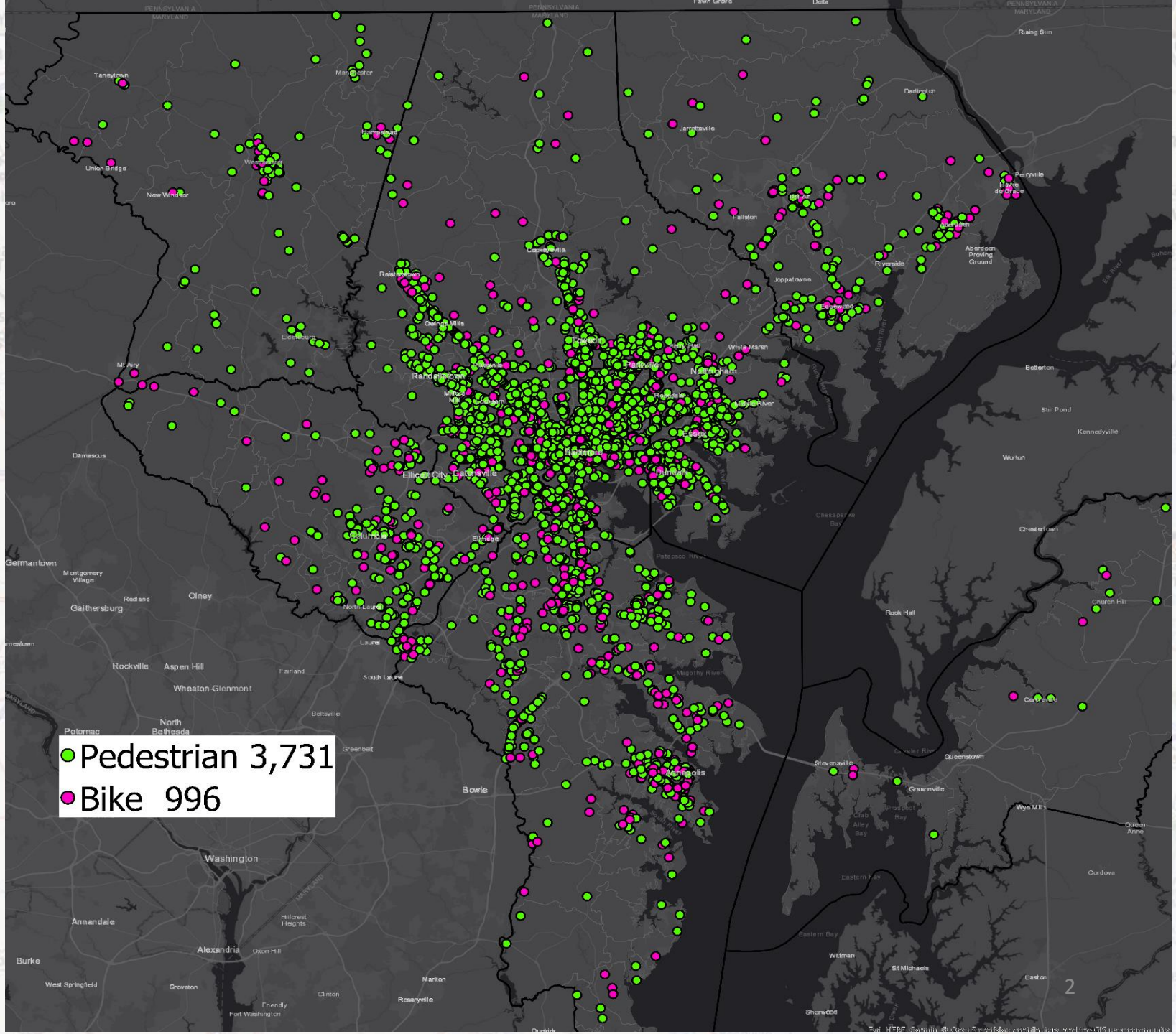
MARYLAND DEPARTMENT OF TRANSPORTATION
MOTOR VEHICLE ADMINISTRATION
Maryland Highway Safety Office

UNIVERSITY of MARYLAND SCHOOL OF MEDICINE
SHOCK, TRAUMA AND ANESTHESIOLOGY RESEARCH CENTER

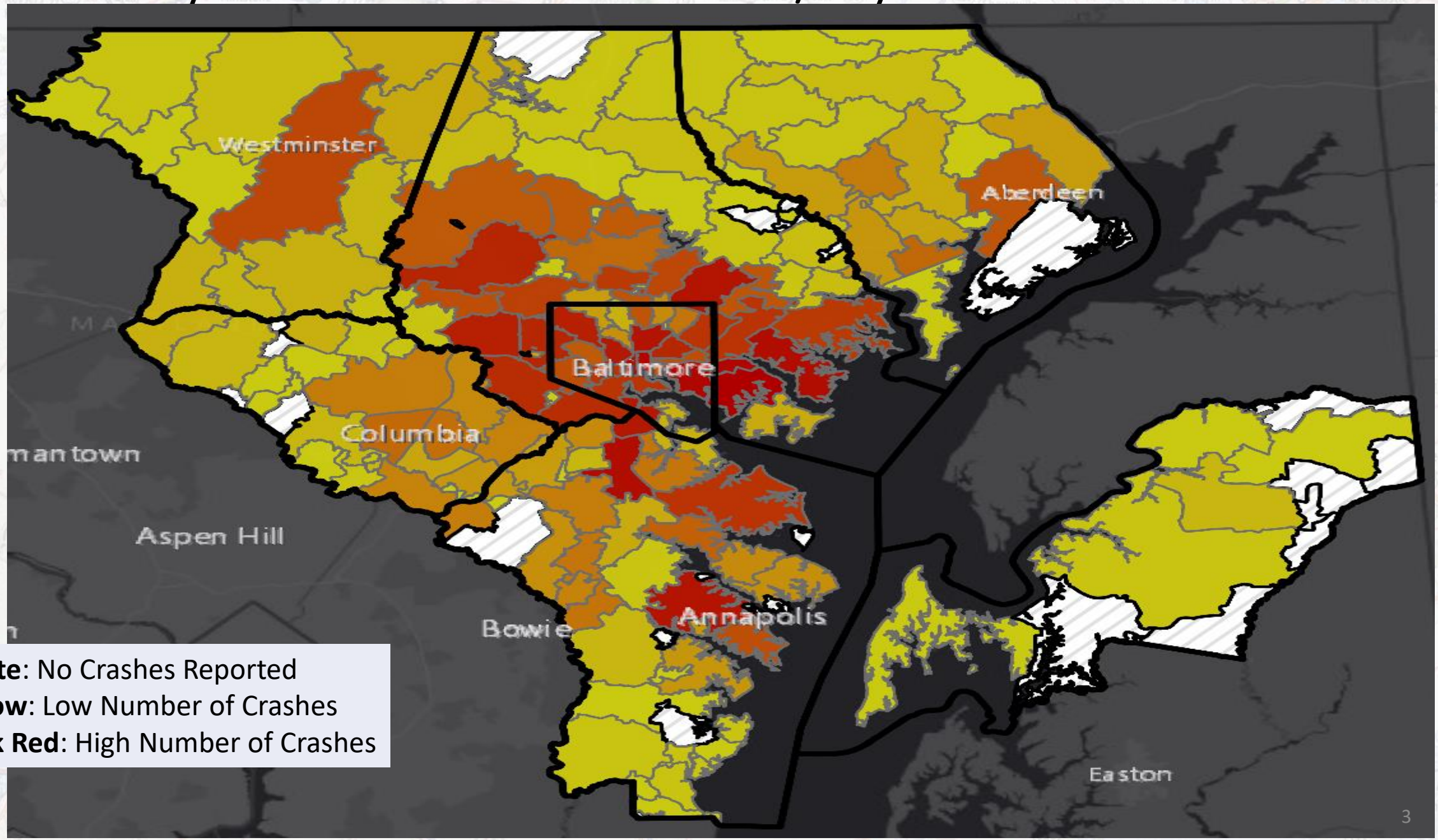
Pedestrian/Bicycle Short Trip Opportunity Area (STOA) Analysis

