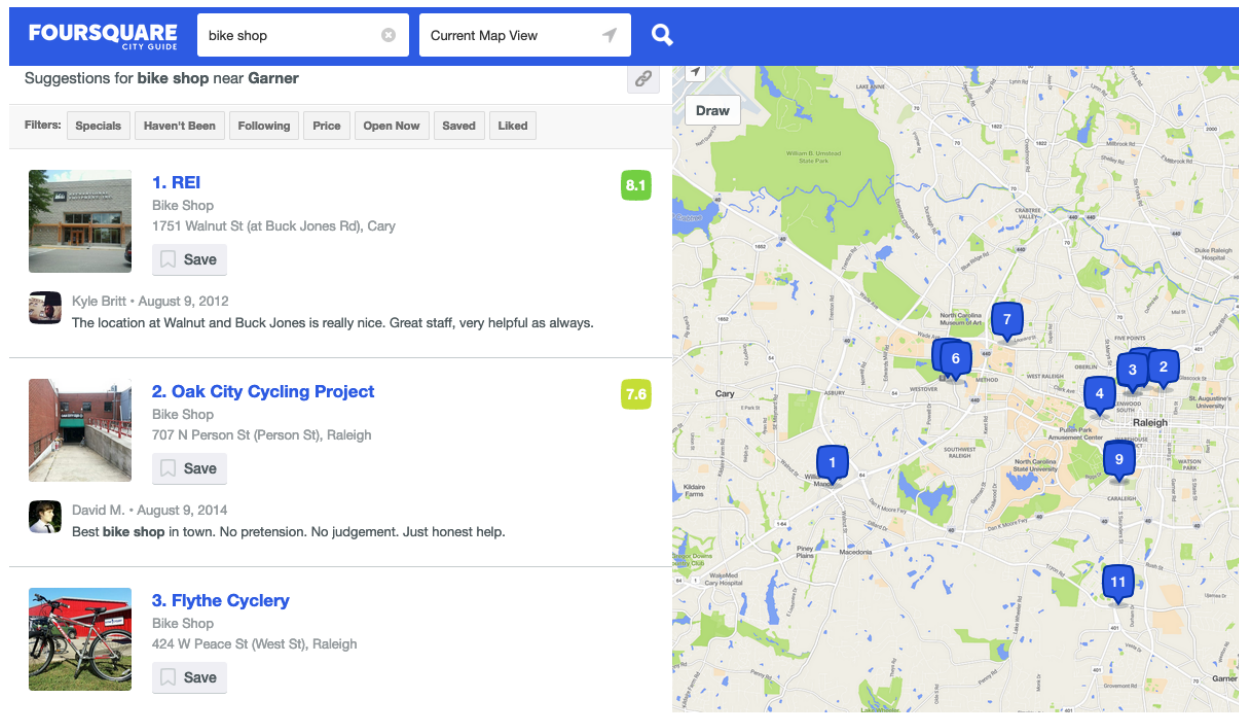
1.3 Interest

The stakeholders have used an owned bike shops in other larger cities and saw the value of having a neighborhood bike shop rather than the need to go to a big box sporting goods store which are more likely in the suburbs. They want a shop where access is easy from the bike since

it makes access easier.

2. Data acquisition

This project will use the Foursquare data on bicycle shops in the central Raleigh NC area. It will also use Foursquare to locate the colleges and universities in the area to give evidence of extra school related populations that could form part of the customer base. We use the venue API to gather this needed information.

The project uses neighborhood data gathered from City-Data.com which provides many details on city neighborhoods. I am interested in neighborhood information on population, population density, and median household income.

Neighborhood data is seen in this example of one Raleigh neighborhood: https://www.city-data.com/neighborhood/Capital-Park-Raleigh-NC.html . Since the dataset is not readily available in downloadable format, we will scrape the pertinent information needed from the webpages of each neighborhood of interest.

Here is an example of the population data:

Area: 0.014 square miles

Population: 96

Population density:
Capital Park: 6,734 people per square mile
Raleigh: 4,142 people per square mile

3. Methodology

When searching for bike shop venues using Foursquare, I searched for "bike bicycle". When I searched on "bike shop", I got all kind of shops not related to bicycles. I found that I also got trails, bike bars, bike events. To handle this problem, I cleaned the data to only include venues with the category of 'Bike Shop'.

Location was a bit of a problem for some of the data too. There was one bike shop that had coordinates for the Raleigh area, but it was in Morrisville VT. (There is a Morrisville NC, and it was mislabeled.) I also got other nearby towns such as Cary NC. To clean this data, I dropped all rows where the city was not Raleigh.

18	All Star Bike Shop	Bike Shop	1241 Kildaire Farm Rd	35.762816	-78.782546	[{'label': 'display', 'lat': 35.76281565434125...	12794	US	Cary	NC	United States	[1241 Kildaire Farm Rd, Cary, NC 27511]	27511	NaN	4bccc5a5cc8cd13a578cc1cf
19	Lake Crabtree Mountain Bike Trail	Trail	NaN	35.838904	-78.782217	[{'label': 'display', 'lat': 35.83890447131183...	13694	US	Cary	NC	United States	[Cary, NC 27513]	27513	NaN	4fe246f3e4b0abb74904bb97
20	Trek Bicycles of Raleigh	Bike Shop	10911 Raven Ridge Rd #107	35.906449	-78.591238	[{'label': 'entrance', 'lat': 35.906495, 'lng'...	14053	US	Raleigh	NC	United States	[10911 Raven Ridge Rd #107 (Durant Rd. & Raven...	27614	Durant Rd. & Raven Ridge Rd.	51aa52467dd2d73fd5cfa68d
21	Chucks Bikes	Bike Shop	45 Bridge St	35.810070	-78.829415	[{'label': 'display', 'lat': 35.81006994208516...	16901	US	Morrisville	VT	United States	[45 Bridge St, Morrisville, VT 05661]	05661	NaN	58d51efe8ee560562c563266
22	Chucks Bikes	Bike Shop	45 Bridge St	35.799994	-78.831335	[{'label': 'display', 'lat': 35.79999392988527...	16946	US	Morrisville	VT	United States	[45 Bridge St, Morrisville, VT 05661]	05661	NaN	5a45cc24e679bc7b22ec4abf

