Washington D.C. Metro Stops Issue

For Coursera Capstone in Data Science

1.0 Introduction:

Washington D.C. is a very large metropolitan area with some of the worst traffic on the Eastern Seaboard of the United States. The issues surrounding traffic in the Washington Metropolitan Area (or WMA) are complex. Washington continues to grow, as it is the nation's capital, and is increasingly popular for non-governmental businesses. The issues surrounding traffic are: construction, lack of public transport, and population growth (among others). In this final assignment, I am going to be looking at the WMA and attempt to determine which line requires additional Metro stops. The current metro stops are illustrated in the figure below (Figure 1). The addition of new and improved public transport options for commuters heading into Washington will assist with the traffic issues.

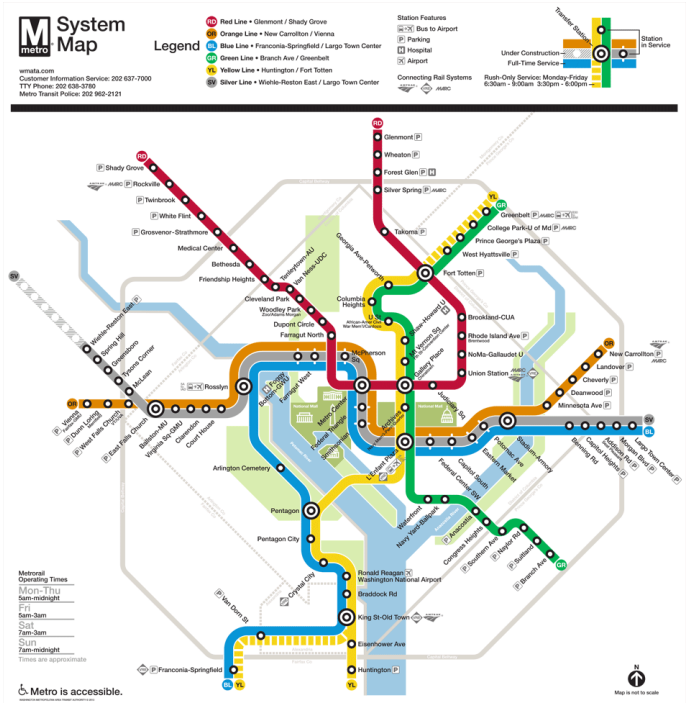

Figure 1: Current Metro Map for Washington D.C.

These issues are highlighted by having an understanding of the interstate around Washington D.C. The following figure illustrates the major highways into Washington D.C. As can be seen in the following figures, there are very few bridges across the river, as well as one primary ring-road around Washington, Interstate 495 (known locally as the Beltway). The Beltway is the cause of many issues and delays, as well as being the location for many deadly crashes each year.