Prepared by: Daniel Knopp, MPP

Crash Point Map of Baltimore Metropolitan Area (BMC): (2013-2016)



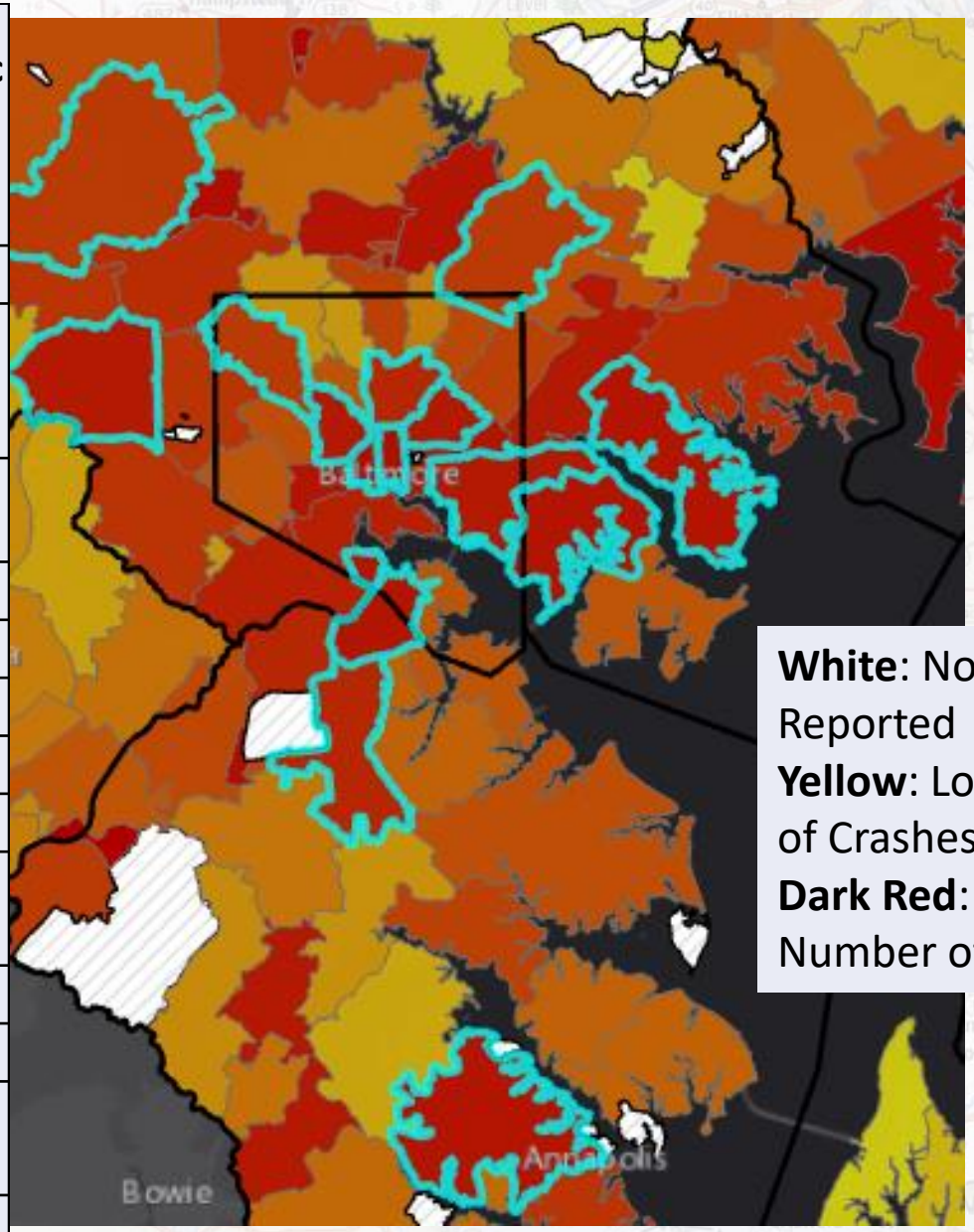
Zip Code Analysis: Raw Number of Pedestrian/Bicycle Crashes



White: No Crashes Reported
Yellow: Low Number of Crashes
Dark Red: High Number of Crashes

Zip Code Analysis: Raw Number of Ped/Bicycle Crashes – Top 15 Zip Codes

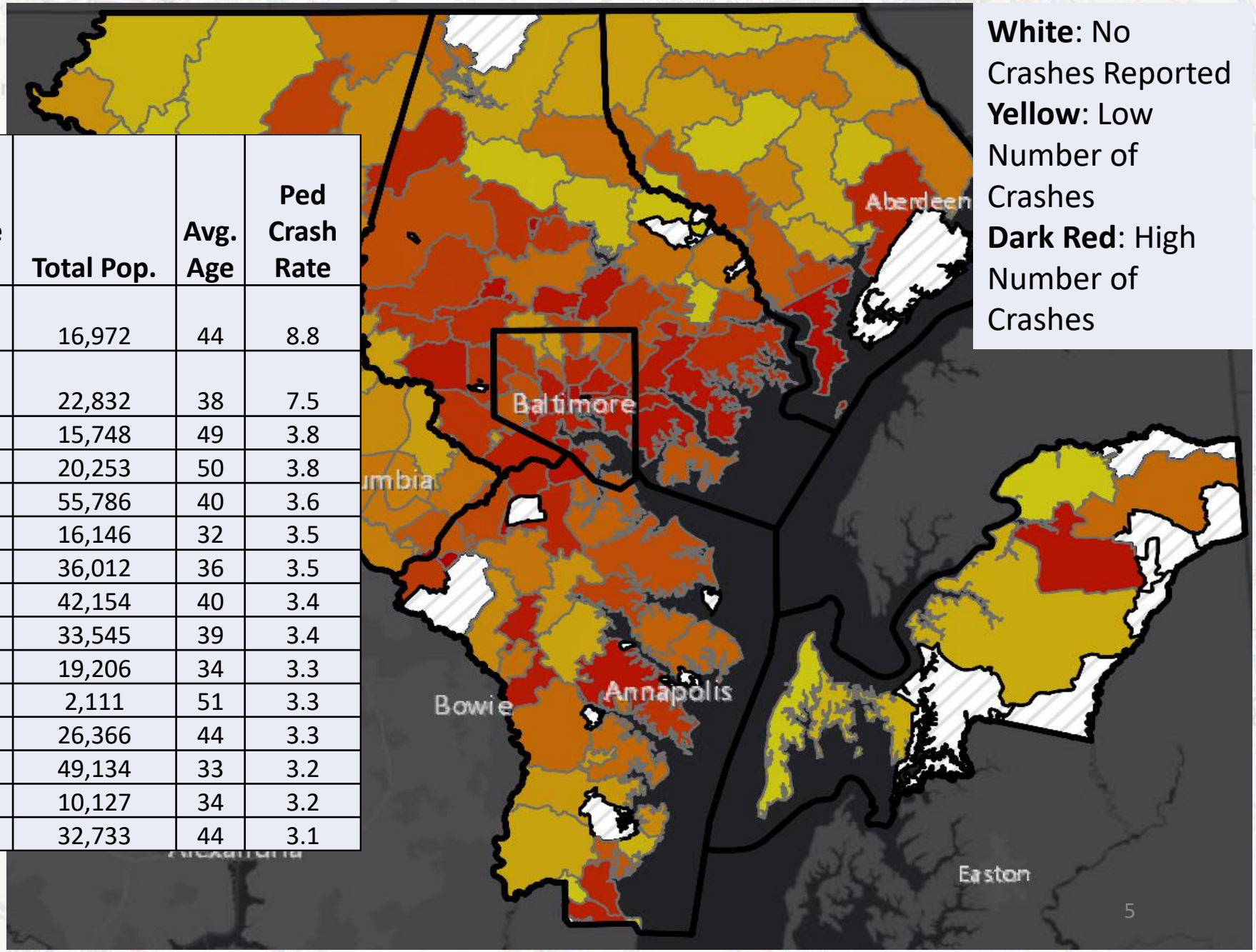
Zip Code	Zip Name	Num. Ped/Bicycle Crashes	Total Population	Avg. Age of Ped/Bicycle Inv.	Ped/Bicycle Crash Rate
21222	Dundalk	203	55,786	40	3.6
21202	Seton Hill/Downtown Baltimore	172	22,832	38	7.5
21224	Canton/Highlandtown	158	49,134	33	3.2
21201	West Baltimore	150	16,972	44	8.8
21221	Essex	143	42,154	40	3.4
21061	Glen Burnie	138	53,684	50	2.6
21234	Parkville	126	69,752	40	1.8
21401	Annapolis	125	36,012	36	3.5
21218	Waverly/Charles Village	119	49,796	32	2.4
21225	Brooklyn	113	33,545	39	3.4
21215	Northwest Baltimore	107	60,161	31	1.8
21217	Penn North/Druid Heights	107	37,111	34	2.9
21244	Windsor Mill	101	34,611	31	2.9
21213	Belair-Edison	100	32,733	44	3.1



