EQUITY ANALYSIS OF SPEED ENFORCEMENT PROGRAM

PROJECT UNDERSTANDING

Mead & Hunt was tasked by the BCDOT ATVES team to perform an evaluation of speed citation data related to the registration addresses of vehicles that received speeding tickets at various speed camera locations throughout Baltimore City. The City wished to determine whether cited motorists predominantly originate from the neighborhood where the citations were issued, or if these motorists hail from distant sources away from the neighborhood (e.g., live elsewhere in City, Maryland, or other states). The resultant spatial findings from this analysis will help the City determine the equitableness of the City's speed enforcement strategy currently in operation.

DATABASE & METHODOLOGY

Mead & Hunt received 6 months of citation data from January to June 2023. Less than 10% of citation records showed incomplete addresses/zip codes, where the cited vehicles were registered out-of-state or registered by a postal code and not a full street address. Using ArcGIS geospatial tools, we were able to visualize all the registration addresses accurately and subsequently utilize all citation records. All speed camera locations were also geocoded in ArcGIS. The geospatial analysis calculated the distances between the physical camera locations and registered addresses of cited vehicles. Below are some major characteristics of the speeding citation data:

- There are **164** speeding cameras within Baltimore City, excluding 2 cameras located in I-83 (NB & SB Jones Falls Expressway at 41st St). Given the focus of this study that is neighborhood cameras and the nature of I-83 expressway, citations issued by I-83 cameras were excluded from further analysis.

- There were **267,974 citations** issued within the 6-month period by **164 cameras**.
    - **92%** of citations (246,422) were issued to vehicles registered in Maryland.
    - **53%** of citations (142,940) were issued to vehicles registered in Baltimore City.

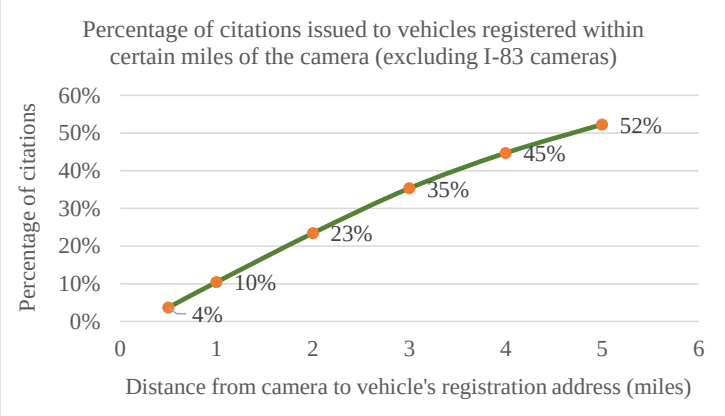
- There were **139,867 registered owners** that received at least one speeding ticket by any of the 164 cameras within the 6-month period.

STUDY FINDINGS:

In addition to citywide analysis, the citation database was evaluated at a zip code level and city council district level. Study findings are graphically represented in citywide maps in the appendices. Below are some major findings:

- Average distance of citation location to vehicle's registration address for In-State residents was **7.2 miles**.

- Only 4% (9,981) of citations were issued to vehicles with registration addresses within **half miles** of the speed camera location; and **10%** of citations (28,080) were issued to vehicles with registration addresses within **one mile** of the camera. Figure below depicts how the percentage of citations grow for vehicles registered far from the camera location. More than half of the citations (**52%** or 140,106) were issued to vehicles registered **5 miles** or more from the camera location.



- Zip codes **21206** (Frankford/Northeast Baltimore) and **21215** (Woodmere/Northwest Baltimore) showed the highest frequencies of registered vehicles with citations.

- Given the total number of citations (267,974) and the number of registered owners received citations (139,867), each registered owner received **an average of 2 citations** within this six-month period. However, the majority (**64%**) received **one ticket**, while there were 33 registered users with more than 50 tickets per six months. Table below shows the distribution of tickets to cited vehicles.

Citation Count per Vehicle	Number of Vehicle	Percent of Total Cited Vehicles
1 ticket	89,759	64.17%
2 tickets	25,232	18.04%
3-5 tickets	18,764	13.42%
6-10 tickets	4,629	3.31%
11-20 tickets	1,235	0.88%
21-50 tickets	215	0.15%
More than 50 tickets	33	0.02%

APPENDICES:

Seven maps are developed to graphically illustrate the distribution of citations across the City Council districts, zip codes, and by camera location, where I-83 cameras are excluded. A description of each map is summarized below.