When gathering the university and college data, I got many random entries here too. My search was for ''college university', and data was returned from bus stops to dorm buildings. All total 49 venues were returned from 32 categories shown here:

```
In [135]: uniqueCategories = universityDF_filtered['categories'].unique()
          uniqueCategories

Out[135]: array(['University', 'College Residence Hall', 'College Gym',
                 'Smoke Shop', 'Bus Station',
                 'Residential Building (Apartment / Condo)', 'Automotive Shop',
                 'City', 'General College & University', 'Neighborhood',
                 'Salon / Barbershop', 'Medical School', 'College Auditorium',
                 'College Quad', 'Government Building', 'College Library',
                 'Post Office', 'College Arts Building', 'Water Park',
                 'College Communications Building', 'College Bookstore', 'Garden',
                 'College Track', 'College Academic Building', 'High School',
                 'College Administrative Building', 'Fraternity House',
                 'College Cafeteria', 'Music School', 'College History Building',
                 'Housing Development', 'College Classroom'], dtype=object)
```

I wanted to only keep the categories 'University' and 'General College & University'. After dropping all un-needed categories, I was down to 7 colleges and universities, but two were still duplicates:

	name	categories	address	crossStreet	lat	lng	labeledLatLngs	distance	postalCode	cc	city	state	country	formattedAddress	
0	William Peace University (Peace College)	University	15 E Peace St	at N Blount St	35.789109	-78.636518	[{'label': 'display', 'lat': 35.78910871456477...	715	27604	US	Raleigh	NC	United States	[15 E Peace St (at N Blount St), Raleigh, NC 2...	4aff082bf964a52C
1	William Peace University Fountain	General College & University	15 E Peace St	NaN	35.788803	-78.637696	[{'label': 'display', 'lat': 35.78880266372348...	604	27604	US	Raleigh	NC	United States	[15 E Peace St, Raleigh, NC 27604]	4bc5c4714a9aa593
2	North Carolina State University	University	4700 Hillsborough St	at Dan Allen Dr	35.785167	-78.674995	[{'label': 'display', 'lat': 35.7851667877948,...	2790	27606	US	Raleigh	NC	United States	[4700 Hillsborough St (at Dan Allen Dr), Ralei...	4c52fae199ecc9b6
3	St. Augustine's University	University	1315 Oakwood Ave	btwn. N. State St. & Hill St.	35.786320	-78.620016	[{'label': 'display', 'lat': 35.78632026430733...	2194	27610	US	Raleigh	NC	United States	[1315 Oakwood Ave (btwn. N. State St. & Hill S...	4be566dacf200f4
4	peace college beach	University	NaN	NaN	35.790500	-78.636929	[{'label': 'display', 'lat': 35.7905, 'lng': -...	729	27604	US	Raleigh	NC	United States	[Raleigh, NC 27604]	4f9c7be1e4b0d8e6
5	Shaw University	General College & University	118 E South St	NaN	35.770772	-78.637522	[{'label': 'display', 'lat': 35.77077179358403...	1984	27601	US	Raleigh	NC	United States	[118 E South St, Raleigh, NC 27601]	4c6db8c44d24b60c
6	Meredith College	University	3800 Hillsborough St	NaN	35.798374	-78.688609	[{'label': 'display', 'lat': 35.79837355941544...	4175	27607	US	Raleigh	NC	United States	[3800 Hillsborough St, Raleigh, NC 27607]	4b2071c5f964a52C

For the neighborhood data, I had a bit of a manual processing to figure out the inner beltline Raleigh neighborhoods using data from https://en.wikipedia.org/wiki/Raleigh,_North_Carolina_neighborhoods and then the corresponding neighborhood page from https://www.city-data.com/neighborhood. The city-data scraping was automated with beautifulsoup but coming up with the neighborhoods to scrape was the manual process.

I started off scraping information on the neighborhoods'
- Area
- Population
- Density
- Median income
- Average household size

Area and average household size proved less useful, and I focused on population, population density, and median income. For example, there were a few cases where the average household

size reported between 13 and 25 even in cases where the neighborhood population was lower than that the average household size. I found that data to be unreliable.