White: No Crashes Reported
Yellow: Low Number of Crashes
Dark Red: High Number of Crashes

Zip Code Analysis: Ratio of Total Ped/Bicycle Crashes to Zip Code's Population

Zip Code	Zip Name	Num. Ped/Bicycle Crashes	Total Pop.	Avg. Age	Ped Crash Rate
21201	Seton Hill/Downtown Baltimore	150	16,972	44	8.8
21202	Penn-Fallsway/Old Town	172	22,832	38	7.5
21231	Upper Fells Point	60	15,748	49	3.8
21204	Towson	77	20,253	50	3.8
21222	Dundalk	203	55,786	40	3.6
21205	East Baltimore	57	16,146	32	3.5
21401	Annapolis	125	36,012	36	3.5
21221	Essex	143	42,154	40	3.4
21225	Brooklyn	113	33,545	39	3.4
21286	Towson	64	19,206	34	3.3
21623	Church Hill	7	2,111	51	3.3
21223	Southwest Baltimore	87	26,366	44	3.3
21224	Southeast Baltimore	158	49,134	33	3.2
21054	Gambrills	32	10,127	34	3.2
21213	Belair-Edison	100	32,733	44	3.1



White: No Crashes Reported
Yellow: Low Number of Crashes
Dark Red: High Number of Crashes

Hot Spot Analysis: How to Interpret

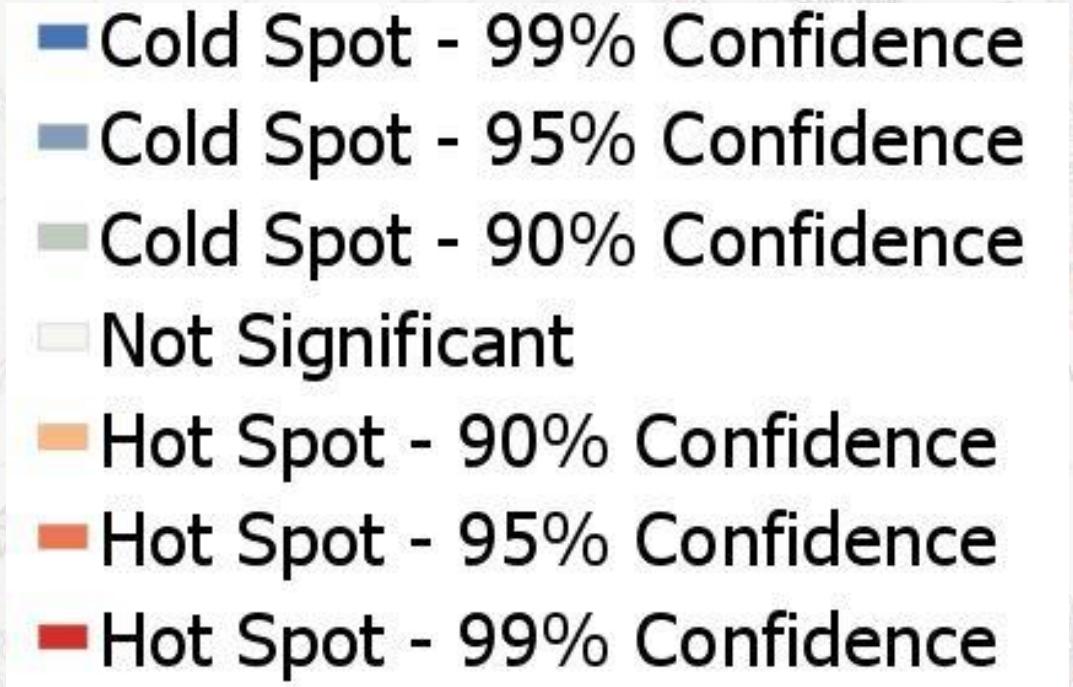
Within the BMC jurisdictions, the hot spots answer the question:

Where are there high concentrations of crashes relative to the rest of the BMC area?

Additionally, we examined how these spatial patterns change when looking at different types of pedestrian crashes.

- Advantage: Identifies areas where clustering is not random.
- Disadvantage: Inherently favors areas where clustering is more likely (cities).

Hot Spot Analysis: How to Interpret the Legend – Confidence Levels



- **Cold Spots**: The higher the confidence level, the more intense the clustering of **low** values

- **Hot Spots**: The higher the confidence level, the more intense the clustering of **high** values.

Hot Spot Analysis: How to Interpret

Example: Count of Bicycle crashes within each ½ mile by ½ mile square.

Hot Spot: Clustering of high counts

10	12
18	10
	15

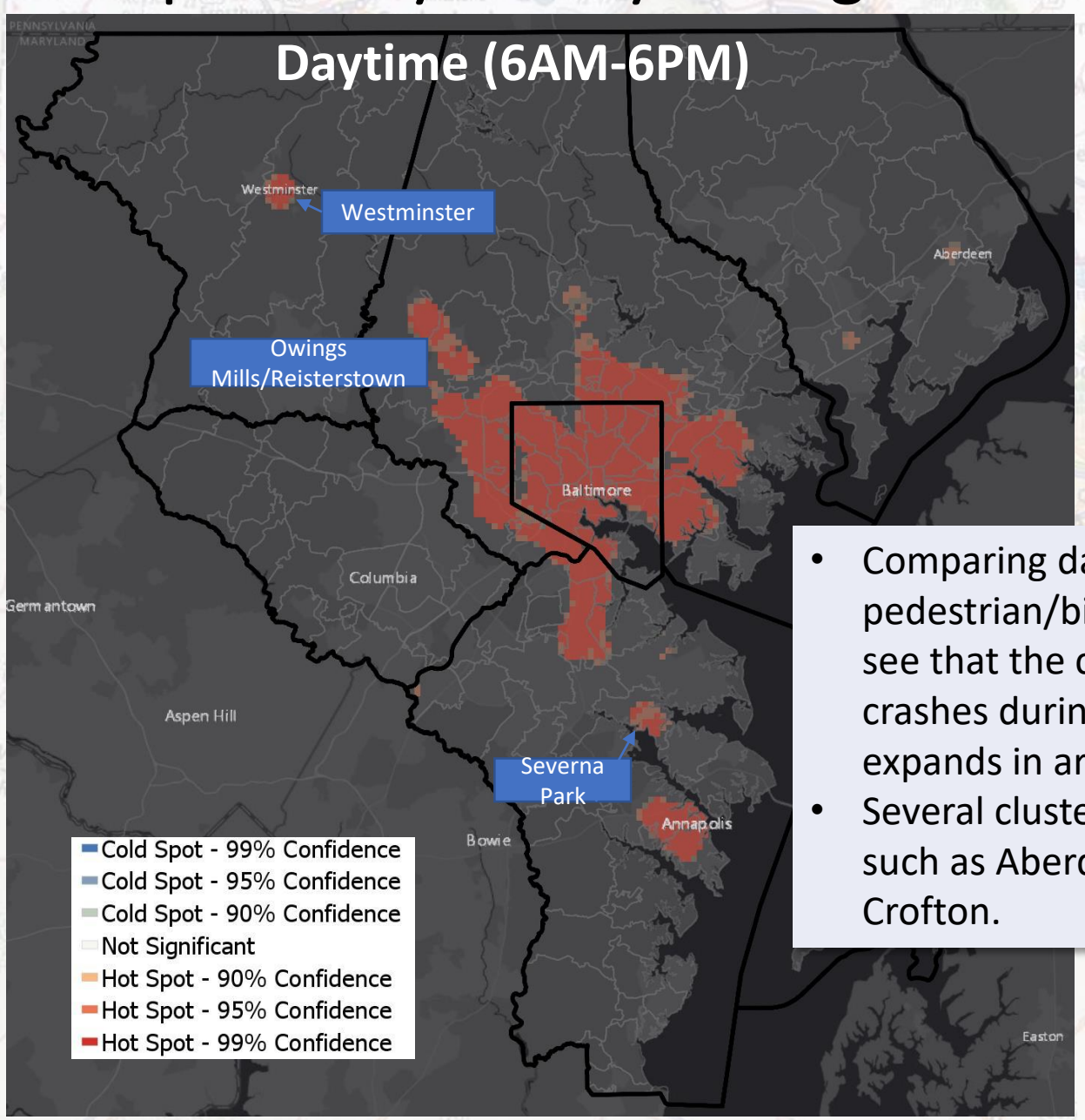
Not Significant: Clustering of **neither high nor low** counts