1) Citywide Map of 164 Speed Camera Locations Where Size Corresponds with Citation Frequency

Map 1 describes the location of speed cameras with the size of each point increasing as the relative number of violations increases. This map provides a geographic representation of the number of violations captured by each camera across the City. In the background, it also shows the City's Vulnerable Population Index (VPI), as provided by the Baltimore Metropolitan Council BMC), and representing census tracts[1]. The darker colors represent a higher VPI. *According to this map, only 14% of the citations were issued in zones with high VPI (dark purple) and the remaining 86% of the citations were issued by cameras in zones with relatively low to moderate vulnerability index.*

2) Citywide Map of 14 Districts Citation Received in the Resident's District

Map 2 provides an overview of the percentage of citations received by residents from a camera located within their home district. It also provides the number of citations issued for residents in each of the City's districts, where the size of the circle in each district represents the relative numbers of citations and the label provides the actual count. Districts 11, 12, 3, 1, and 5 account for the least number of citations issued. It also shows that the percentages are not homogenous across the City districts. *Districts 10 and 1 show the largest and districts 12 and 14 show the smallest proportion of motorists cited for citations within their home districts.*

3) Citywide Map of 14 Districts Citation within One Mile of Resident's Home

Map 3 shows the percentage of citations received by a motorist from a camera located within one mile of their residence, by district. As the data include drivers that may reside outside of the City, the results are more evenly distributed than the previous map. *It ranges from 7% in District 6 to 19% in District 11, with a Districtwide average of 12% of citations issued to motorists residing within a mile from the camera location*.

4) Citywide Map of 164 Camera Locations with Distance Less than One Mile

Map 4 represents the likelihood a camera will capture a violation for a motorist who resides within a one-mile radius of the camera. *In average, only 10% of motorists cited for citations reside within a one-mile radius of all camera locations.*

5) Citywide Map of 166 Camera Locations with Distance Less than Two Miles

Map 5 represents the likelihood a camera will capture a violation from a driver who resides within a two-mile radius of the camera. In this map violations appear to be more regionally distributed than with the one-mile radius, with areas in the northeast showing higher rates than others. *In average, 23% of motorists cited for citations reside within a two-mile radius of all camera locations*.

6) Citywide Map of Citations Received in each Zip Code with Vulnerable Population Index (VPI)

Map 6 provides the number of citations issued for each of the City's zip codes, where the size of the circle in each zip code represents the relative numbers of citations and the label provides the actual count. The City's Vulnerable Population Index (VPI) layer is shown in the background. *Less citations are issued to zip codes with more vulnerable population (i.e., darker purple in the background), such as zip codes 21223, 21202, 21205, and 21231 where their average citation per population is below citywide average*.

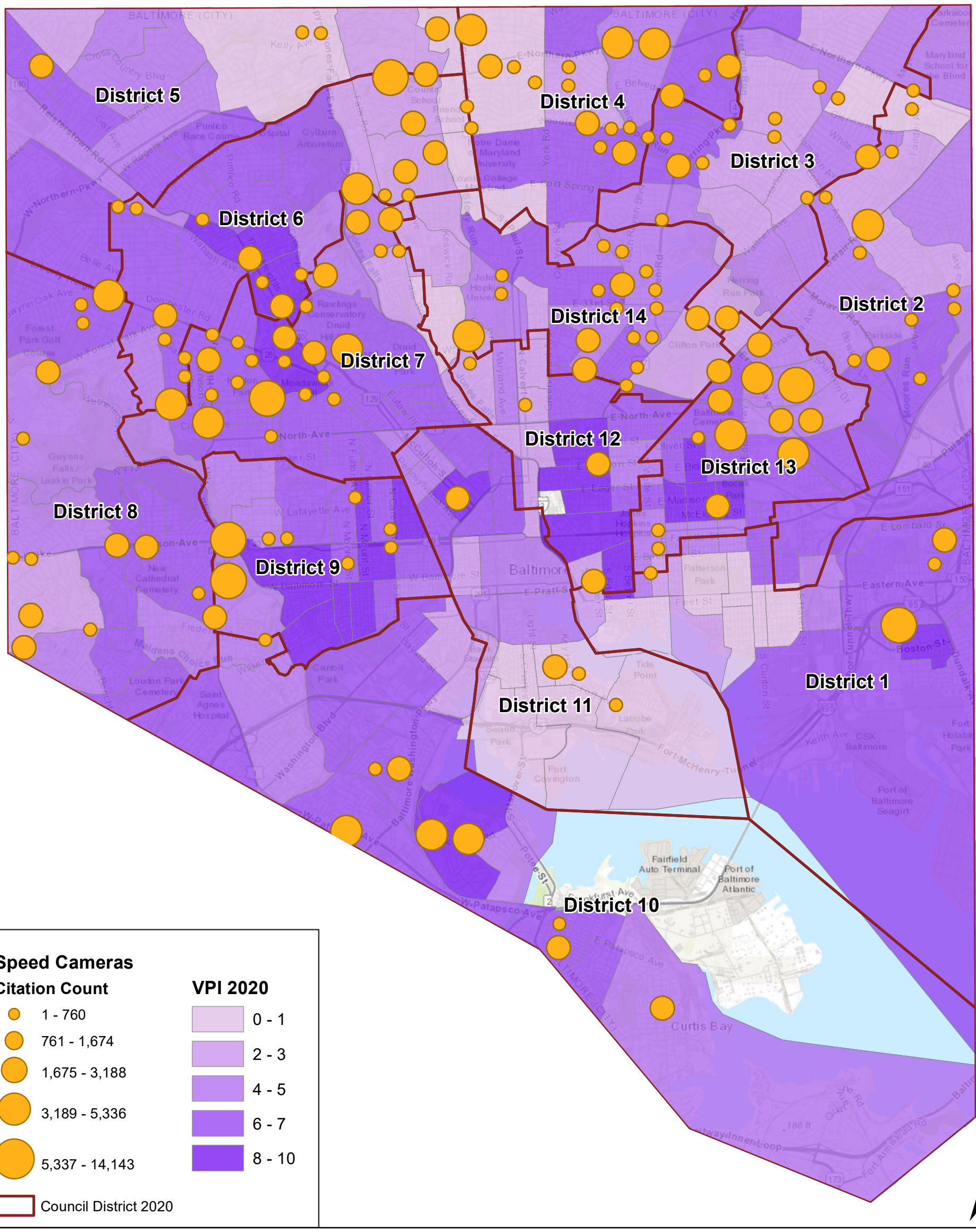
7) Citywide Map of Citations per Capita Received in each Zip Code

