Transportation Systems Management and Operations Performance Report

4TH EDITION

JANUARY 2020

TSMO

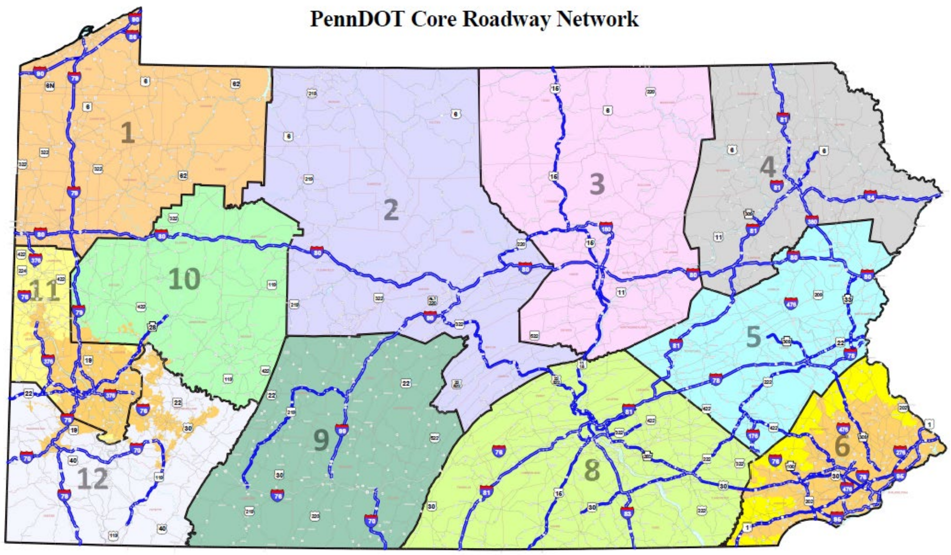




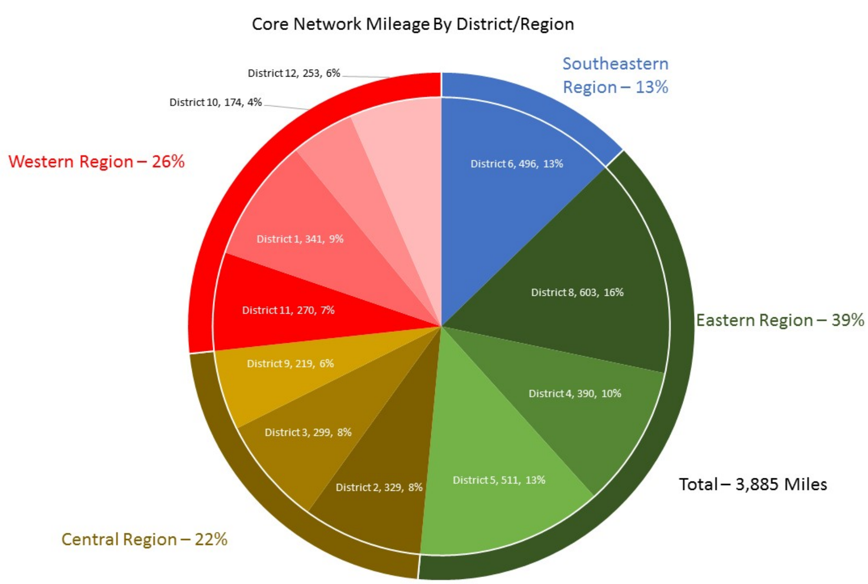
pennsylvania
DEPARTMENT OF TRANSPORTATION

Executive Summary

The TSMO Performance Report exists to provide information to traffic management personnel within PennDOT and partner agencies who impact traffic operations and incident management. With this information we hope to empower responsible parties to make informed decisions to improve the safety of our roads, and the reliable movement of people and goods on PennDOT's Core Roadway Network[1].



The PennDOT Core Roadway Network mileage is broken down by District/Region as seen below:



[1] Pennsylvania's "Core Roadway Network" was established in 2011 for 511PA, and includes state owned interstates, limited access roads, and other major routes throughout the Commonwealth.

The 4th Edition of the TSMO Performance Report has several focuses. The foremost is to introduce a data driven Pennsylvania-specific congestion pie chart. For the sake of this report, the congestion pie chart has been presented from the statewide and PennDOT District perspective, but capability is available to build a corridor congestion profile down to county and roadway.

This report re-visits the foundation of previous editions, and compares previous analysis of TMC verification rates of reportable crashes (all crashes and heavy congestion crashes) from 2017 to 2018. Additionally, an analysis of the growth in verification rates for TMCs that utilized the traffic alerts tool is provided.

Several new data comparisons are included in this edition as well. Investigations include heavy congestion crash verification rates by TMC operational shift, a Computer Aided Dispatch (CAD) integration into a TMC before and after study, and TMC incident verification rates in areas with and without camera coverage.

Additionally, updated 2018 data has been provided for incident clearance times by District, county, and interstate.

Table 1: 2017 and 2018 RCRS Verified Crashes - All Reportable Crashes
- Statewide RCRS verified rate of reportable crashes on the core roadway increased by 2.39% from 2017 to 2018, representing growth of 7.32%

Table 2: 2017 and 2018 RCRS Verified Crashes - Heavy Congestion Crashes
- Statewide RCRS verified rate of reportable crashes that caused heavy congestion on the core roadway network increased by 1.62% from 2017 to 2018, representing a growth of 1.88%

Table 3: 2017 and 2018 RCRS Verified Crashes - Heavy Congestion Crashes, by TMC Shift

Table 4: Growth in RCRS Verified Crash Rates for TMCs that Utilized Traffic Alerts Dashboard
- TMCs that utilized the Traffics Alerts Dashboard application in 2018 increased their crash verification rates by at least 17%

Table 5: Before and After Crash Verified Rates and RCRS Entry Time – CAD Integrations
- CAD Integrations by the Central Region RTMC have produced more than a 19% increase in their RCRS capture rate for reportable crashes on the core roadway network.