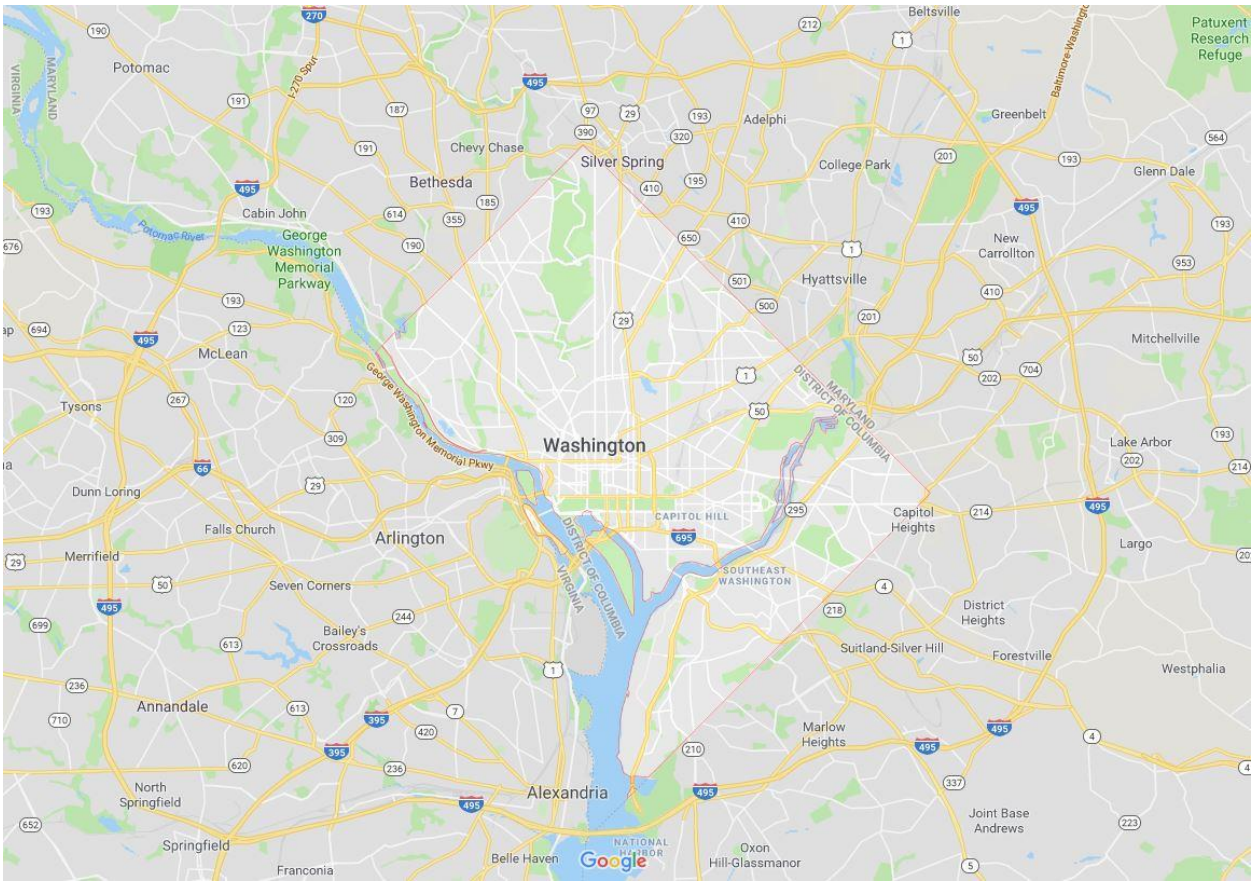

Figure 2: Google Map of Washington D.C., including interstates and state routes.

1.1 Business Areas of Concern

The business problems associated with this are the increase of profit and the decrease of overhead. The longer that people (employees) are stuck in traffic, the less time they have to

complete their work. As such, a smooth and efficient commute (not to mention stress-free!) would seriously benefit companies and employees.

The Texas Travel Institute states that commuting via cars etc costs the average person 52 wasted hours a year. In addition, the costs associated with owning a car are becoming exceedingly high, as the United States has focused on commuting via car (often called solo-commuting) as opposed to alternative methods (carpool, public transport, remote work or telework, etc.). By enhancing the alternative methods, it is possible for the commute to be shorter for everyone, as well as more economical and ecological.

Link for further information: https://meetingoftheminds.org/improving-journey-work-benefits-commuters-communities-companies-18344

2.0 Data:

The data that I will be using for this project consists of Foursquare data for the WMA as well as Wikipedia (https://en.wikipedia.org/wiki/List_of_Washington_Metro_stations) and pre-constructed visualizations from the Washington Metropolitan Area Transit Authority (WMATA) in order to best determine what line of the area's metro should use more stops. This is especially important for the WMA as the cost of living increases the closer to Washington D.C. a person lives. Therefore, more people are moving farther out, and requiring more time to come into work (and thereby creating more traffic).

The other data that I used included population of Maryland's counties, and latitude and longitude data gathered from Google. This was to demonstrate where the different counties were, and therefore where the different areas of concern are.

3.0 Methodology

The methodology for this project consisted of plotting the real-world locations for the Metro stations, as the WMATA map is not to scale. This allows for analysis to be conducted based on the real-world locations of the Metro stations. In addition, a chart showing the line ridership numbers was created, in order to see which line was the busiest, and therefore which line needs additional stations. Finally, a map of the top ten most populous counties in Maryland was produced, as that state had the line with the most passengers. This project used folium and matplotlib to illustrate the images required.

The first step was to see where the stops are in Washington D.C. and the WMA. This was done through Folium. The resulting map is displayed, with a close-up of Washington D.C. as well (Figures 3 and 4). This data was gathered through the Foursquare available data. One issue was that the Foursquare data only had information for approximately 50 of the approximately 150 metro stops. As a result, I attempted to find other sources for the location data, but was unable to. The Foursquare data, used in conjunction with the other available data, provides a decent understanding of the current layout of the Washington Metro system.