While Map 6 does not account for the population of zip codes, Map 7 provides the rate of citations per capita (total number of citations divided by number of people residing in the zip code) issued in each zip code, where the size of the circle represents the relative ratio of citations per capita, and the label provides the actual rate. This map shows consistency with the previous map and indicates per capita citation aligns with total citations issued in each zip code. *Zip codes 21226 and 21231 ranked the lowest citation rate and zip codes 21213 and 21239 ranked the highest citation rate among city zip codes*.

[1] The following seven populations were determined to be vulnerable based on an understanding of both federal requirements and regional demographics: 1) Low-Income Population (below 200% of poverty level); 2) Non-Hispanic Minority Population; 3) Hispanic or Latino Population (all races); 4) Population with Limited English Proficiency (LEP); 5) Population with Disabilities; 6) Elderly Population (age 75 and up); 7) Households with No Car.
For each of these populations, Census tracts with concentrations above the regional mean concentration are divided into two categories above the regional mean. These categories are calculated by dividing the range of values between the regional mean and the regional maximum into two equal-sized intervals. Tracts in the lower interval are given a score of 1 and tracts in the upper interval are given a score of 2 for that demographic variable. The scores are totaled from the seven individual demographic variables to yield the Vulnerable Population Index (VPI). The VPI can range from zero to fourteen (0 to 14). A lower VPI indicates a less vulnerable area, while a higher VPI indicates a more vulnerable area. Source: Vulnerable Population Index 2020 | Baltimore Metropolitan Council (baltometro.org)

Baltimore City
Department of Transportation

Citywide Map of 164 Speed Camera Locations Where Size Corresponds with Citation Frequency



Citywide Map of 166 Speed Camera Locations
Where Size Corresponds with Citation Frequency