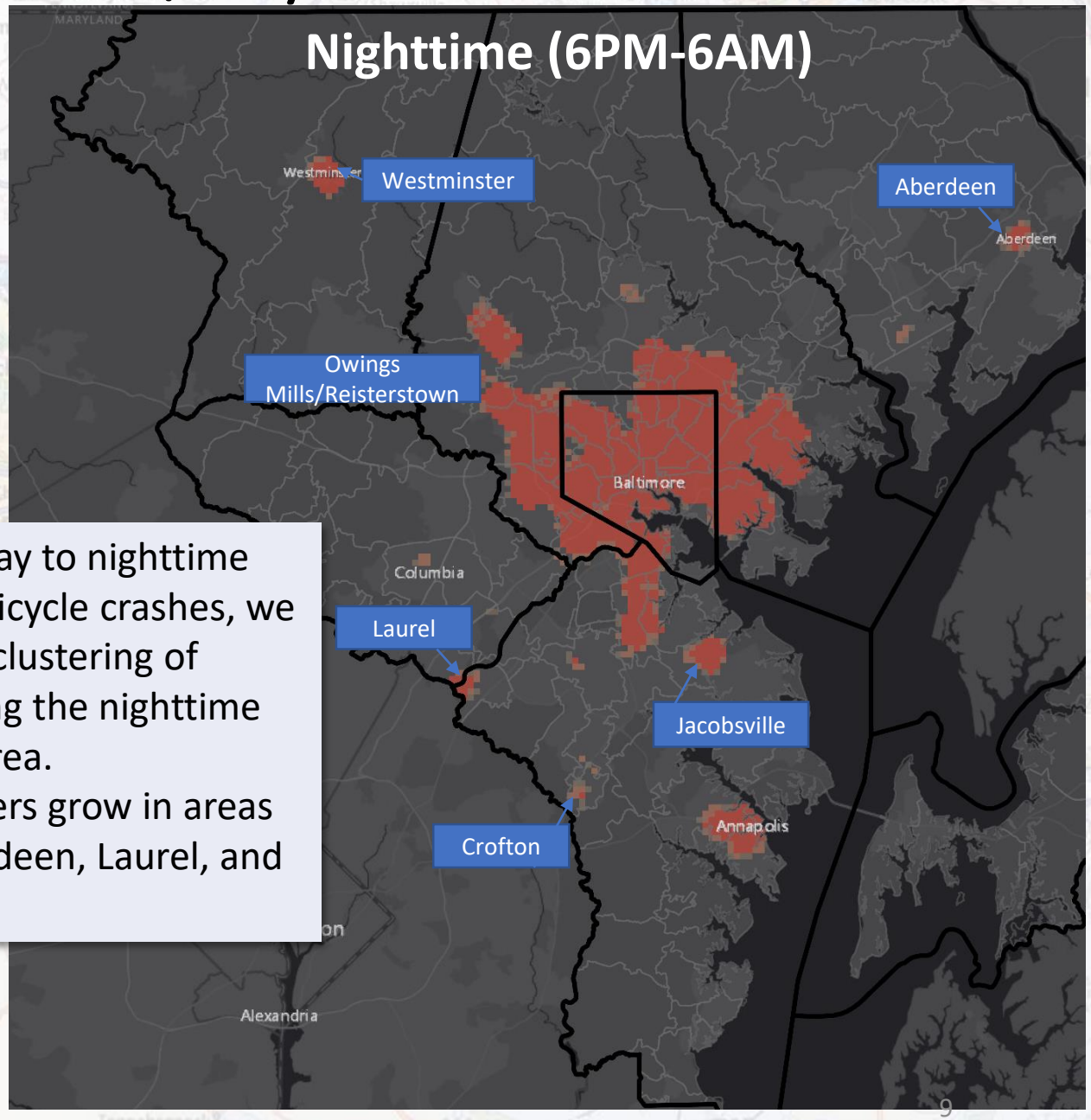
5	4
3	5
	4

Cold Spot: Clustering of **low** counts

0	0
1	1
	0

Hot Spot Analysis: Day vs. Night Pedestrian/Bicycle Crashes





- Comparing day to nighttime pedestrian/bicycle crashes, we see that the clustering of crashes during the nighttime expands in area.
- Several clusters grow in areas such as Aberdeen, Laurel, and Crofton.

Queen Anne's County omitted due to space restrictions. Queen Anne's had no hotspots for day or night pedestrian crashes

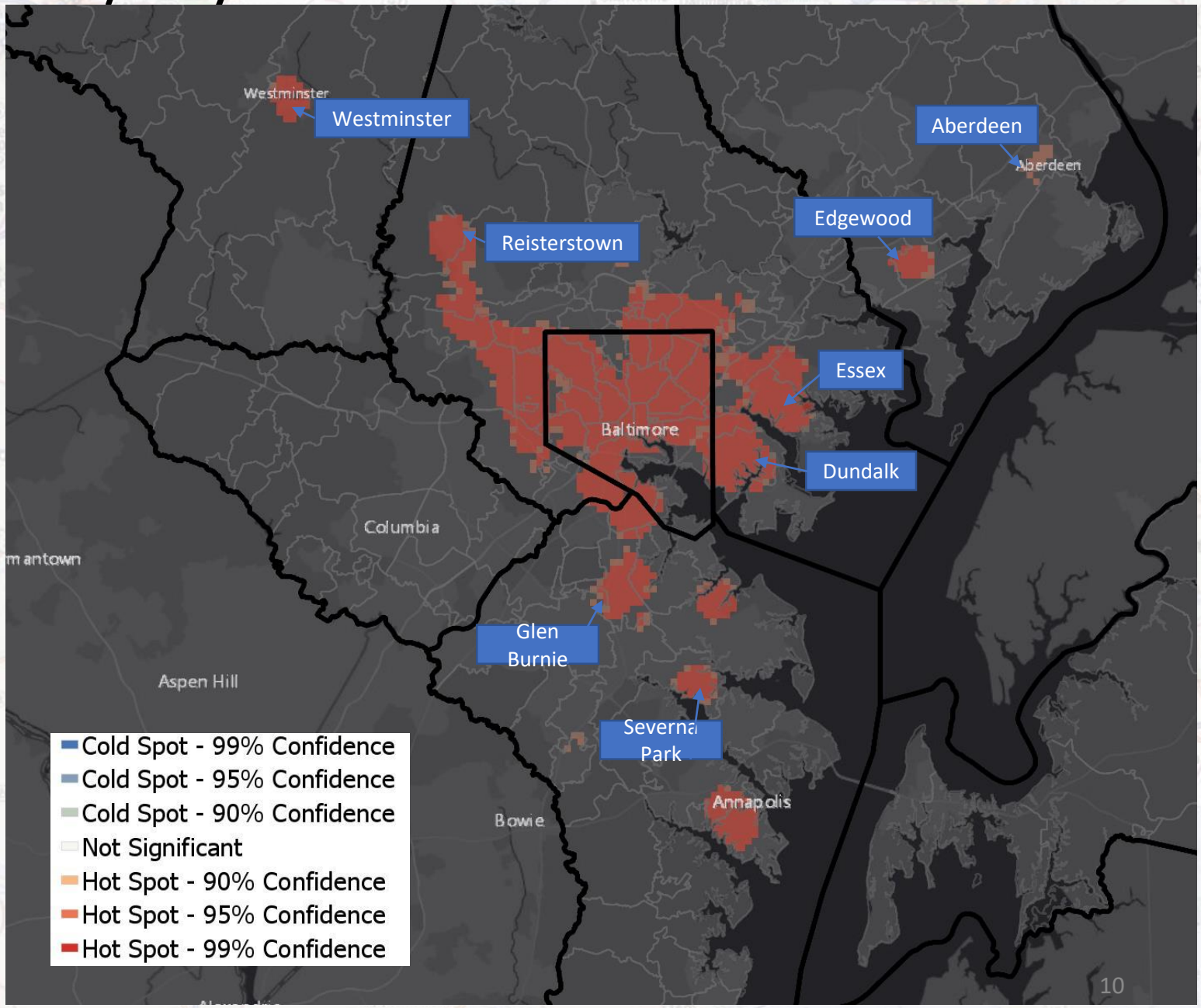
Hot Spot Analysis: Student Ped/Bicycle Crashes