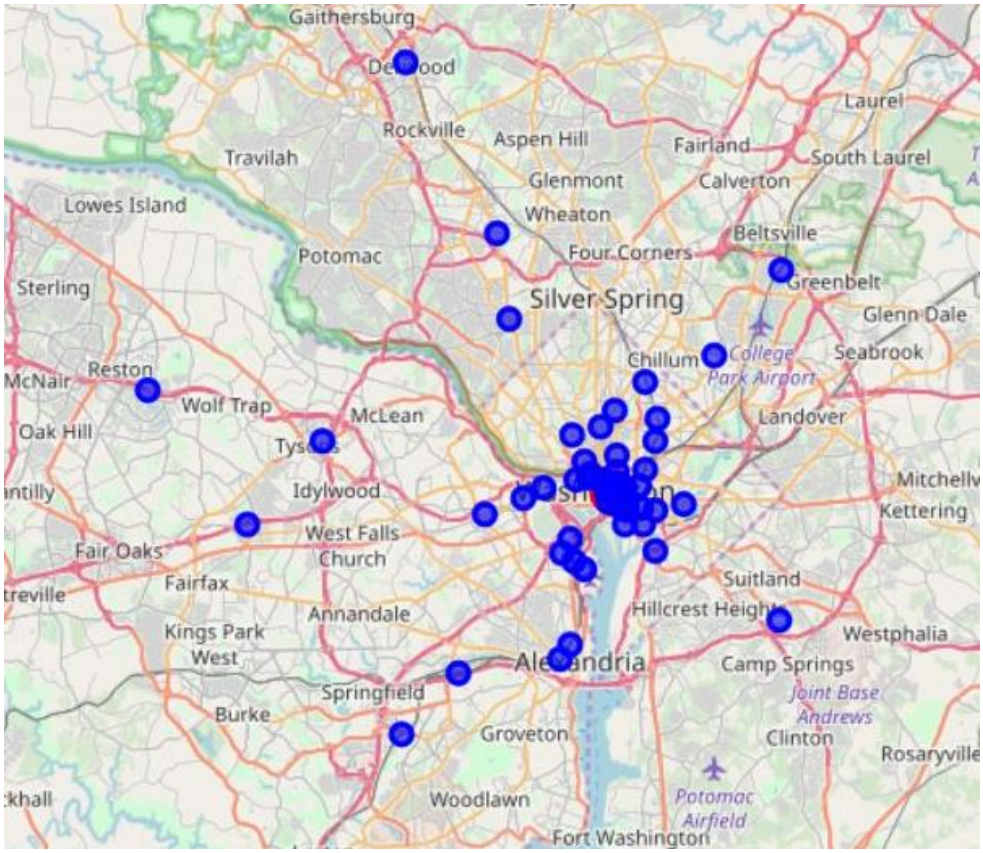

Figure 3: Foursquare data of Metro stop locations

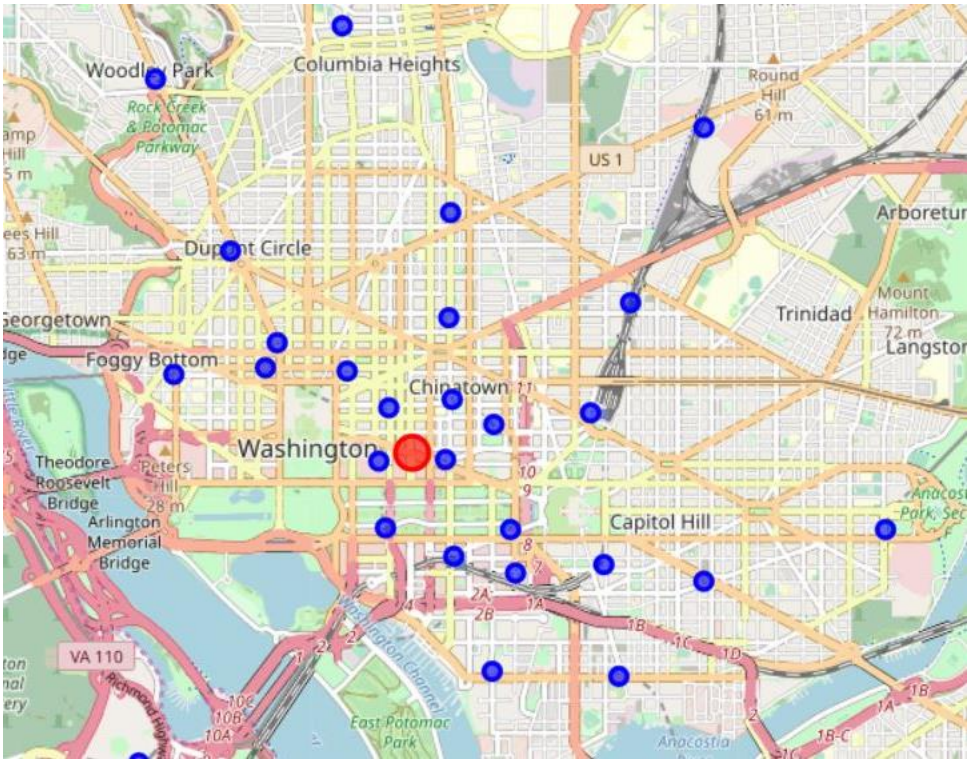

Figure 4: Closeup of Forsquare data of Metro stop locations. Red marker is White House.

4.0 Results

This project illustrated that Maryland has the Metro stations that have the most passengers, as well as having the busiest metro line (the Red line). In addition, the Red line ends in the most populous county in Maryland. In addition, the other direction, covered by the Green line, does not extend far enough--leaving commuters from four or five counties having to drive in, rather than take the Metro or other commuting options.