Table 6: Crash Verified Rates for RCRS and Waze Based on Distance from Camera – Heavy Congestion
- Statewide crash capture rate for heavy congestion crashes was 75.34% in 2018 for crashes that occurred within 2 miles of a traffic camera, and 52.96% for crashes that occurred further than 2 miles from a camera

Table 7: Incident Clearance Times by District/County – 2017 vs 2018

Table 8: Incident Clearance Times by Interstate/County – 2017 vs 2018

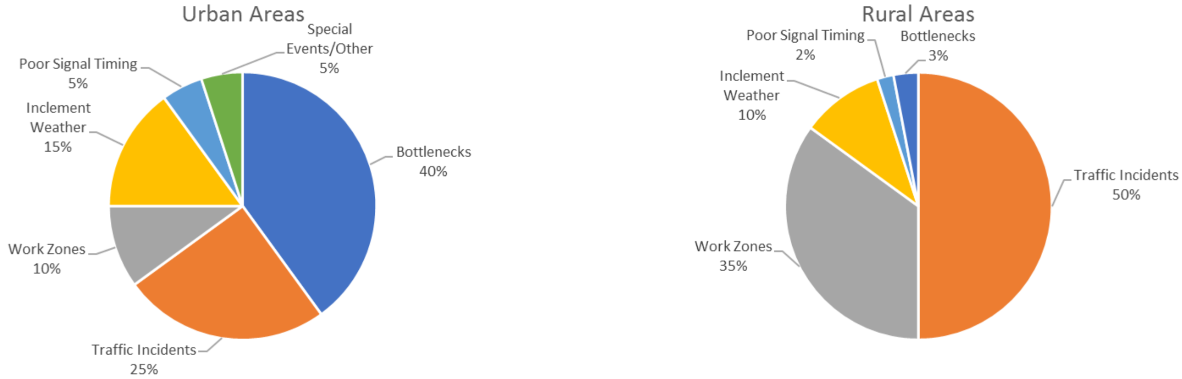
Based on the information provided in this report, the Department shall collectively evaluate the detailed data and consider recommendations as to how make improvements in the highlighted areas. District Traffic Operations offices and partners responsible for the operation of the Core Roadway Network may request further analysis/clarifications into the included topics of this report, and any other area of interest, from the Bureau of Maintenance and Operations, Traffic Systems and Performance Unit.

Pennsylvania's Congestion Pie Chart - 2018

Background

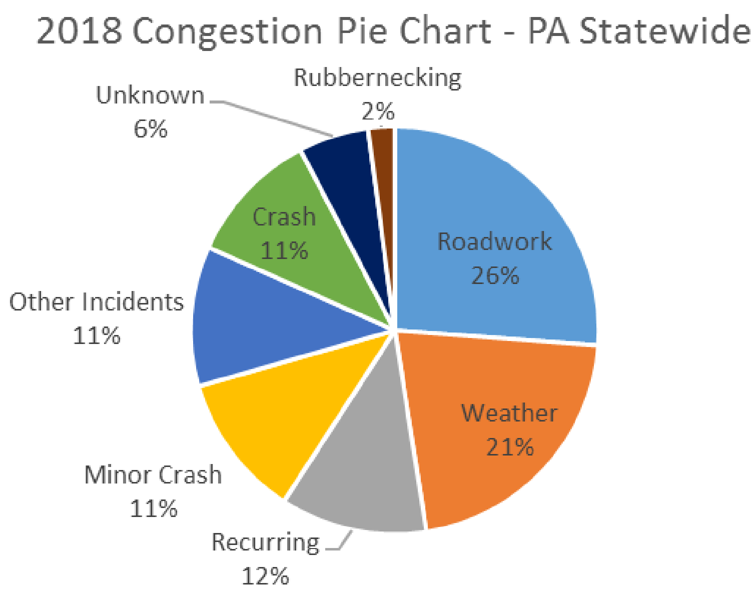
In 2005, FHWA published the original "congestion pie chart" – a pie chart that identified congestion by suspected cause. The chart was produced for both urban and rural areas, and both are seen below:

Figure 1 – FHWA Congestion Pie Chart Urban and Rural Areas



This pie chart has been held as a standard in the transportation industry, and in the nearly 15 years since it was released there have been no significant advancements to update/improve upon it. A year ago, the PennDOT Traffic Systems and Performance Unit set out to create a Pennsylvania-specific version of the congestion pie chart with a tool that could be used to generate pie charts relative to regions, districts and corridors. The goal of this effort is to enhance Department and planning partner decisions focused toward Transportation Systems Management and Operations (TSMO) congestion management strategies.

2018 Congestion Pie Chart – Statewide (Core Roadway Network)

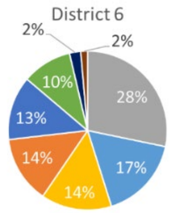


Cause	***Source/Definition***
Roadwork	RCRS Roadwork, Maintenance Database, or Waze Roadwork event
Weather	Inclement weather[2] conditions from RWIS or Waze weather event
Recurring	Congestion where speed drop is no more than 10% greater than the historical average speed
Minor Crash	Non-reportable crash from RCRS or Waze
Other Incident	Non-crash traffic hazard from Waze (i.e. disabled/car stopped on shoulder, hazard on roadway)
Crash	Reportable crash from the Crash Record System (CRS)
Unknown	Cause could not be identified with current data sources
Rubbernecking	Any previously identified congestion pie chart incident cause is linked to one side of the road, and no incident is correlated to the other side of the road in the same area, but still experiences a speed drop above historical norm

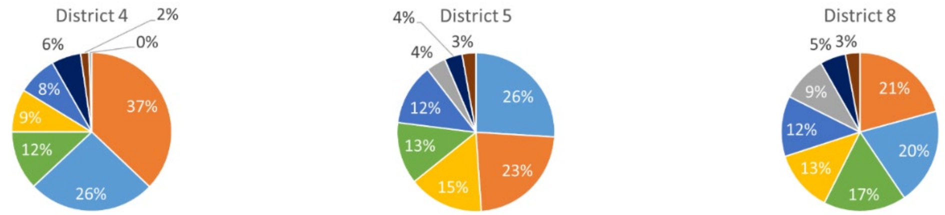
[2] Heavy rain, any kind of snow, and/or snow covered, icy, or wet (with temperature below freezing) roads