# 4. Results

4.1 Bicycle Shops in central Raleigh

First, I plotted a red dot at the center of Raleigh's geo coordinates. Next, I plotted the bike shops found using a blue dot and labeled them by name. I am focusing inside the inner beltline toward the city center.
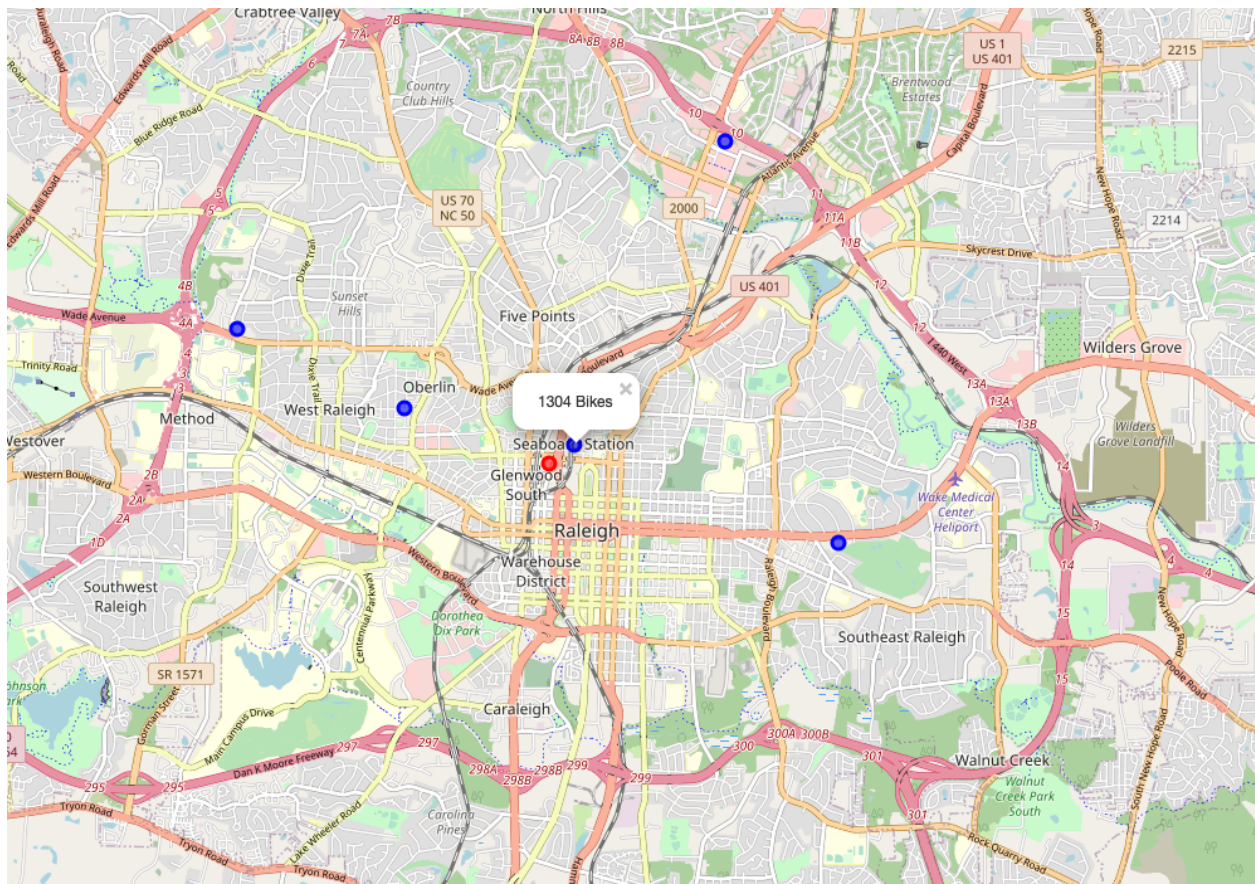
4.2 Colleges and Universities in central Raleigh