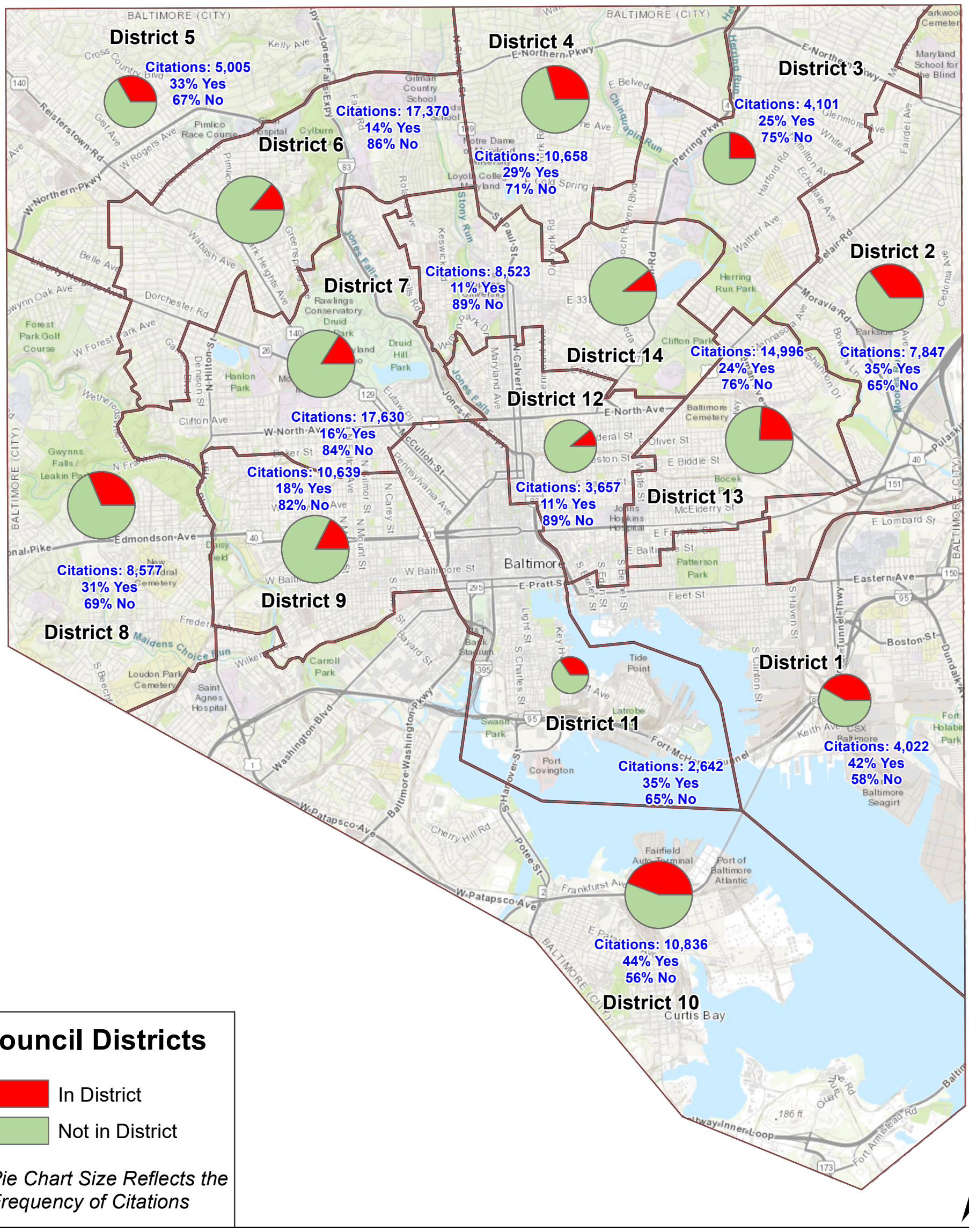
0 0.75 1.5
Miles

Map Date: 1/5/2024

Disclaimer: This map is not a survey or legal property description.

Baltimore City
Department of Transportation

Citywide Map of 14 Districts
Citation Received in the Resident's District



Citywide Map of 14 Districts
Citation Received in the Resident's District

Disclaimer: This map is not a survey or legal property description.