2018 Congestion Pie Charts – By District (Core Roadway Network)

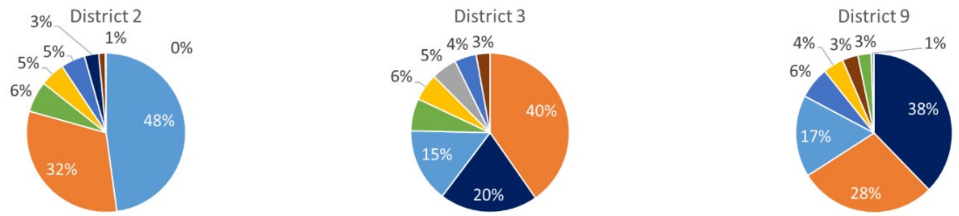
Southeastern Region



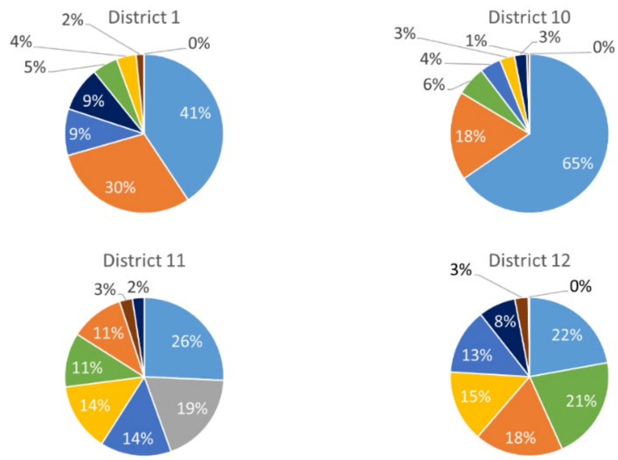
Eastern Region



Central Region



Western Region



Methodology

PennDOT's congestion pie chart was developed by utilizing traffic speed data provided by INRIX's flow incident API. While INRIX's exact methodology for conditions that produce a flow incident is proprietary, the general guidelines they issue are traffic speeds that drop below 65% of reference (freeflow) speed for at least 2 minutes, and that a flow incident ends when speeds have returned to greater than 70% of reference speed.

PennDOT's congestion pie chart tool was developed using 2018 data and it is limited to routes on PennDOT's Core Roadway Network. All INRIX flow incidents on the Core Roadway Network for 2018 were brought into the database and correlated to a variety of Department data sources to uncover DOT known "causes":

Data Source	Data Type
Road Condition Reporting System (RCRS)	Traffic Incidents, Roadwork
Maintenance Database	Roadwork
Crash Reporting System (CRS)	Reportable Crashes[3]
Roadway Weather Information System (RWIS)	Inclement Weather

For all data sources except RWIS[4], a cause was correlated to a congestion incident if the cause occurred within 30 minutes of the congestion and within a mile of the congestion event. If no cause of congestion could be determined from Department sources, crowed-sourced data from Waze was used to attempt to determine a cause, using the same 1 mile, 30-minute buffer parameters.

In some cases, multiple potential causes were identified for a single congestion incident. At this time, no special analysis was done to determine a primary cause, or to assign percentages of congestion across the multiple causes. For purposes of this analysis, congestion that correlated to multiple causes, DOT data or crowd-sourced, were classified using the following priority:

1. Crash
2. Roadwork
3. Weather

To generate the pie chart, all congestion events were assigned an impact score[5]. The congestion pie charts as presented represent a breakdown of the total impact score by cause.

Known Limitations and Clarifications

- The Core Roadway Network is predominantly limited access, though there are limited signalized areas. There was no effort made to quantify the impact of signals at this time.
- Any recurring congestion due to poor signal timing would fall under recurring congestion for purposes of this tool
- Due to INRIX mapping issues, no flow incidents were reported on Interstate 81 in Franklin and Cumberland Counties from March 2018 through the end of the year
- The original FHWA congestion pie chart was calculated based on vehicle hours of delay

[3] A reportable crash is one in which an injury or a fatality occurs, or if at least one of the vehicles involved required towing from the scene.

[4] Weather data from RWIS was correlated if it was indicated by the nearest RWIS station to the congestion event, with a maximum distance of 15 miles

[5] The impact score of a congestion event = (event duration) x (length of queue) x (speed drop).

- PennDOT's congestion pie chart tool currently does not take volume into account, although this is planned for a future enhancement

Conclusions

PennDOT's congestion pie chart tool can be utilized by PennDOT traffic operations personnel and planning partners to better understand the nature of congestion specific to their area of interest. Knowing the predominant causes of congestion provide the input to choose effective programs and strategies that deal with that particular concern. The analysis tool will allow users to generate a congestion pie chart for the entire state, district(s), county(s), specific roadway, or roadway/county combinations (corridor). Future enhancements are already in the works to allow smaller segments of roadways to be analyzed, and to further investigate the impact of multiple congestion causes on safety and severity of the incident timeline.

TMC Situational Awareness

RCRS Verified – All Reportable Crashes

The first two TSMO Performance reports issued in 2018 focused on the percentage of core network reportable crashes that were verified by TMC personnel. Table 1. displays the RCRS verification rate for all reportable crashes, and Table 3. shows those same verification rates for heavy congestion[6] crashes on the Core Roadway network in 2017 and 2018. These numbers are provided as insight into how TMCs are progressing in their efforts to improve situational awareness.

Table 1. 2017 and 2018 RCRS Verified Crashes – All Reportable Crashes

Traffic Management Centers (TMC)	2017 Reportable Crashes	2017 Linked to RCRS[7]	%	2018 Reportable Crashes	2018 Linked to RCRS	%	Change[8]	Growth[9]
Southeastern RTMC (D6)	***6,559***	***2,635***	***40.2%***	***7118***	***2822***	***39.6%***	***-0.5%***	***-1.3%***
Eastern RTMC (D8)	***7,433***	***2,243***	***30.2%***	***7851***	***2797***	***35.6%***	***5.4%***	***18.1%***
District 4	280	49	17.5%	473	113	23.9%	6.4%	36.5%
District 4 (D8)	852	77	9.0%	719	117	16.3%	7.2%	80.1%
District 5	2724	624	22.9%	2790	787	28.2%	5.3%	23.1%
District 5 (D8)	1199	154	12.8%	1201	235	19.6%	6.7%	52.3%
District 8	3,577	1,493	41.7%	3869	1780	46.0%	4.3%	10.2%
Central RTMC (D2)	***1905***	***365***	***19.2%***	***2015***	***454***	***22.5%***	***3.4%***	***17.6%***
District 2	718	246	34.3%	710	294	41.4%	7.1%	20.9%
District 3	771	94	12.2%	797	105	13.2%	1.0%	8.1%
District 9	416	25	6.0%	508	55	10.8%	4.8%	80.2%
Western RTMC (D11)	***3,650***	***1136***	***31.1%***	***3733***	***1183***	***31.7%***	***0.6%***	***1.8%***
District 1	272	29	10.7%	250	29	11.6%	0.9%	8.8%
District 1 (D11)	312	23	7.4%	304	18	5.9%	-1.5%	-19.7%
District 10	377	46	12.2%	424	37	8.7%	-3.5%	-28.5%
District 11	1,886	875	46.4%	1939	955	49.3%	2.9%	6.2%
District 12	804	164	20.4%	816	144	17.6%	-2.8%	-13.5%
Statewide	***19,547***	***6,379***	***32.6%***	***20717***	***7256***	***35.0%***	***2.4%***	***7.3%***

2017 numbers differ from those that were presented in the 2018 reports. Since those reports were issued, the data methodology was refined to improve route matching of incidents. Over 4000 additional crashes were identified as being on the core network in 2017.