Next, I added the college and university data that shows some of the extra population areas. University information is added with purple dots:
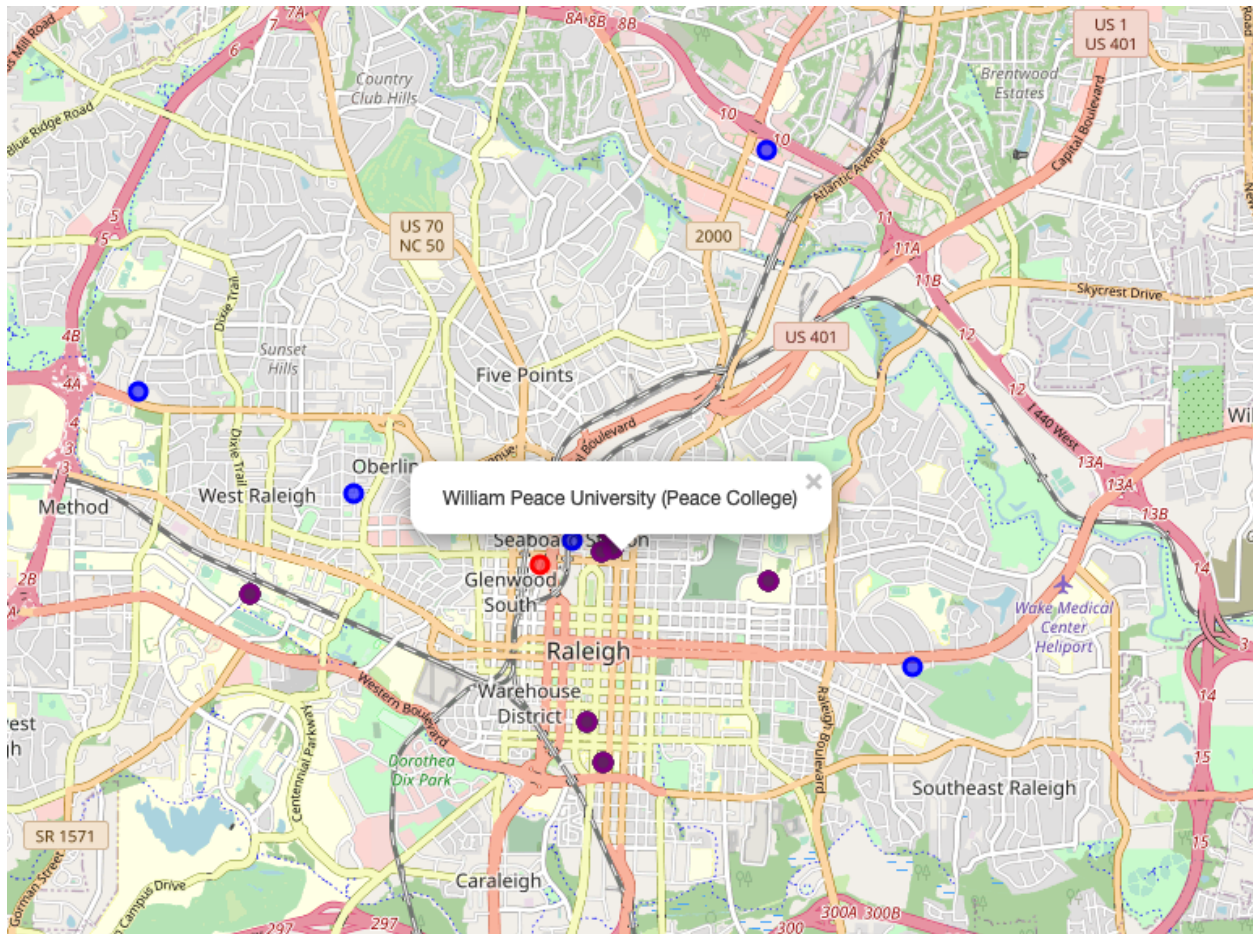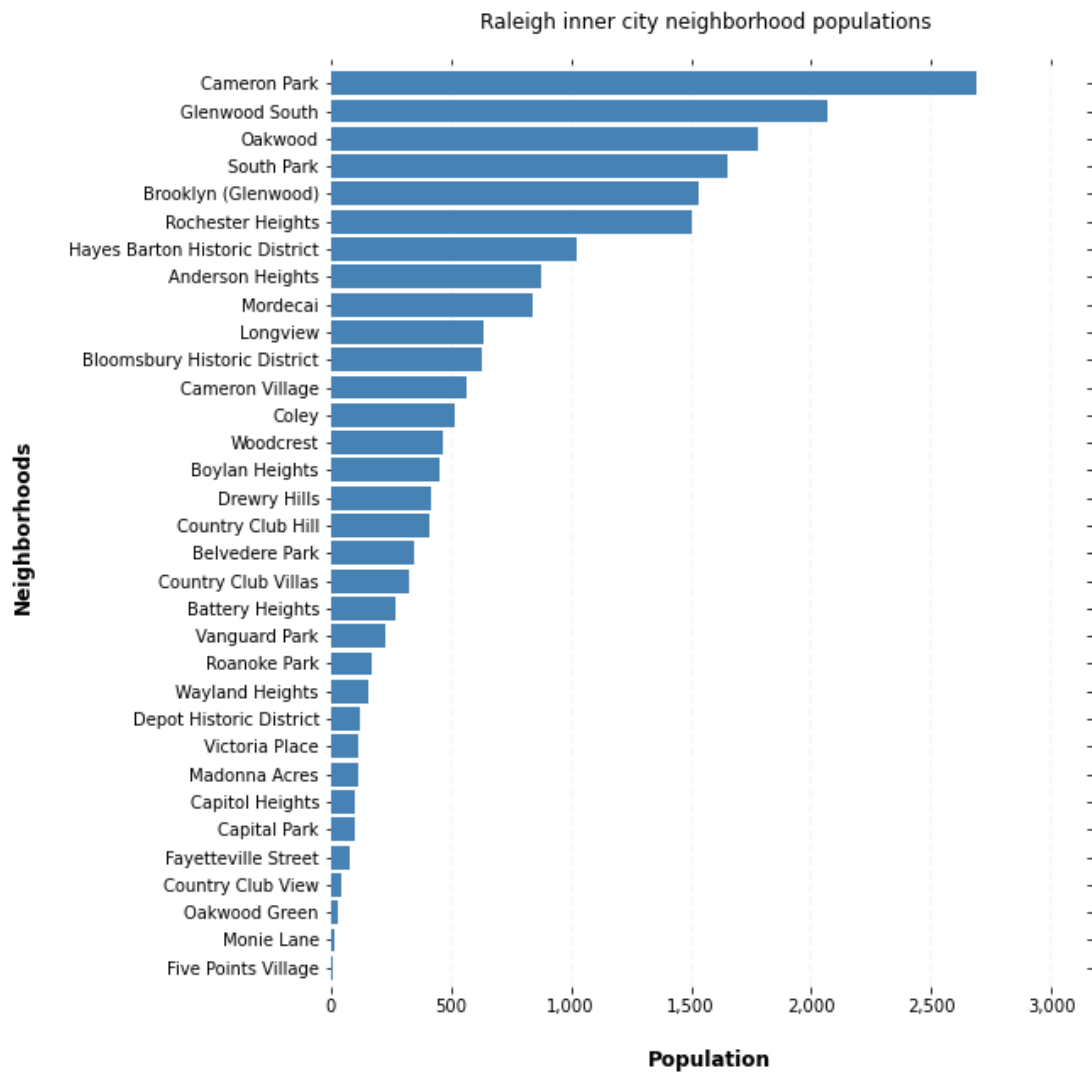

4.3 Neighborhood Data

The data gathered for each neighborhood is shown in the table below. These neighborhoods are all small areas of population and the density per square mile varied greatly.