Student (daytime, age 3-18) pedestrian/bicycle crashes clustering:

- Western Aberdeen
- Edgewood (concentrated cluster around Edgewood H.S., M.S.)
- Towson/Parkville
- Essex, Middle River
- Catonsville, Reisterstown, Milford Mill
- Glen Burnie, Jacobsville

Student crashes: 6AM-6PM, Age 3-18

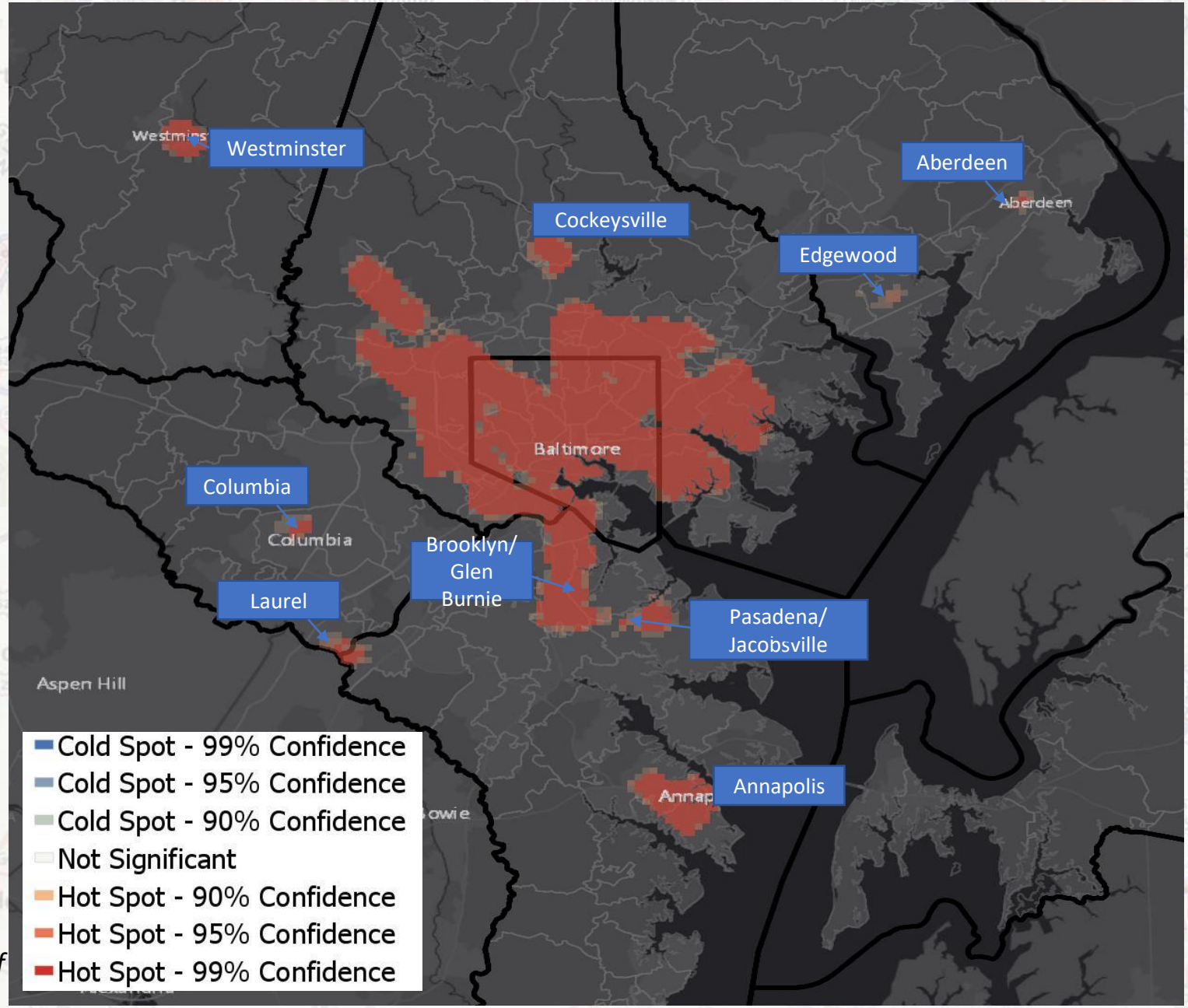
Areas omitted due to space restrictions. Any omitted areas had no hotspots for these types of pedestrian crashes



Hot Spot Analysis: Pedestrian On-Foot Crashes

Pedestrian on-foot crash clustering is in fewer areas, but more concentrated.

- Annapolis
- Westminster
- Laurel (Route 1), Columbia
- Ritchie Highway (Brooklyn to Glen Burnie), Jacobsville
- Western Aberdeen, Edgewood



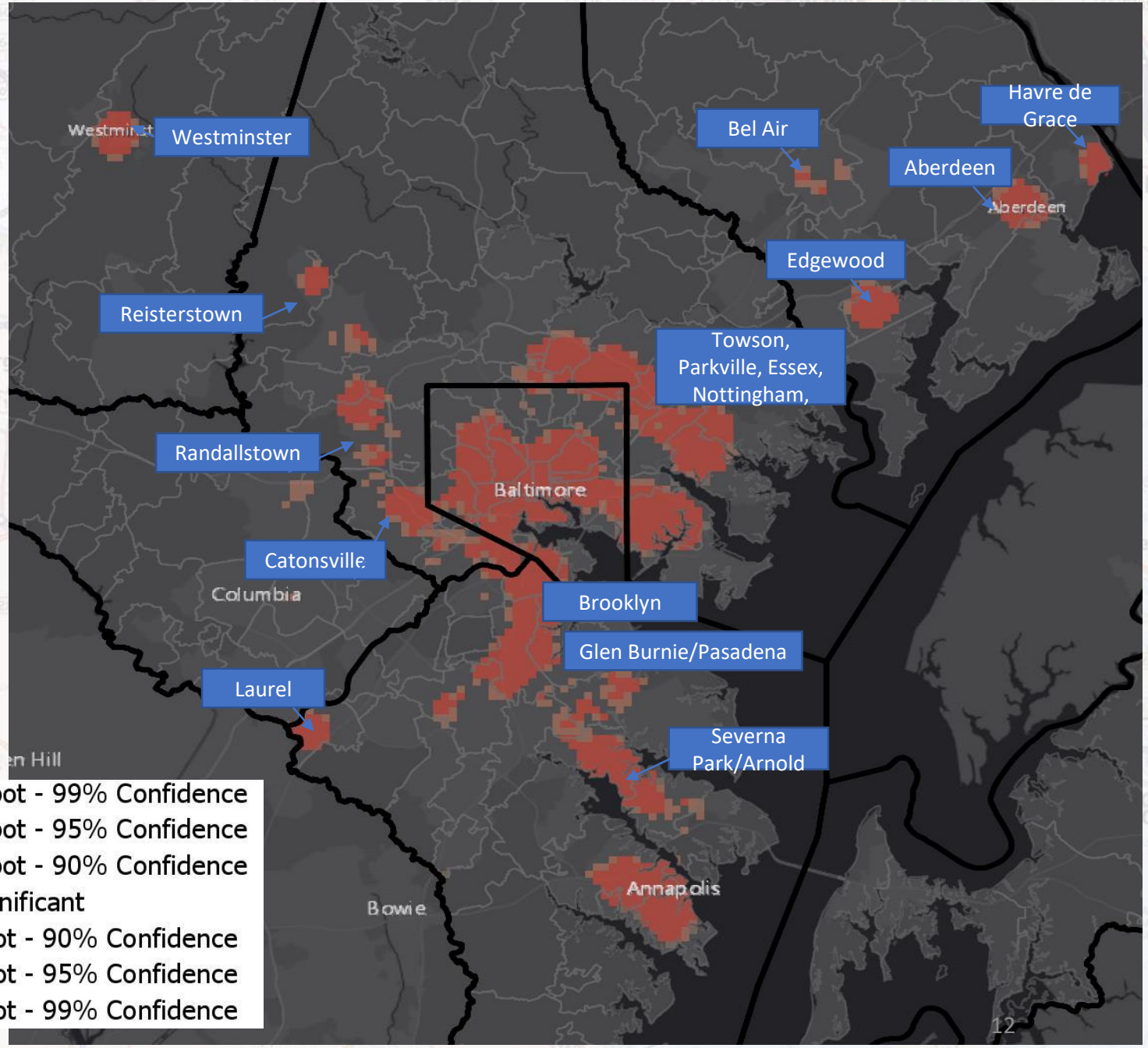
Areas omitted due to space restrictions. Any omitted areas had no hotspots for these types of pedestrian crashes