[6] A heavy congestion event has the scores: (1-Critical >= 10000, 2-Severe 3000 – 9999). Severity score methodology = (Duration of Incident) * (Historical Avg. Speed – Avg. Speed during Incident)

[7] Reportable crashes are determined to be linked to an RCRS event if there is an RCRS "crash" entry within 1500 meters (~1 mile) of the location of any crash report, and with a start time within 45 minutes of the date and time on any crash report, or while there is still congestion present, whichever is greater.

[8] Change = 2018 RCRS Verified Rate – 2017 RCRS Verified Rate

[9] Growth = Change/2017 RCRS Verified Rate

RCRS Verified - Heavy Congestion Crashes

Major crashes on core network roads can gridlock ntire metropolitan areas. These are the instances when effective traffic management strategies are paramount, and most importantly need to be clearly communicated to first responders, and the traveling public to allow for actionable decisions. PennDOT TMCs should aim to have 85% of heavy congestion crashes verified by an RCRS entry for all core roadway network roads. Table 2. below illustrates the TMC situational awareness of heavy congestion reportable crashes from 2017 and 2018.

Table 2. 2017 and 2018 RCRS Verified Crashes – Heavy Congestion Crashes[10]

Traffic Management Centers (TMC)	2017 Reportable Heavy Congestion Crashes	2017 Linked to RCRS	%	2018 Reportable Heavy Congestion Crashes	2018 Linked to RCRS	%	Change	Growth
Southeastern RTMC (D6)	***943***	***664***	***70.4%***	***1025***	***739***	***72.1%***	***1.7%***	***2.4%***
Eastern RTMC (D8)	***1,329***	***869***	***65.4%***	***1498***	***1035***	***69.1%***	***3.7%***	***5.7%***
District 4	53	25	47.2%	88	44	50.0%	2.8%	6.0%
District 4 (D8)	117	40	34.2%	95	48	50.5%	16.3%	47.8%
District 5	352	222	63.1%	338	218	64.5%	1.4%	2.3%
District 5 (D8)	149	65	43.6%	172	103	59.9%	16.3%	37.3%
District 8	658	517	78.6%	805	622	77.3%	-1.3%	-1.7%
Central RTMC (D2)	***203***	***136***	***67.0%***	***267***	***168***	***62.9%***	***-4.1%***	***-6.1%***
District 2	96	80	83.3%	120	91	75.8%	-7.5%	-9.0%
District 3	80	49	61.3%	84	54	64.3%	3.0%	5.0%
District 9	27	7	25.9%	63	21	33.3%	7.4%	28.6%
Western RTMC (D11)	***672***	***445***	***66.2%***	***676***	***430***	***63.6%***	***-2.6%***	***-3.9%***
District 1	23	13	60.0%	22	14	63.6%	3.6%	6.1%
District 1 (D11)	42	18	40.0%	40	12	17.5%	-22.5%	-56.3%
District 10	73	32	43.8%	69	24	34.8%	-9.1%	-20.7%
District 11	403	311	77.2%	401	311	77.6%	0.4%	0.5%
District 12	131	71	54.2%	144	74	51.4%	-2.8%	-5.2%
Statewide	***3147***	***2114***	***67.2%***	***3466***	***2372***	***68.4%***	***1.3%***	***1.9%***

[10] A heavy congestion event has the scores: (1-Critical >= 10000, 2-Severe 3000 – 9999). Severity score methodology = (Duration of Incident) * (Historical Avg. Speed – Avg. Speed during Incident)

RCRS Verified - Heavy Congestion Crashes by TMC Shift

In response to the previous performance reports, several TMC managers requested to see crash capture rates broken down by TMC shift to understand how certain shifts are performing compared to their peers. These numbers are provided in Table 3. below for heavy congestion crashes in 2017 and 2018.

Table 3. 2017 and 2018 RCRS Verified Crashes – Heavy Congestion Crashes, by TMC and Shift

Southeastern and Eastern Regions

Traffic Management Centers (TMC)	2017 Reportable Heavy Congestion Crashes	2017 Linked to RCRS	%	2018 Reportable Heavy Congestion Crashes	2018 Linked to RCRS	%	Change	Growth
Southeastern RTMC (D6)	***943***	***664***	***70.4%***	***1025***	***739***	***72.1%***	***1.7%***	***2.4%***
AM Shift (4 AM to 12 PM)	*379*	*256*	67.5%	*435*	*308*	70.8%	3.3%	4.8%
PM Shift (12 PM to 8 PM)	*467*	*331*	70.9%	*500*	*356*	71.2%	0.3%	0.5%
Overnight (8 PM to 4 AM)	*98*	*76*	77.6%	*91*	*76*	83.5%	6.0%	7.7%
Eastern RTMC (D8)	***924***	***622***	***67.3%***	***1072***	***773***	***72.1%***	***4.8%***	***7.1%***
AM Shift (5 AM to 1 PM)	349	244	69.9%	489	354	72.4%	2.5%	3.5%
District 4[11]	28	10	35.7%	22	13	59.1%	23.4%	65.5%
District 5[12]	59	23	39.0%	57	25	43.9%	4.9%	12.5%
District 8	262	211	80.5%	410	316	77.1%	-3.5%	-4.3%
PM Shift (1 PM to 9 PM)	472	307	65.0%	466	318	68.2%	3.2%	4.9%
District 4[12]	73	16	21.9%	54	20	37.0%	15.1%	69.0%
District 5[12]	44	19	43.2%	64	34	53.1%	9.9%	23.0%
District 8	355	272	76.6%	348	264	75.9%	-0.8%	-1.0%
Overnight (9 PM to 5 AM)	103	71	68.9%	117	101	86.3%	17.4%	25.2%
District 4[12]	16	14	87.5%	19	15	78.9%	-8.6%	-9.8%
District 5[12]	46	23	50.0%	51	44	86.3%	36.3%	72.5%
District 8	41	34	82.9%	47	42	89.4%	6.4%	7.8%
District 4 TMC[12]	***53***	***25***	***47.2%***	***88***	***44***	***50.0%***	***2.8%***	***6.0%***
1st Shift (6 AM to 9 AM)	N/A	N/A	N/A	*5*	*1*	20.0%	N/A	N/A
2nd Shift (9 AM to 2 PM)	N/A	N/A	N/A	*18*	*9*	50.0%	N/A	N/A
3rd Shift (2 PM to 6 PM)	N/A	N/A	N/A	*33*	*16*	48.6%	N/A	N/A
District 5 TMC	***352***	***222***	***63.1%***	***338***	***218***	***64.5%***	***1.4%***	***2.3%***
AM Shift (6 AM to 12 PM)	*116*	*80*	69.0%	*150*	*92*	61.3%	-7.6%	-11.1%
PM Shift (12 PM to 8 PM)	*236*	*142*	60.2%	*188*	*126*	67.0%	6.9%	11.4%