	neighborhood	population	area	density	median income	average household size
0	Anderson Heights	877	0.370	2369	218953	2.7
1	Belvedere Park	345	0.094	3684	75936	13.2
2	Battery Heights	267	0.087	3052	39899	2.0

	neighborhood	population	area	density	median income	average household size
3	Bloomsbury Historic District	625	0.183	3424	155158	2.2
4	Boylan Heights	454	0.106	4270	72500	25.0
5	Cameron Park	2690	0.199	13526	53453	1.6
6	Cameron Village	563	0.067	8403	73269	1.6
7	Capital Park	96	0.014	6734	66125	2.0
8	Capitol Heights	98	0.046	2134	45096	2.5
9	Country Club Hill	408	0.406	1005	140984	2.4
10	Country Club View	40	0.033	1199	36854	2.9
11	Country Club Villas	324	0.105	3093	182912	2.3
12	Coley	513	0.237	2169	148646	2.6
13	Depot Historic District	123	0.024	5133	105133	1.6
14	Drewry Hills	417	0.260	1601	140549	2.4
15	Fayetteville Street	79	0.016	5083	105133	1.6
16	Five Points Village	6	0.003	1868	100526	25.0
17	Brooklyn (Glenwood)	1531	0.240	6385	85874	1.6
18	Glenwood South	2065	0.225	9167	79856	5.5
19	Hayes Barton Historic District	1027	0.267	3844	118080	8.9
20	Oakwood	1782	0.277	6426	61417	2.1
21	Oakwood Green	32	0.004	7512	85750	2.5
22	Longview	637	0.368	1731	48694	3.2
23	Madonna Acres	110	0.027	4095	23542	2.8
24	Monie Lane	14	0.002	7124	35878	2.1
25	Mordecai	839	0.282	2970	66861	11.1
26	Roanoke Park	167	0.060	2788	114272	13.8
27	Rochester Heights	1503	0.068	22077	49698	2.9
28	South Park	1652	0.318	5187	35558	3.9
29	Vanguard Park	223	0.050	4449	114272	13.8
30	Victoria Place	115	0.031	3730	45938	2.6
31	Wayland Heights	153	0.053	2863	172702	2.6
32	Woodcrest	468	0.184	2550	66383	10.7

Using a horizontal bar chart shows the neighborhood population comparisons quite well.
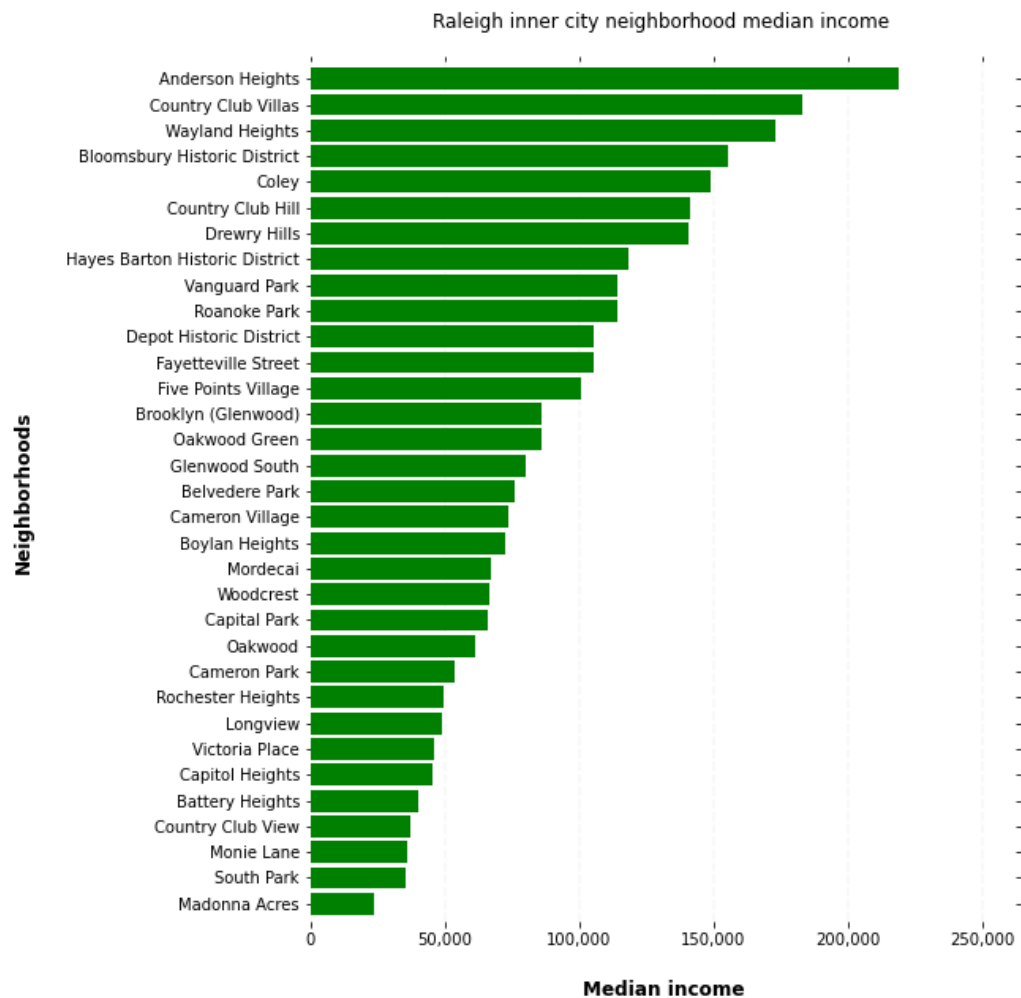

Raleigh inner city neighborhood populations

In a similar fashion, the following chart shows the neighborhood densities:

Raleigh inner city neighborhood densities
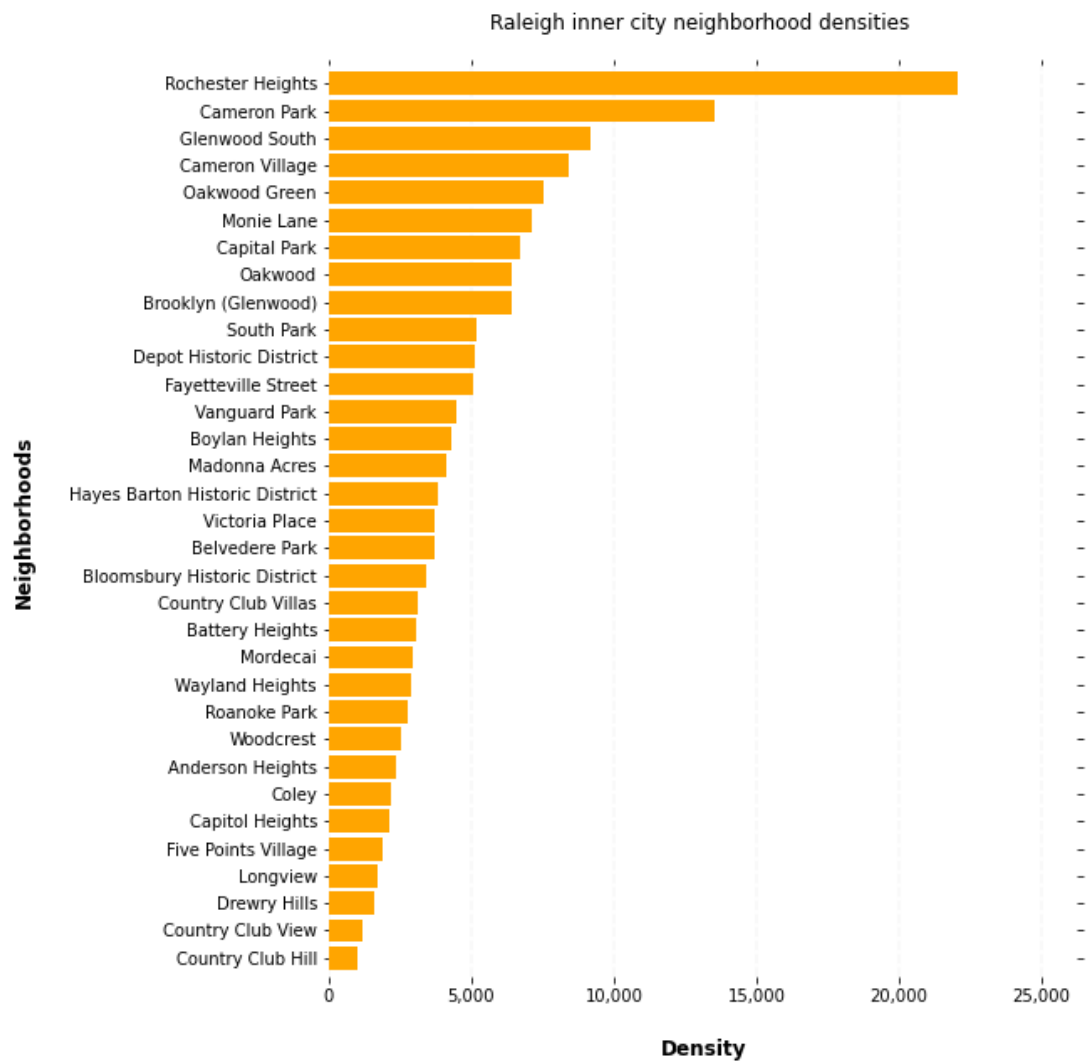
Here is the graph of the median household incomes.

By normalizing and combining all the neighborhood data, we can visualize the effect of all three measurements. First, I normalized each of the columns of data and created the total for each row. By sorting on the total, we can see how the neighborhoods rank on the combined measurement.

neighborhood	population	density	income	total
Country Club View	0.012668	0.009207	0.068123	0.089997
Madonna Acres	0.038748	0.146640	0.000000	0.185388
Capitol Heights	0.034277	0.053578	0.110301	0.198156
Battery Heights	0.097243	0.097143	0.083706	0.278092
Victoria Place	0.040611	0.129319	0.114610	0.284539