Hot Spot Analysis: Bicycle Crashes

Bicycle definition: Pedestrian type 02: Bicycle

The Bicycle-only crashes have large clusters:

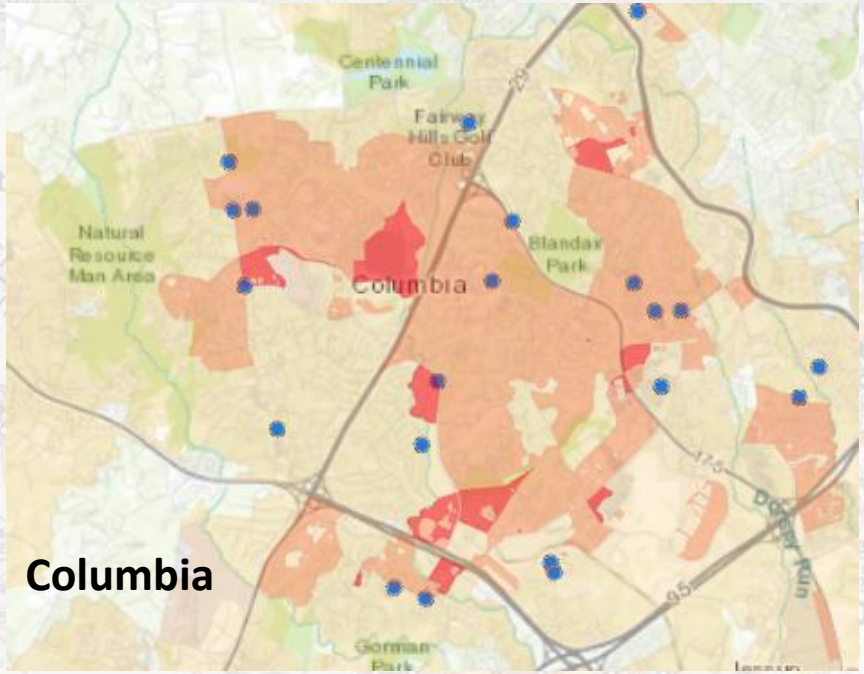
- Catonsville, Randallstown and Reisterstown.
- Notable clusters in Baltimore County:
  - Towson down to Essex.
  - Glen Burnie, Pasadena, Arnold
- Edgewood, Aberdeen, and Havre de Grace have clusters of Bicycle crashes also.



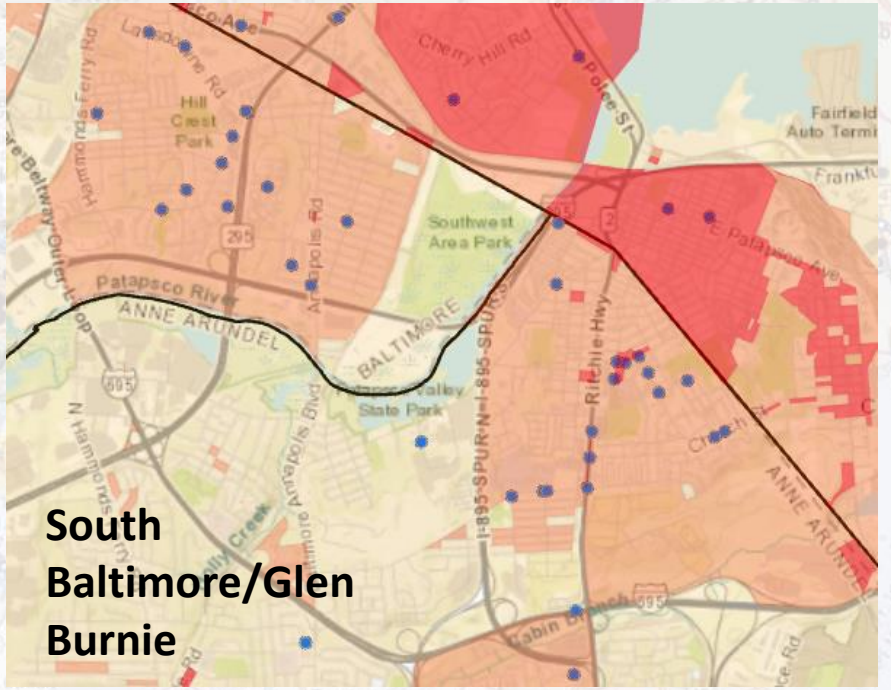
Areas omitted due to space restrictions. Any omitted areas had no hotspots for these types of pedestrian crashes

STOA & K-12

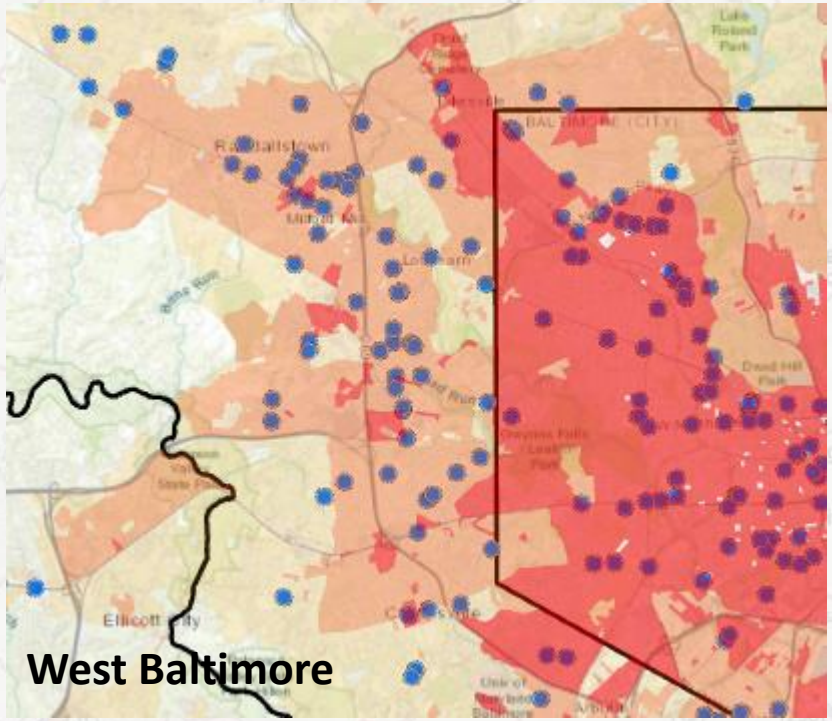
- Created 1 mile buffer around each K-12 in Maryland (Public or Charter).
- Created new layer of student (day time, age 3-18) crashes occurring within 1 mile buffer.
- Overlaid with STOA of 3 or above.