[11] Represents crashes that occurred during days/hours when the home District TMC was not in operation and RTMC was covering

[12] The District 4 TMC changed their operating hours from 7:00 AM to 3:30 PM to 6 AM to 6 PM in June of 2018. Shift specific numbers are provided only for the period after the change in hours.

Central and Western Regions

Traffic Management Centers (TMC)	2017 Reportable Heavy Congestion Crashes	2017 Linked to RCRS	%	2018 Reportable Heavy Congestion Crashes	2018 Linked to RCRS	%	Change	Growth
Central RTMC (D2)	***203***	***136***	***67.0%***	***267***	***168***	***62.9%***	***-4.1%***	***-6.1%***
AM Shift (7 AM to 3 PM)	*101*	*65*	64.4%	*131*	*74*	56.5%	-7.9%	-12.2%
District 2	49	38	77.6%	58	41	70.7%	-6.9%	-8.8%
District 3	40	26	65.0%	39	24	61.5%	-3.5%	-5.3%
District 9	12	1	8.3%	34	9	26.5%	18.1%	217.6%
PM Shift (3 PM to 11 PM)	*67*	*45*	67.2%	*98*	*68*	69.4%	2.2%	3.3%
District 2	32	28	87.5%	44	36	81.8%	-5.7%	-6.5%
District 3	24	13	54.2%	32	19	59.4%	5.2%	9.6%
District 9	11	4	36.4%	22	13	59.1%	22.7%	62.5%
Overnight (11 PM to 7 AM)	*35*	*26*	74.3%	*40*	*28*	70.0%	-4.3%	-5.8%
District 2	15	14	93.3%	20	16	80.0%	-13.3%	-14.3%
District 3	16	10	62.5%	13	11	84.6%	22.1%	35.4%
District 9	4	2	50.0%	7	1	14.3%	-35.7%	-71.4%
Western RTMC (D11)	***647***	***430***	***66.5%***	***654***	***416***	***63.6%***	***-2.9%***	***-4.3%***
AM Shift (6 AM to 2 PM)	*275*	*189*	68.7%	*278*	*178*	64.0%	-4.7%	-6.8%
District 1	14	6	42.9%	21	5	23.8%	-19.0%	-44.4%
District 10	33	13	39.4%	28	9	32.1%	-7.3%	-18.4%
District 11	185	144	77.8%	171	135	78.9%	1.1%	1.4%
District 12	43	26	60.5%	58	29	50.0%	-10.5%	-17.3%
PM Shift (2PM to 10 PM)	*311*	*196*	63.0%	*310*	*192*	61.9%	-1.1%	-1.7%
District 1	21	7	33.3%	18	2	11.1%	-22.2%	-66.7%
District 10	34	15	44.1%	33	11	33.3%	-10.8%	-24.4%
District 11	184	139	75.5%	187	146	78.1%	2.5%	3.4%
District 12	72	35	48.6%	72	33	45.8%	-2.8%	-5.7%
Overnight (10 PM to 6 AM)	*61*	*45*	73.8%	*66*	*46*	69.7%	-4.1%	-5.5%
District 1	5	3	60.0%	1	0	0.0%	-60.0%	-100.0%
District 10	6	4	66.7%	8	4	50.0%	-16.7%	-25.0%
District 11	34	28	82.4%	43	30	69.8%	-12.6%	-15.3%
District 12	16	10	62.5%	14	12	85.7%	23.2%	37.1%
District 1 TMC	***25***	***15***	***60.0%***	***22***	***14***	***63.64%***	3.6%	6.1%
AM Shift (8 AM to 4 PM)	*15*	*10*	66.7%	*4*	*2*	*50.00%*	-16.7%	-25.0%
PM Shift (4 PM to 12 AM)	*3*	*1*	33.3%	*10*	*8*	*80.00%*	46.7%	140.0%
Overnight (12 AM to 8 AM)	*7*	*4*	57.1%	*8*	*4*	*50.00%*	-7.1%	-12.5%

Conclusions

There was statewide growth rate of over 7% for all reportable crashes verified in RCRS, with virtually all Districts/TMCs experiencing at least some growth. TMC early adopters of the "Traffic Alerts" dashboard in 2018 all experienced the highest growth in their crash capture rates between 2017 and 2018, as seen in the Table 4.

Table 4. Growth in RCRS Verified Crash Rates for TMCs that Utilized Traffic Alerts Dashboard in 2018

TMC	2017	2018	Change	Growth
District 4	17.5%	23.9%	6.4%	36.5%
Eastern RTMC	30.6%	36.8%	6.2%	20.2%
Central RTMC	19.2%	22.6%	3.4%	17.6%

Statewide growth in the verification of heavy congestion crashes on the Core Roadway network was less significant than that seen for all reportable crashes. However, District 8's RTMC did experience significant growth during regional coverage hours in District 5. Comprehensive coverage of satellite Districts during regional operations is an area all RTMCs should continue to improve upon with the tools provided (Traffic Alerts Application, TIM/CAD outreach, proactive operator identification/investigation of significant congestion events across all shifts [Google maps, Waze, PSP outreach, etc.]).

County 911 CAD Integration in the RTMC

Since 2016, the Central RTMC has been integrating computer aided dispatch (CAD) systems from county 911 centers in its region. The goal of their effort is to improve situational awareness of roads, decrease the time it takes for TMC operational responses, and increase the safety for first responders and motorist approaching an incident. To date, they have been able to integrate 23 out of 24 counties in their region. Table 5. shows a subset of the early integrated counties, and where reliable before and after data was available.