Raleigh inner city neighborhood comparison
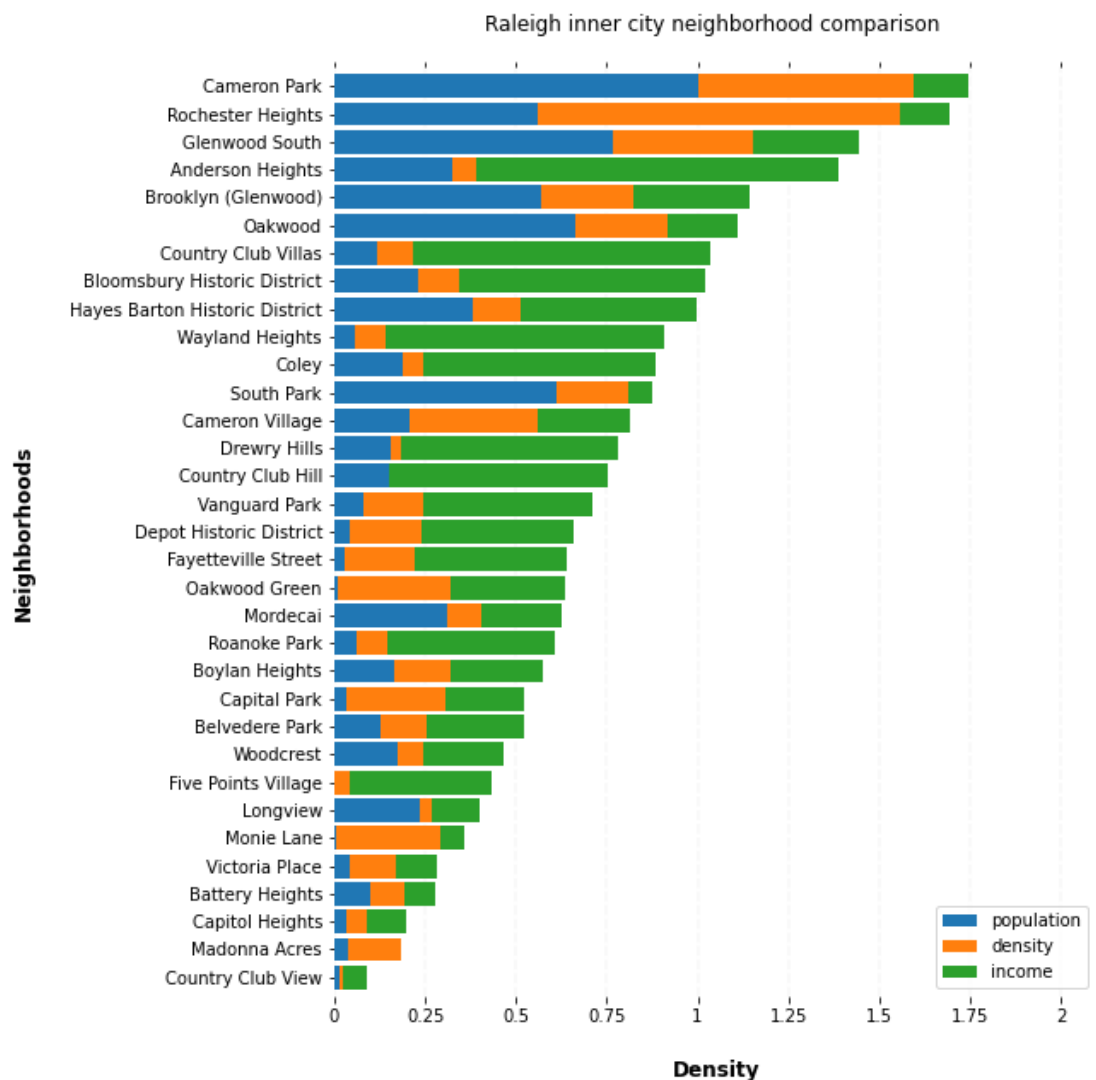
4.4 Top 6 neighborhoods

According to the sort, we will look further at the top six of these neighborhoods and add them to the map. Plot a circle near the center of the neighborhood using coordinates obtained manually from nominatim.openstreetmap.org. The circle size is based on the total ranking.

neighborhood	lat	lng	total
Cameron Park	35.785779	-78.655470	1.747268
Rochester Heights	35.754714	-78.627885	1.691601
Glenwood South	35.785436	-78.647354	1.442660
Anderson Heights	35.817863	-78.637782	1.389246
Brooklyn (Glenwood)	35.789495	-78.649347	1.142476
Oakwood	35.784842	-78.632029	1.112782
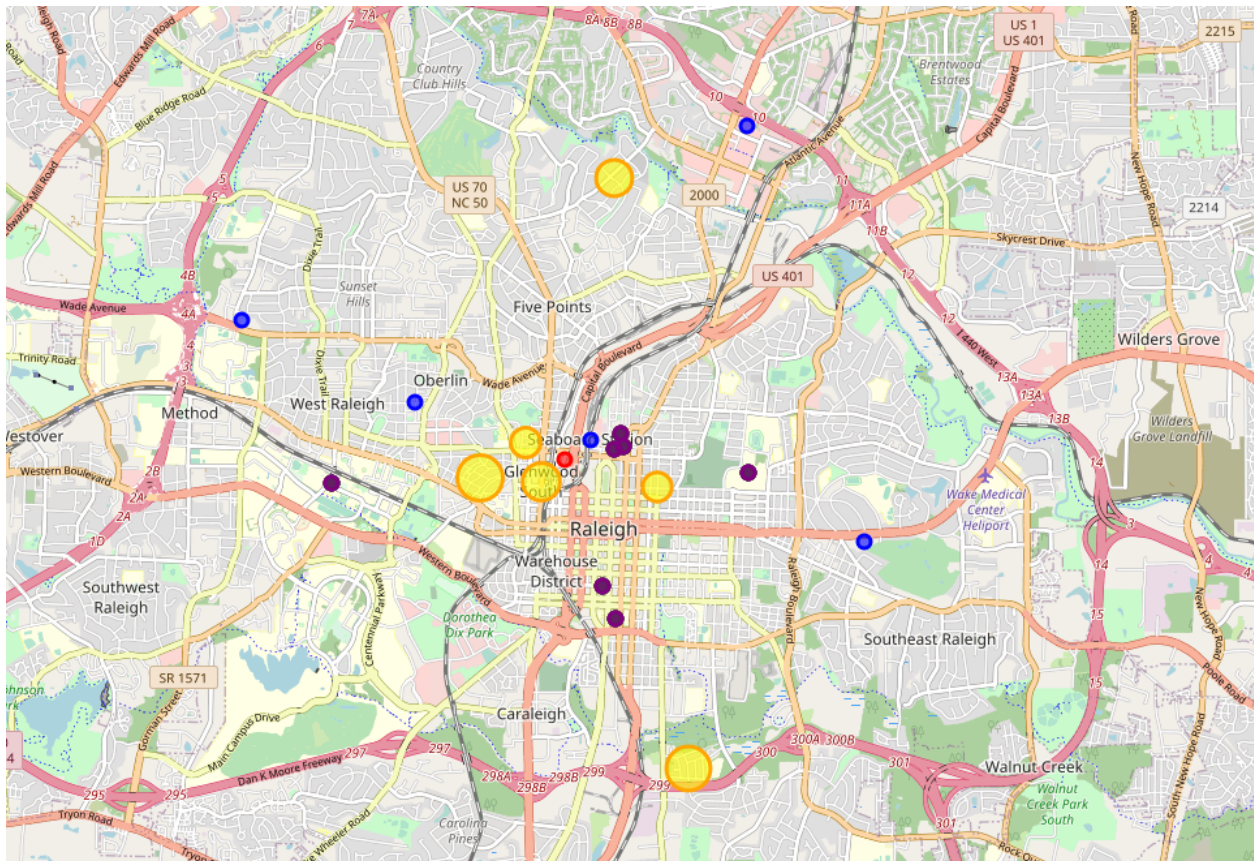
5. Discussion