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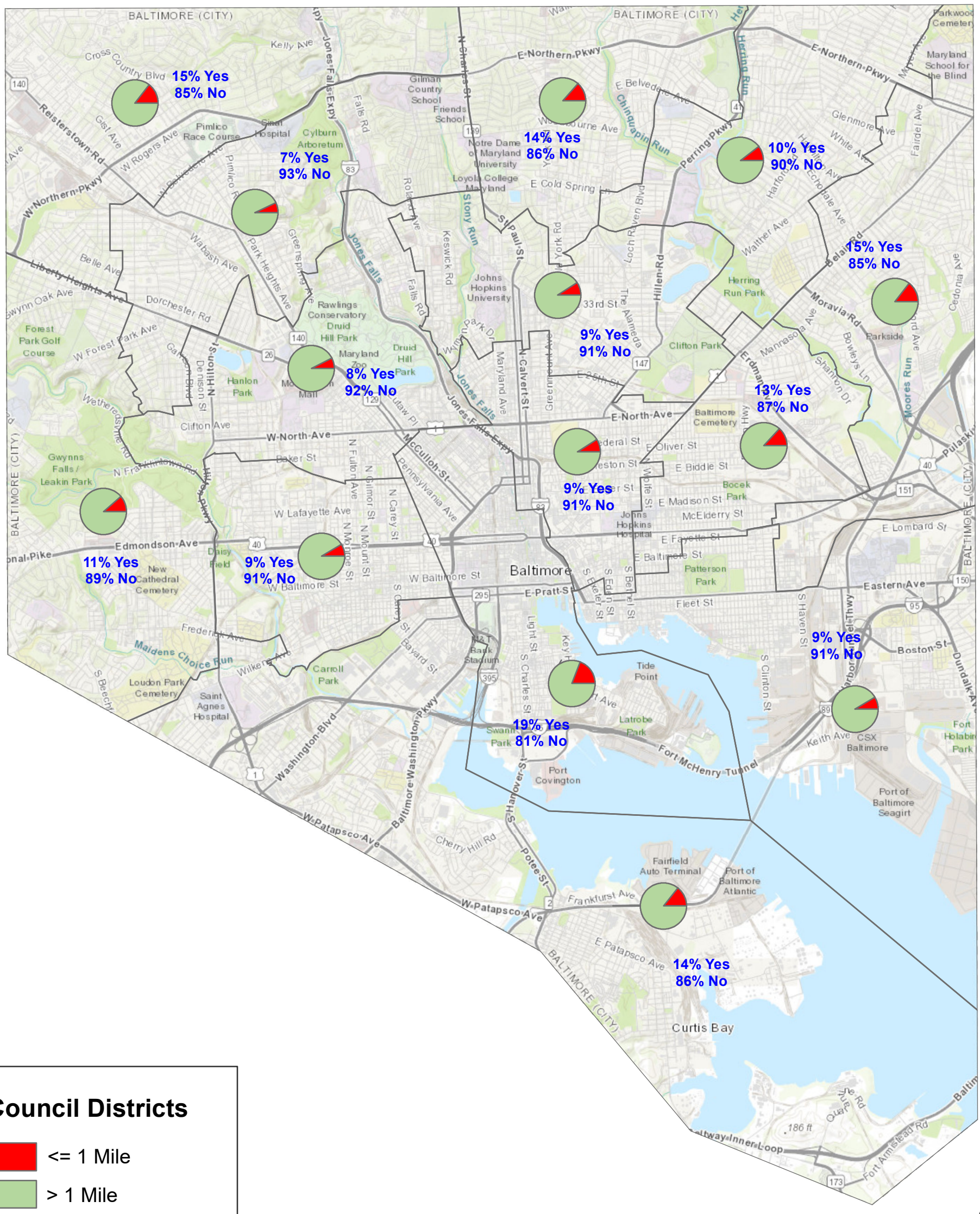
Department of Transportation

Citywide Map of 14 Districts
Citation within One Mile of Resident's Home



Council Districts

- <= 1 Mile
- > 1 Mile

0 0.75 1.5
Miles

Map Date: 1/5/2024

Citywide Map of 14 Districts
Citation within One Mile of Resident's Home

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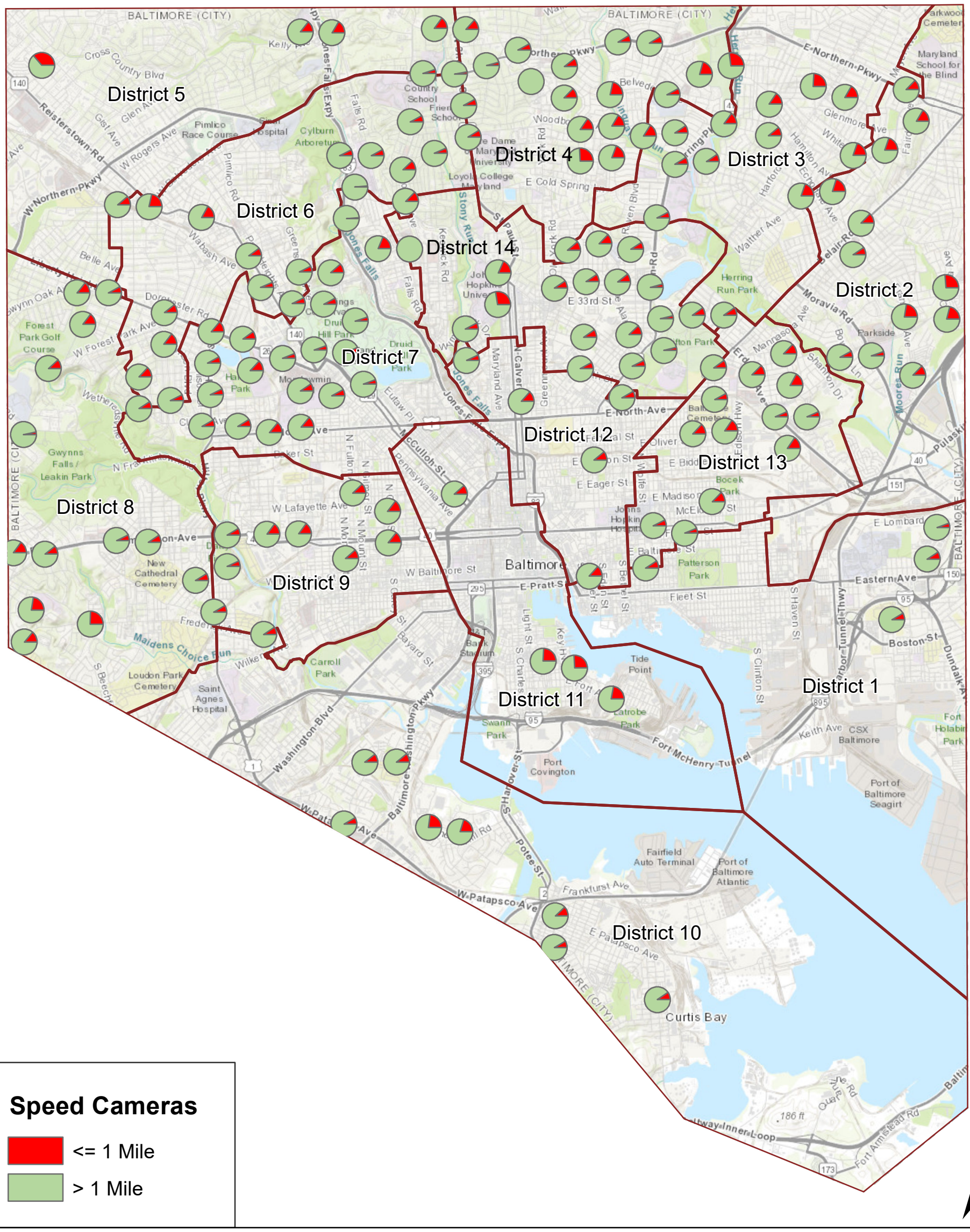
Citywide Map of 164 Camera Locations with Distance Less than One Mile