Table 5. Before and After CAD Integration - Crash Verified Rates and RCRS Entry Time

Counties integrated in 2018 or prior – after data through 12/31/2018

		BEFORE				AFTER				CHANGE	
County	Date Integrated	Crashes	Verified in RCRS	%	RCRS Entry Time (Min)	Crashes	Verified in RCRS	%	RCRS Entry Time (Min)	Capture %	RCRS Entry Time (Min)
Clearfield	7/7/2016	66	24	36.4%	30	112	51	45.5%	21	9.2%	-9
Centre	11/22/2017	284	94	33.1%	23	264	124	47.0%	20	13.9%	-3
Northumberland	1/10/2017	86	3	3.5%	44	76	7	9.2%	37	5.7%	-7
Mifflin	7/16/2017	96	8	8.3%	27	100	39	39.0%	24	30.7%	-3
Clinton	6/13/2018	52	13	25.0%	14	75	33	44.0%	17	19.0%	3
Somerset	9/18/2018	15	1	6.7%	39	20	3	15.0%	21	8.3%	-18
									Total	15.8%	-3.24

Note: Finalized data is available from 1/1/2016 to 12/31/2018. For counties where a year of before and after data is available (Centre, Northumberland, Mifflin), before data is for 1 year prior to the integration date and after is for 1 year after. For other counties, the before and after ranges were set to allow an equal period of data on each side:

Clearfield: Before - 1/1/2016 to 7/6/2016, After – 7/7/2016 to 2/14/2017
Clinton: Before – 12/1/2017 to 6/12/2018, After – 6/13/2018 to 12/31/2018
Somerset: Before – 6/5/2018 to 9/17/2018, After – 9/18/2018 to 12/2018

Conclusions

There is significant growth in crash verified rates, and a decrease in RCRS entry times in counties where CAD integration has been completed. This clearly demonstrates that integration increases the timeliness of incident information to TMC Operators.

> "***While responding to an incident on Interstate 80, we passed the Dynamic Message Sign which was a mile or two before the incident. To my surprise and amazement, the sign was already updated and alerting traffic to the incident ahead. Motorists were moved into the left lane, passing the emergency, and there was no traffic backlog. The system was working how it should!"***
>
> – Jeremy Ruffner, Clearfield County 911 Center & local firefighter

Outreach and integration planning meetings with County 911 Centers should be considered by all TMC managers. An effort has begun to investigate, scope, and build a solution that could allow for all 67 county feeds to be viewable by TMC personnel. This solution will be piloted in the Central Region. Further study will be done to determine the impact on the number of secondary crashes and overall congestion in areas where integration has been completed.

Impact of Traffic Cameras on Situational Awareness

Traffic cameras are one of the most heavily utilized tools for situational awareness and verification. As a result, a preliminary analysis was done to determine the effective radius of cameras of heavy congestion crashes. While cameras may only provide an actual view of incidents that occur within the immediate vicinity of the camera, analysis showed they are a significant aid in detecting heavy congestion crashes occurring up to 2 miles away from the camera.

The numbers in Table 6. are compared with Waze reported incidents from our Connected Citizens agreement.

Table 6. Crash Capture Rates for RCRS and Waze Based on Distance from Camera – Heavy Congestion

TMC	*Camera*[13]					*No Camera*[14]				
	Crashes [15]	RCRS	%	Waze	%	Crashes [14]	RCRS	%	Waze	%
Southeastern RTMC (D6)	***871***	***662***	***76.0%***	***738***	***84.7%***	***154***	***77***	***50.0%***	***119***	***77.3%***
Eastern RTMC (D8)	***970***	***726***	***74.8%***	***799***	***82.4%***	***528***	***310***	***58.7%***	***415***	***78.6%***
District 4	52	25	48.1%	41	78.8%	36	19	52.8%	26	72.2%
District 4 (D8)	59	35	59.3%	47	79.7%	36	13	36.1%	27	75.0%
District 5	220	153	69.5%	178	80.9%	118	65	55.1%	93	78.8%
District 5 (D8)	106	66	62.3%	82	77.4%	66	38	57.6%	37	56.1%
District 8	533	447	83.9%	451	84.6%	272	175	64.3%	232	85.3%
Central RTMC (D2)	***83***	***55***	***66.3%***	***58***	***69.9%***	***184***	***113***	***61.4%***	***117***	***63.6%***
District 2	51	40	78.4%	35	68.6%	69	51	73.9%	41	59.4%
District 3	4	3	75.0%	3	75.0%	80	51	63.8%	57	71.3%
District 9	28	12	42.9%	20	71.4%	35	11	31.4%	19	54.3%
Western RTMC (D11)	***444***	***340***	***76.6%***	***376***	***84.7%***	***232***	***91***	***39.2%***	***177***	***76.3%***
District 1	3	2	66.7%	0	0.0%	19	12	63.2%	14	73.7%
District 1 (D11)	5	1	20.0%	5	100.0%	35	7	20.0%	24	68.6%
District 10	7	0	0.0%	7	100.0%	62	24	38.7%	44	71.0%
District 11	353	298	84.4%	302	85.6%	48	13	27.1%	39	81.3%
District 12	76	39	51.3%	62	81.6%	68	35	51.5%	56	82.4%
Statewide	***2368***	***1783***	***75.3%***	***1971***	***83.2%***	***1098***	***591***	***53.8%***	***828***	***75.4%***

Conclusions

Waze has a higher capture rate for crashes that occur more than 2 miles from a camera. This correlation provides a look at how much improvement could be offered to TMCs using crowd sourced incident data, e.g. using the Traffic Alerts Application. It should also be noted, INRIX speed data detected 100% of crashes in the table above.