	Line	Stations	Terminus 1	Terminus 2	Rider Number	Percentage
1	Red	27	Shady Grove	Glenmont	277741	(37%)
2	Orange	26	Vienna	New Carrollton	187663	(25%)
3	Blue	27	Franconia–Springfield	Largo Town Center	120104	(16%)
4	Green	21	Branch Avenue	Greenbelt	105091	(14%)
5	Yellow	17(12 during peak hours)	Huntington	Mount Vernon Square (rush peak)Fort Totten (al...	59781	(8%)

Figure 5: Busiest Lines by Rider Number for Washington Metro.

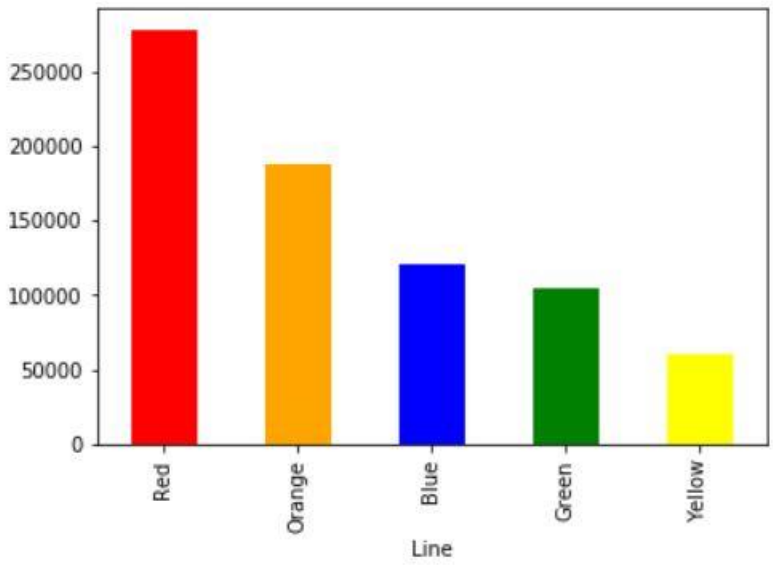

Figure 6: Bar Chart of Busiest Lines by Rider Number for Washington Metro.