Speed Cameras

- <= 1 Mile
- > 1 Mile

dot DEPARTMENT OF TRANSPORTATION BALTIMORE CITY

Citywide Map of 166 Camera Locations
with Distance Less than One Mile

0 0.75 1.5
Miles

Map Date: 1/4/2024

Disclaimer: This map is not a survey or legal property description.

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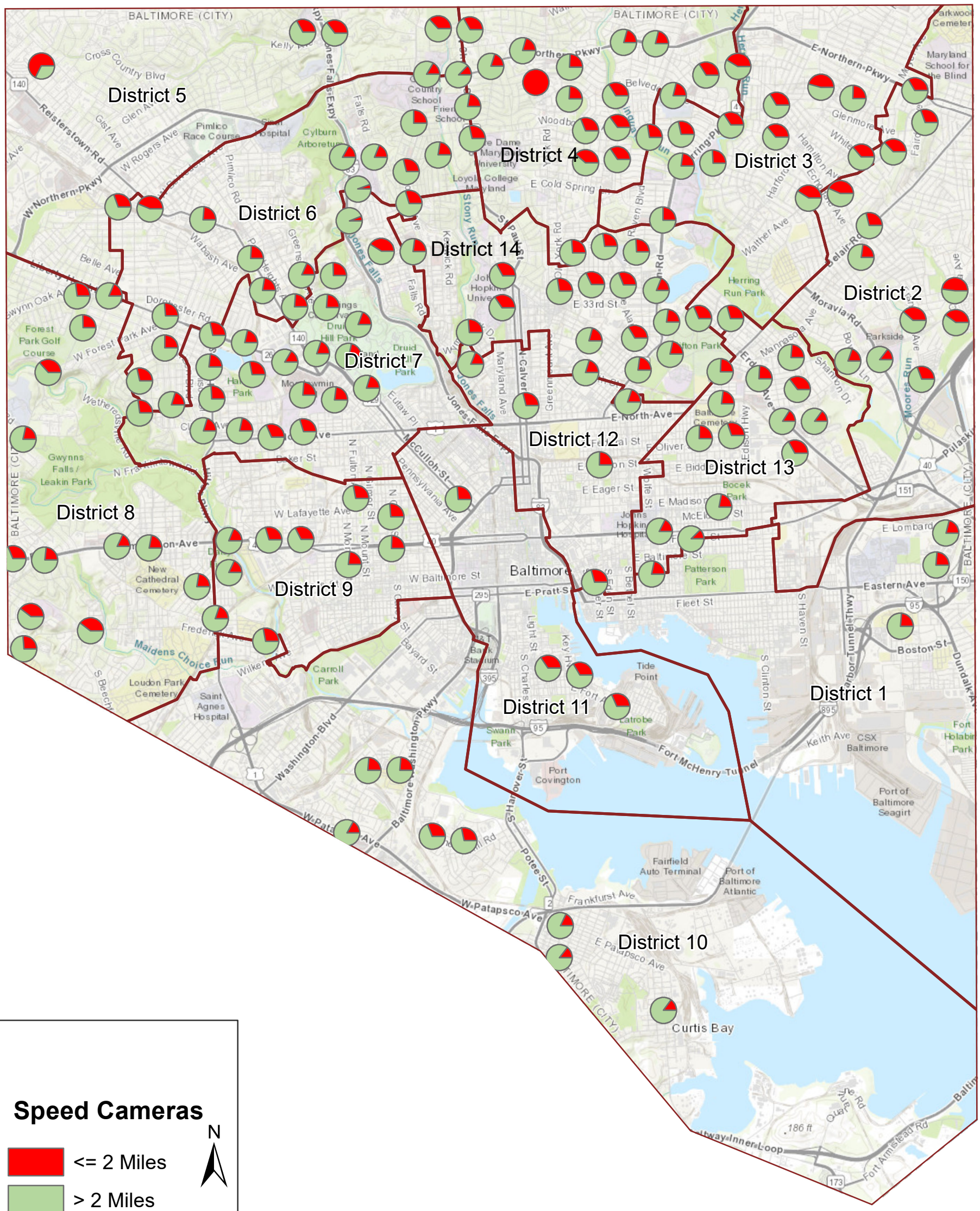
Citywide Map of 164 Camera Locations with Distance Less than Two Miles