The below heat map only highlights heavy congestion crashes that occurred further than 2 miles from a camera and were not verified in RCRS. The darker red areas illustrate locations where improved situational awareness is most needed. Those highlighted areas are potential locations for future camera deployments (mobile or permanent) and

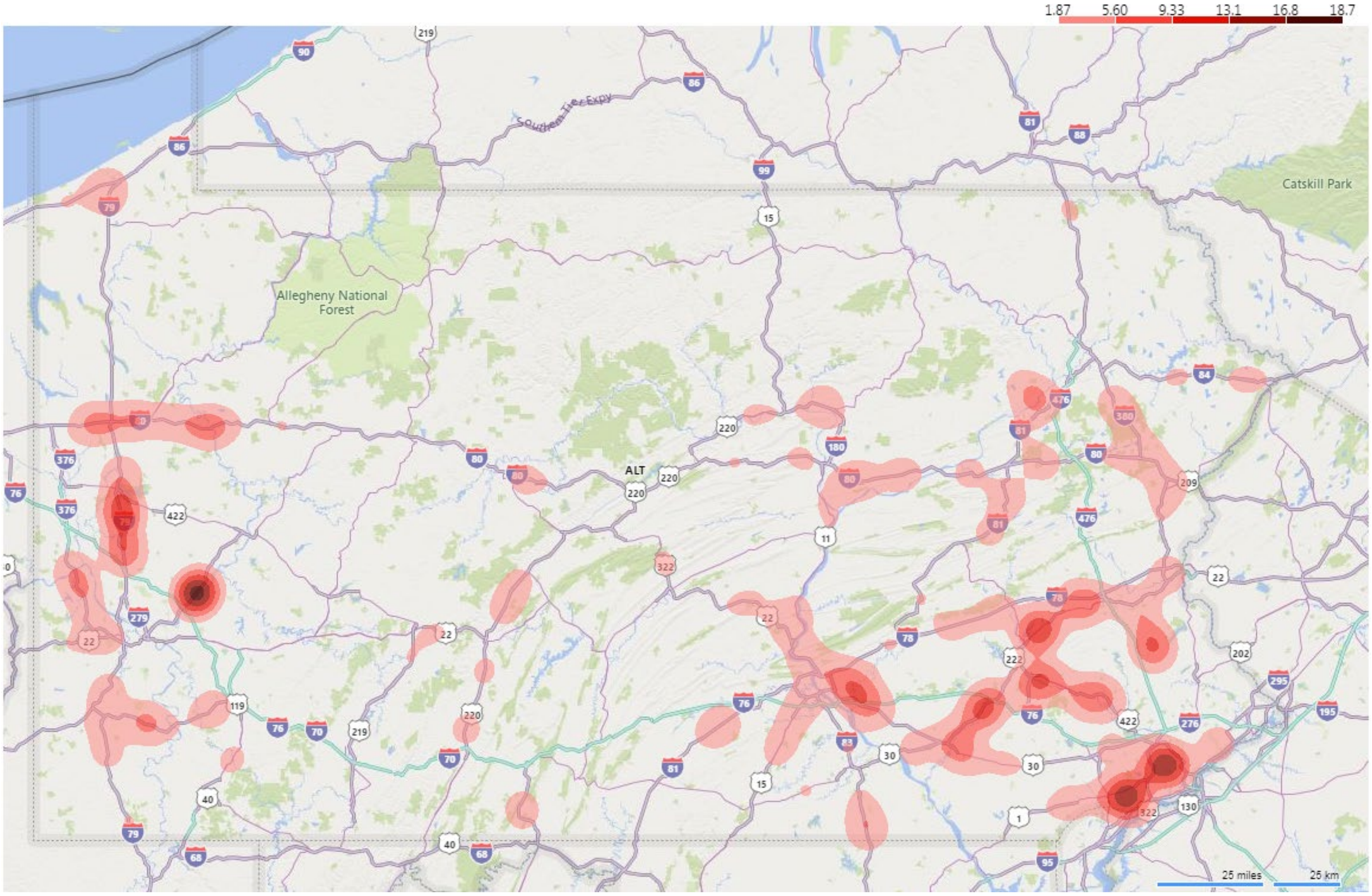
[13] Crashes that occurred within 2 miles of the nearest traffic camera

[14] Crashes that occurred more than 2 miles from the nearest traffic camera

[15] Reportable crashes on the Core Roadway Network that caused heavy congestion

should be targeted roads in the Traffic Alerts Dashboard for RTMCs during all shifts. For more detailed maps for each District, see ***Appendix 1 – District Specific Camera Coverage Maps***.

Figure 2 – Heat Map of Un-Verified Heavy Congestion Crashes 2+ Miles from a Camera



Average Incident Clearance Times – 2017 vs 2018

The first TSMO Performance Report issued in February 2018 presented a breakdown of average incident clearance times by District and County for all routes on the Core Roadway Network. Table 7. below updates this information for 2017 and 2018.[16]

To better drill down this information and provide a useful look at where TIM strategies are being effectively implemented, a new Table 8. has been developed which presents data for incident clearance times by interstate and county.

Table 7. Incident Clearance Times by District/County – 2017 vs 2018

	2017 Incident Clearance Time (min)	2017 Incident Count	2018 Incident Clearance Time (min)	2018 Incident Count	Change		2017 Incident Clearance Time (min)	2017 Incident Count	2018 Incident Clearance Time (min)	2018 Incident Count	Change
District 1	***197***	***89***	***127***	***97***	***-70***	***District 2***	***135***	***333***	***111***	***440***	***-24***
CRAWFORD	292	6	156	2	-136	CENTRE	150	142	104	178	-46
ERIE	180	36	112	51	-68	CLEARFIELD	116	100	111	151	-5
MERCER	156	37	146	37	-10	CLINTON	172	52	145	63	-27
VENANGO	348	10	123	7	-225	JUNIATA	70	4	122	4	52
						MIFFLIN	77	35	88	44	11
District 3	***178***	***138***	***159***	***149***	***-19***	***District 4***	***124***	***174***	***149***	***341***	***25***
COLUMBIA	173	16	192	15	19	LACKAWANNA	99	69	114	109	15
LYCOMING	157	29	132	41	-25	LUZERNE	129	67	109	151	-20
MONTOUR	260	10	203	11	-57	PIKE	139	21	157	27	18
NORTHUMBERLAND	200	15	169	23	-31	SUSQUEHANNA	114	8	152	47	38
SNYDER	119	13	157	10	38	WAYNE	248	9	199	7	-49
TIOGA	118	18	177	14	59						
UNION	214	37	148	35	-66						
District 5	***88***	***1034***	***96***	***1300***	***8***	***District 6***	***59***	***4676***	***63***	***4631***	***4***
BERKS	129	178	127	268	-2	BUCKS*	57	399	65	424	8
CARBON	172	8	286	12	114	CHESTER*	61	360	64	398	3
LEHIGH	64	467	68	509	4	DELAWARE*	63	651	78	579	15
MONROE	109	82	138	119	29	MONTGOMERY*	63	965	69	890	6
NORTHAMPTON	72	263	80	332	8	PHILADELPHIA*	56	2301	57	2340	1
SCHUYLKILL	244	36	166	60	-78						
District 8	***80***	***2466***	***92***	***2673***	***12***	***District 9***	***137***	***41***	***122***	***74***	***-15***
ADAMS	117	31	125	17	8	BEDFORD	45	1	61	1	16
CUMBERLAND*	81	562	84	562	3	BLAIR	93	23	115	43	22
DAUPHIN*	75	801	89	819	14	CAMBRIA	82	5	123	14	41
FRANKLIN	96	82	96	80	0	FULTON	283	10	175	8	-108
LANCASTER	83	381	113	436	30	SOMERSET	101	2	109	8	8
LEBANON*	123	83	116	135	-7						
PERRY	98	27	128	45	30						
YORK	74	499	76	579	2						
District 10	***350***	***60***	***197***	***48***	***-153***	***District 11***	***66***	***1697***	***66***	***1172***	***0***
BUTLER*	495	22	124	15	-371	ALLEGHENY*	66	1688	66	1761	0
CLARION	301	16	210	19	-91	BEAVER*	68	3	117	7	49
JEFFERSON*	241	22	257	14	16	LAWRENCE*	147	6	313	4	166
District 12	***134***	***219***	***110***	***205***	***-24***						
FAYETTE*	143	5	199	2	56						
GREENE*	195	6	94	23	-101						
WASHINGTON*	152	114	115	112	-37						
WESTMORELAND	108	94	104	68	-4						