When plotted together, we see that three of the top six neighborhoods (Cameron Park, Glenwood South, and Brooklyn) are in proximity of each other. This cluster is worth considering first since the other three neighborhoods must stand on their own as potential locations.

The cluster of neighborhoods of interest is between two existing bike shops. One is on the other side of a major thoroughfare which makes it more difficult to approach by bike from those neighborhoods. The other is farther away, but more analysis can be done of the comments on these two bike shops to see if they have good reviews from customers or not.
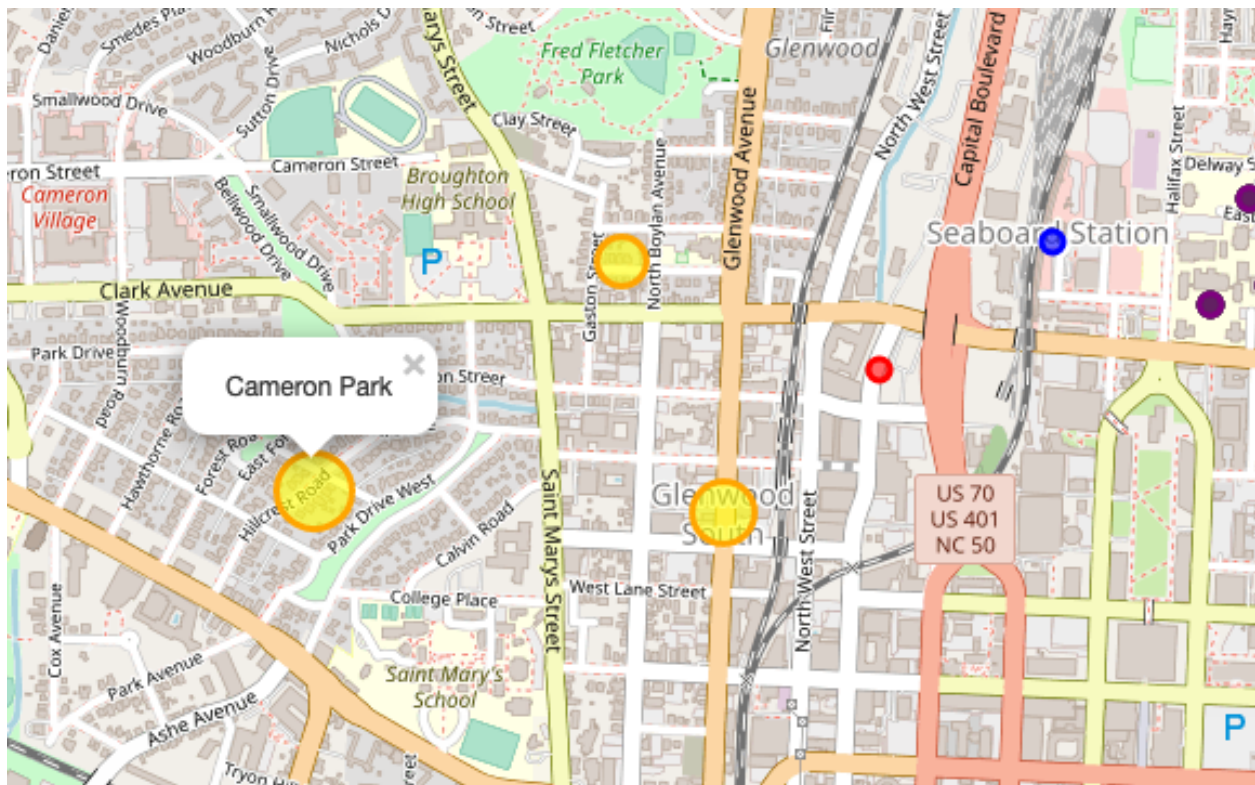
Using data analysis gives us a starting point to solving the question on where to open a new shop. It will require deeper neighborhood study including looking at the retail space available and retail space cost.

I started this process looking at neighborhoods, but not all neighborhoods in the beltline had data available. It is possible that potential neighborhoods were overlooked because of the lack of data. I was surprised to see neighborhoods with such small populations. In the future, it might be interesting to compare the results I have based on neighborhoods to those achieved if using zip code areas.

While the university data was interesting to consider, it really did not affect the outcome.

6. Conclusions

In this study I have looked at the bike shops and the neighborhood populations, densities, and median income in central Raleigh to help determine a good location to open a new bike shop in town. The Cameron Park, Glenwood South and Brooklyn neighborhoods are all in the top 6 rankings and they are very close to each other without being divided by major highways. This area would be great for a deeper business study to see if a new bike shop is viable in that area.