Citywide Map of 166 Camera Locations
with Distance Less than Two Miles

Map Date: 1/5/2024

Disclaimer: This map is not a survey or legal property description.

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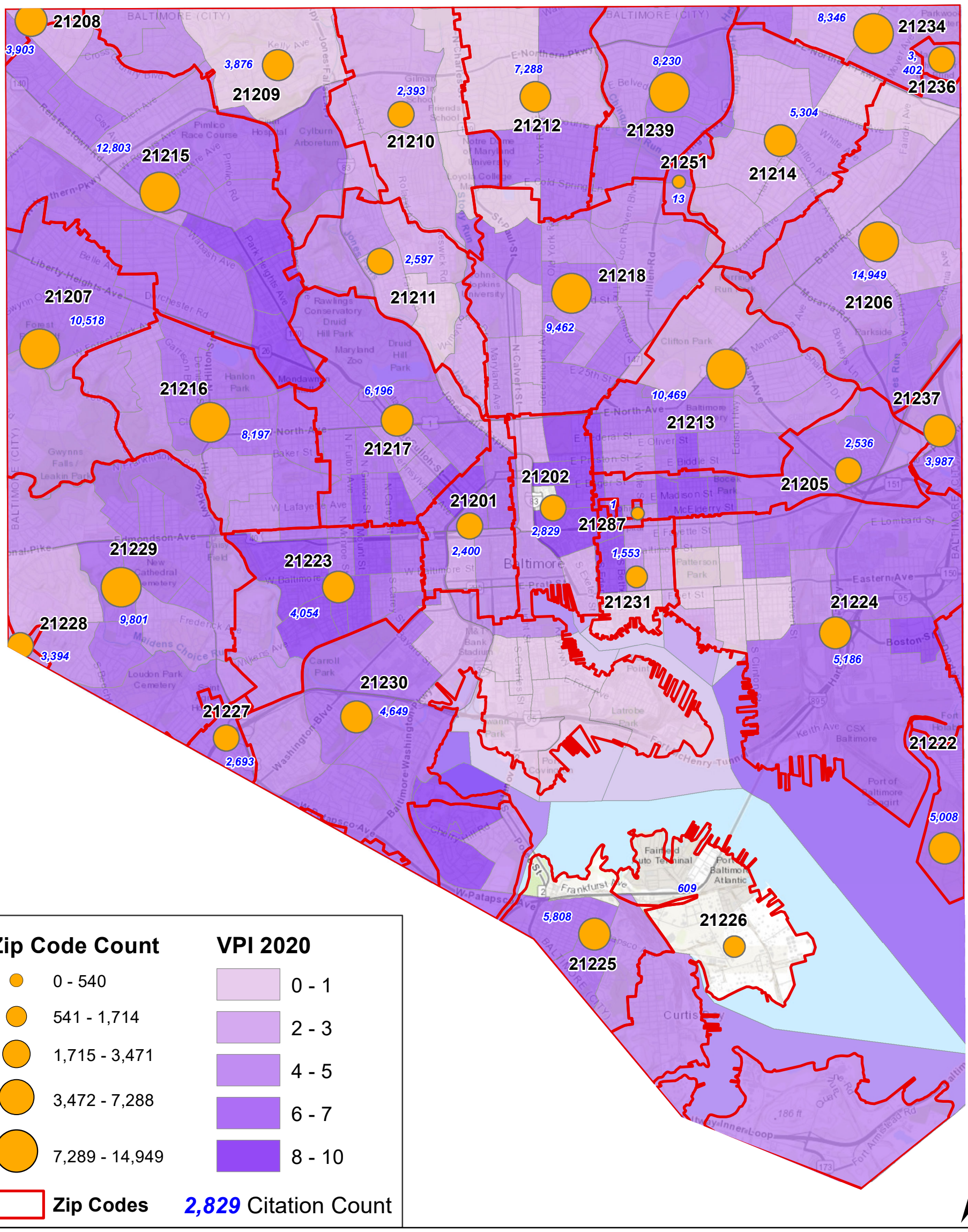
Citywide Map of Zip Codes
Count of Citations Received in each Zip Code



Citywide Map of 14 Districts
Count of Citations Received in each District with VPI

Map Date: 1/5/2024

0 0.75 1.5
Miles

Disclaimer: This map is not a survey or legal property description.