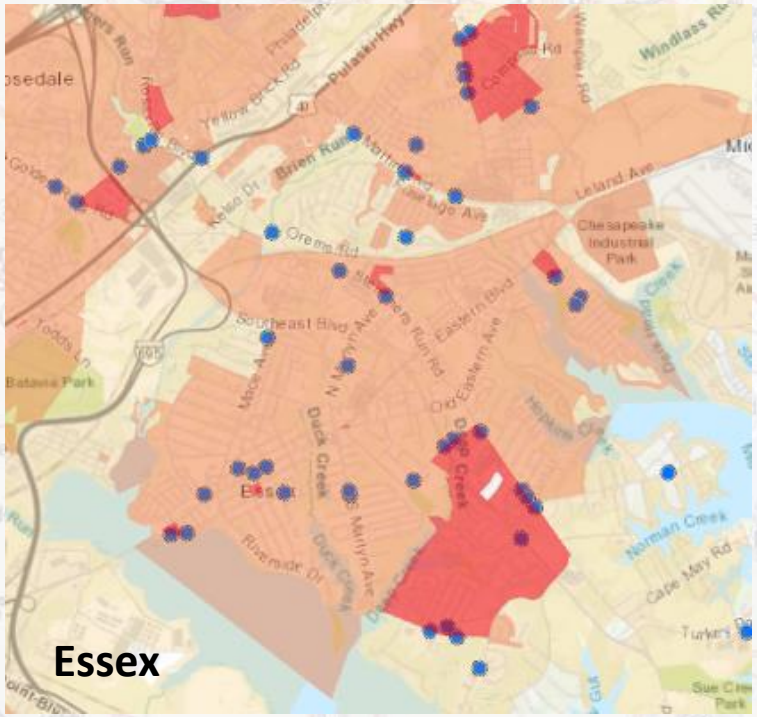
Columbia



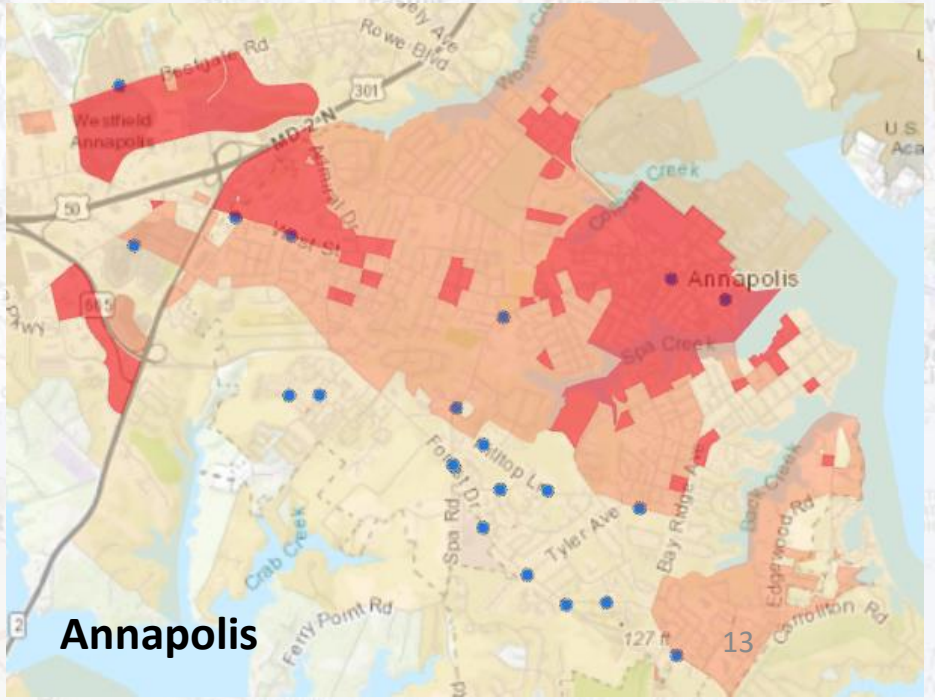
South Baltimore/Glen Burnie



West Baltimore

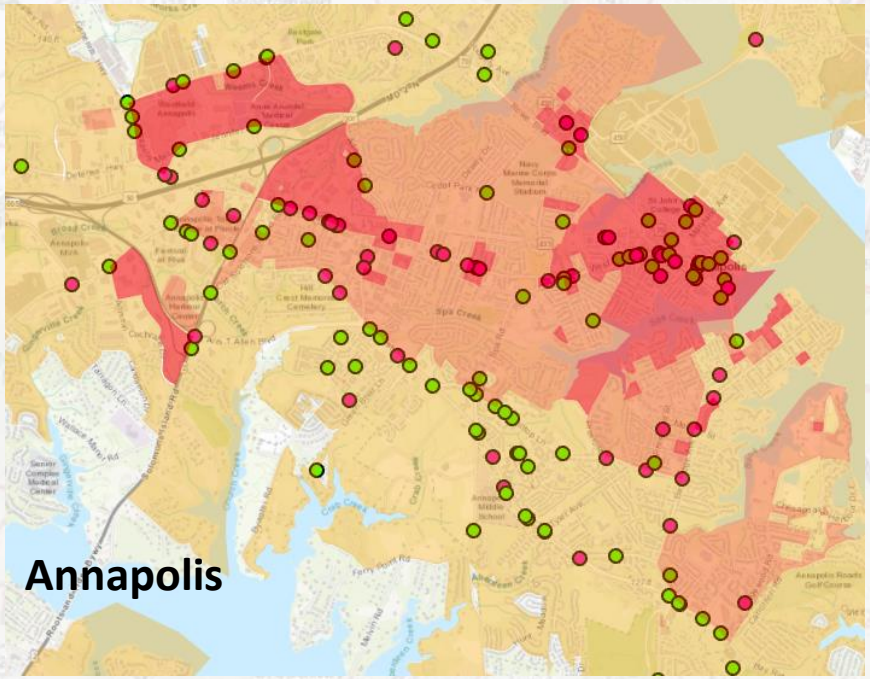


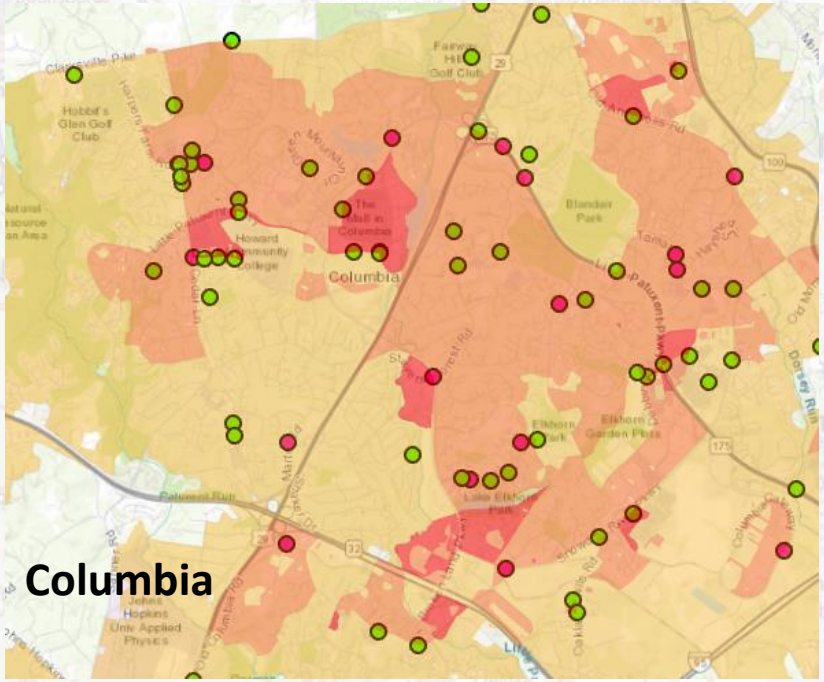
Essex

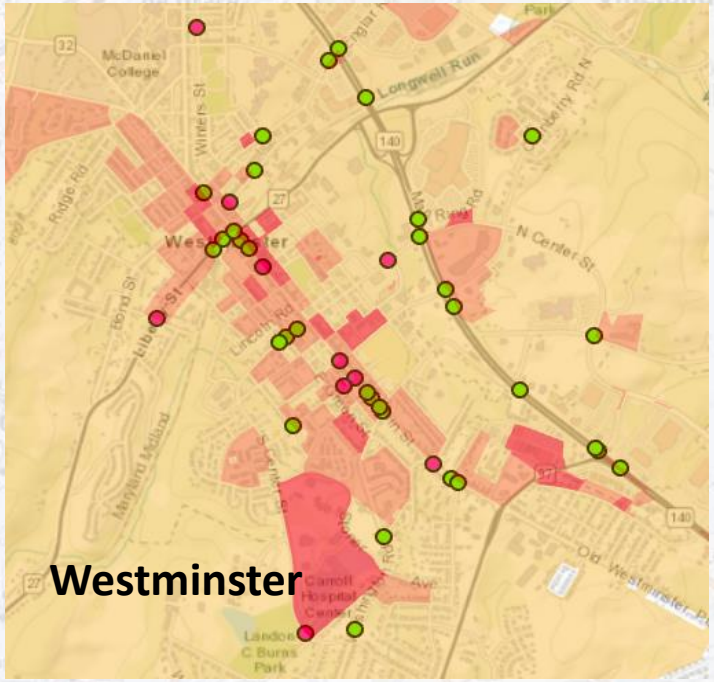


Annapolis

STOA Layer with All Ped/Bicycle Crash Layer

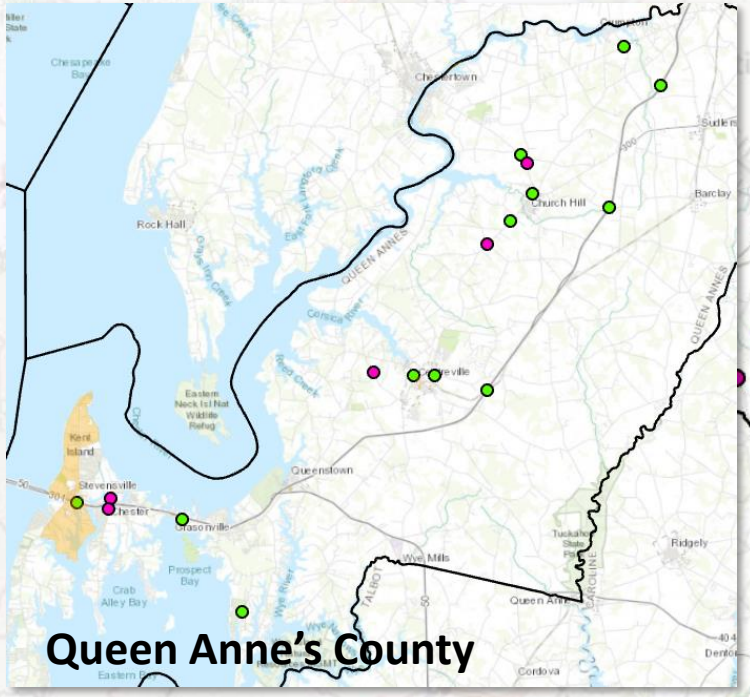






The STOA layer does a good job of identifying high risk areas for pedestrian crashes in many of the cities. Most of the pedestrian crashes in urban areas fall within a STOA of 3 or higher.

STOA Layer: Potential to Underperform in Rural Areas?



Due to the nature of STOA scores, it often fails to capture pedestrian crashes occurring outside of population centers. Future research should work to identify criteria similar to STOA but for rural locations.

Rural Areas of Baltimore Metro

Experimental Layer (PedScore)