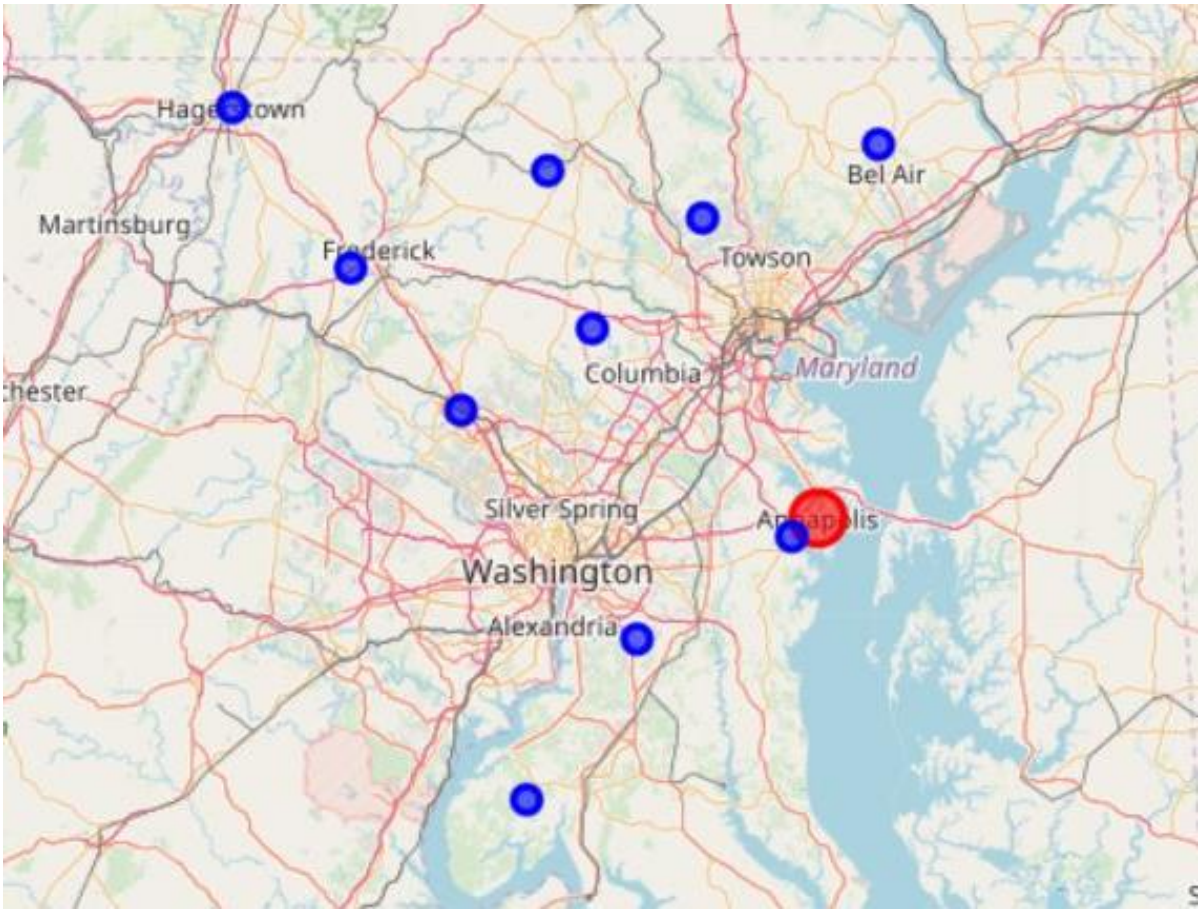

Figure 7: Top Ten most populous counties in Maryland. Red Marker is the Maryland State House of Representatives.

5.0 Discussion

As a result of the above images and the data gathered as a part of this project, I suggest extending the Red line in order to reduce traffic. My secondary suggestion would be to expand the Green line.

The WMATA and both state and federal governments are looking into expanding the Metro. There is a proposed "Purple" line which would run around part of Washington D.C. in Maryland, and would assist commuters in going from one part of Maryland to another—currently they have to go through D.C. in order to transfer to a different line. In addition, various entities are looking for other places to put a bridge or tunnel to cross the Potomac River. And, by 2021, the Silver Line should be completed, which will allow for easier travel to

and from parts of Northern Virginia. However, even with these proposed changes, many people are still commuting into work via car rather than public transportation.

6.0 Conclusion

While this project has only presented a small snapshot of the issues surrounding Washington D.C. and WMA traffic, it is clear that expanding the Metro facilities throughout Maryland would be highly beneficial to the individual communities and the larger economy of the WMA. The Red Line expansion would assist over one million Americans, and the Green Line expansion would assist almost as many.

Regardless of the type of public transport utilized, it is important to use it in order to provide a better commute for everyone. Less cars on the road which contain only one passenger would result in faster commutes, and people would be using less fuel, thereby saving themselves (and companies) money, as well as assisting in reducing the output of greenhouse gases.