Baltimore City
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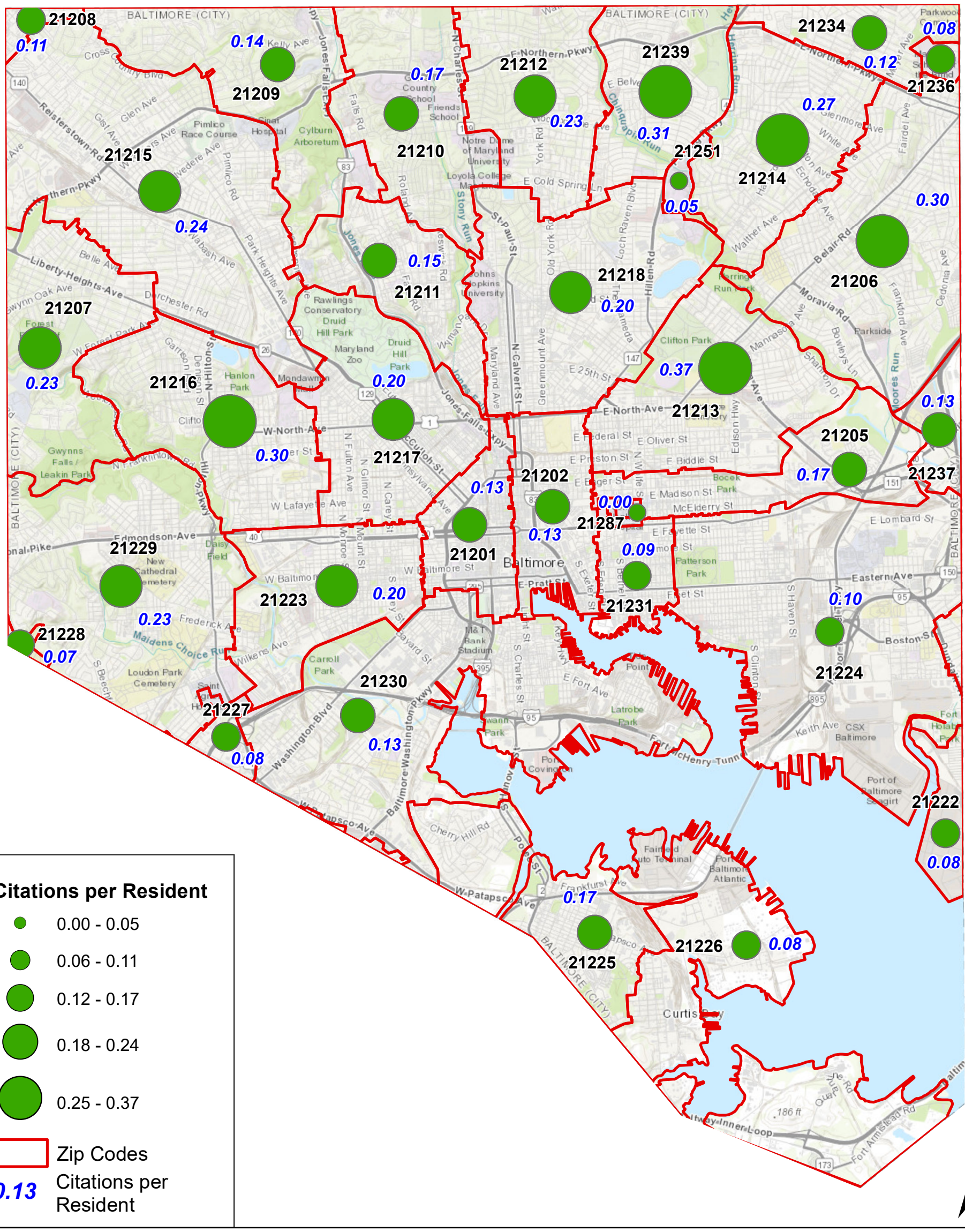
Citywide Map of Zip Codes
Citations Received by Zip Code: Population Ratio



Citywide Map of Zip Codes
Citations Received by Zip Code: Population Ratio

0 0.75 1.5
Miles

Map Date: 1/12/2024

Disclaimer: This map is not a survey or legal property description.

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