$$Score = (InjurySeverity + (student) + STOASCORE + ((1/Distance) * 1000) + (.25 * Population))$$

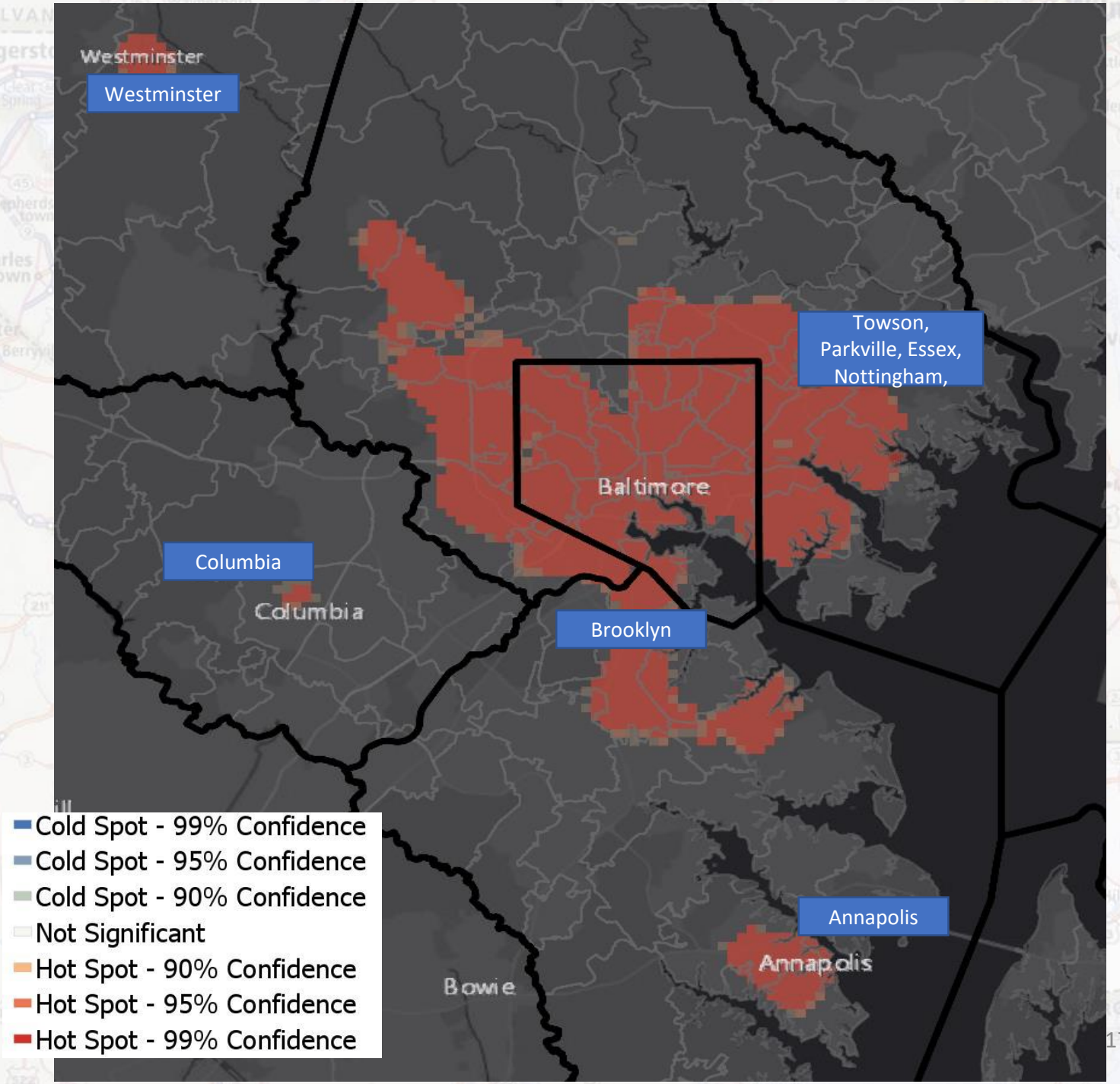
Starts with the injury severity of the crash then adds:

- $(student)$ • Adds 1 to score if pedestrian was a student (daytime, age 3-18)
- $((1/ * Distance) * 1000)$ • Weights crashes closer to schools than those further away.
- $STOASCORE$ • Adds the STOA score of the area where crash occurred
- $(.25 * Population)$ • Higher populated areas have higher scores
  - Rationale: interventions target more pedestrians, more opportunities for crashes.

Hot Spot Analysis: PedScore

Clustering of high PedScores follow closely with the distribution of other crash types.

Future: it is possible to tweak the equation to favor rural pedestrian crashes.



Areas omitted due to space restrictions. Any omitted areas had no hotspots for these types of pedestrian crashes