*- County that has an active Traffic Incident Management (TIM) Team

[16] 2017 numbers will differ from those originally reported in the February 2018 report, as a result of fixing the error regarding which incidents were classified as being on the core roadway network.

Table 8. Incident Clearance Times by Interstate/County – 2017 vs 2018

	2017 Incident Clearance Time (min)	2017 Incident Count	2018 Incident Clearance Time (min)	2018 Incident Count	Change		2017 Incident Clearance Time (min)	2017 Incident Count	2018 Incident Clearance Time (min)	2018 Incident Count	Change
I-90	***171***	***30***	***124***	***41***	***-47***	***I-86***	***273***	***4***	***N/A***	***0***	***N/A***
ERIE	171	30	124	41	-47	ERIE	273	4	N/A	0	N/A
I-376	***62***	***994***	***61***	***977***	***-1***	***I-70***	***164***	***122***	***123***	***127***	***-41***
ALLEGHENY*	62	983	60	964	-2	BEDFORD	45	1	17	1	-28
BEAVER*	68	3	117	7	49	FULTON	283	10	175	8	-108
LAWRENCE*	147	6	313	4	166	WASHINGTON*	192	62	117	77	-74
MERCER	51	2	148	2	97	WESTMORELAND	108	49	127	41	19
I-79	***122***	***329***	***86***	***350***	***-36***	***I-80***	***174***	***423***	***139***	***536***	***-35***
ALLEGHENY*	85	241	81	263	-4	BUTLER*	N/A	0	244	1	N/A
BUTLER*	511	21	115	14	-396	CARBON	172	8	271	13	99
CRAWFORD	292	6	156	2	-136	CENTRE	175	62	114	74	-60
ERIE	142	2	66	10	-76	CLARION	301	16	210	19	-91
GREENE*	195	6	94	23	-101	CLEARFIELD	116	100	111	151	-6
MERCER	114	6	81	6	-33	CLINTON	202	39	172	45	-30
WASHINGTON*	106	47	109	32	3	COLUMBIA	173	16	192	15	19
I-279	***66***	***211***	***78***	***248***	***12***	JEFFERSON	241	22	257	14	16
ALLEGHENY*	66	211	78	248	12	LUZERNE	171	20	136	32	-35
I-579	***53***	***25***	***52***	***29***	***-1***	MERCER	172	29	159	29	-13
ALLEGHENY*	53	25	52	29	-1	MONROE	109	66	107	92	-2
I-99	***120***	***76***	***90***	***100***	***-30***	MONTOUR	260	10	203	11	-57
BEDFORD	N/A	0	61	1	N/A	NORTHUMBERLAND	244	10	153	15	-91
BLAIR	96	21	117	39	21	UNION	331	15	162	18	-169
CENTRE	136	55	73	60	-63	VENANGO	348	10	123	7	-226
I-81	***101***	***777***	***109***	***941***	***8***	***I-180***	***143***	***9***	***122***	***16***	***-21***
CUMBERLAND*	89	263	97	244	8	LYCOMING	131	7	123	12	-7
DAUPHIN*	81	214	101	225	19	NORTHUMBERLAND	187	2	119	4	-69
FRANKLIN	96	82	96	80	1	***I-283***	***68***	***65***	***88***	***71***	***20***
LACKAWANNA	98	62	113	73	14	DAUPHIN*	68	65	88	71	20
LEBANON*	132	69	121	98	-10	***I-83***	***74***	***836***	***75***	***833***	***1***
LUZERNE	114	43	98	114	-16	CUMBERLAND*	74	121	72	97	-2
SCHUYLKILL	244	36	166	60	-78	DAUPHIN*	69	358	73	320	4
SUSQUEHANNA	114	8	152	47	38	YORK	79	357	77	416	-2
I-78	***88***	***343***	***108***	***469***	***20***	***I-176***	***316***	***6***	***161***	***10***	***-155***
BERKS	113	89	139	159	26	BERKS	316	6	161	10	-155
LEBANON*	77	14	96	33	19	***I-380***	***76***	***5***	***219***	***23***	***143***
LEHIGH	77	166	83	178	6	LACKAWANNA	65	1	181	8	116
NORTHAMPTON	85	74	108	99	22	MONROE	79	4	239	15	160
I-76	***56***	***1186***	***56***	***1015***	***0***	***I-84***	***161***	***36***	***139***	***57***	***-22***
MONTGOMERY*	59	507	62	395	3	LACKAWANNA	108	6	99	23	-9
PHILADELPHIA*	54	679	51	620	-3	PIKE	139	21	157	27	18
I-476	***72***	***245***	***79***	***189***	***7***	WAYNE	248	9	199	7	-49
DELAWARE*	63	154	68	127	6	***I-676***	***50***	***474***	***50***	***422***	***0***
MONTGOMERY*	88	91	101	62	13	PHILADELPHIA*	50	474	50	422	0
I-95	***60***	***1603***	***67***	***1679***	***7***						
BUCKS*	58	215	67	220	9						
DELAWARE*	61	450	79	422	18						
PHILADELPHIA*	60	938	63	1037	3						

*- County that has an active Traffic Incident Management (TIM) Team

Conclusions

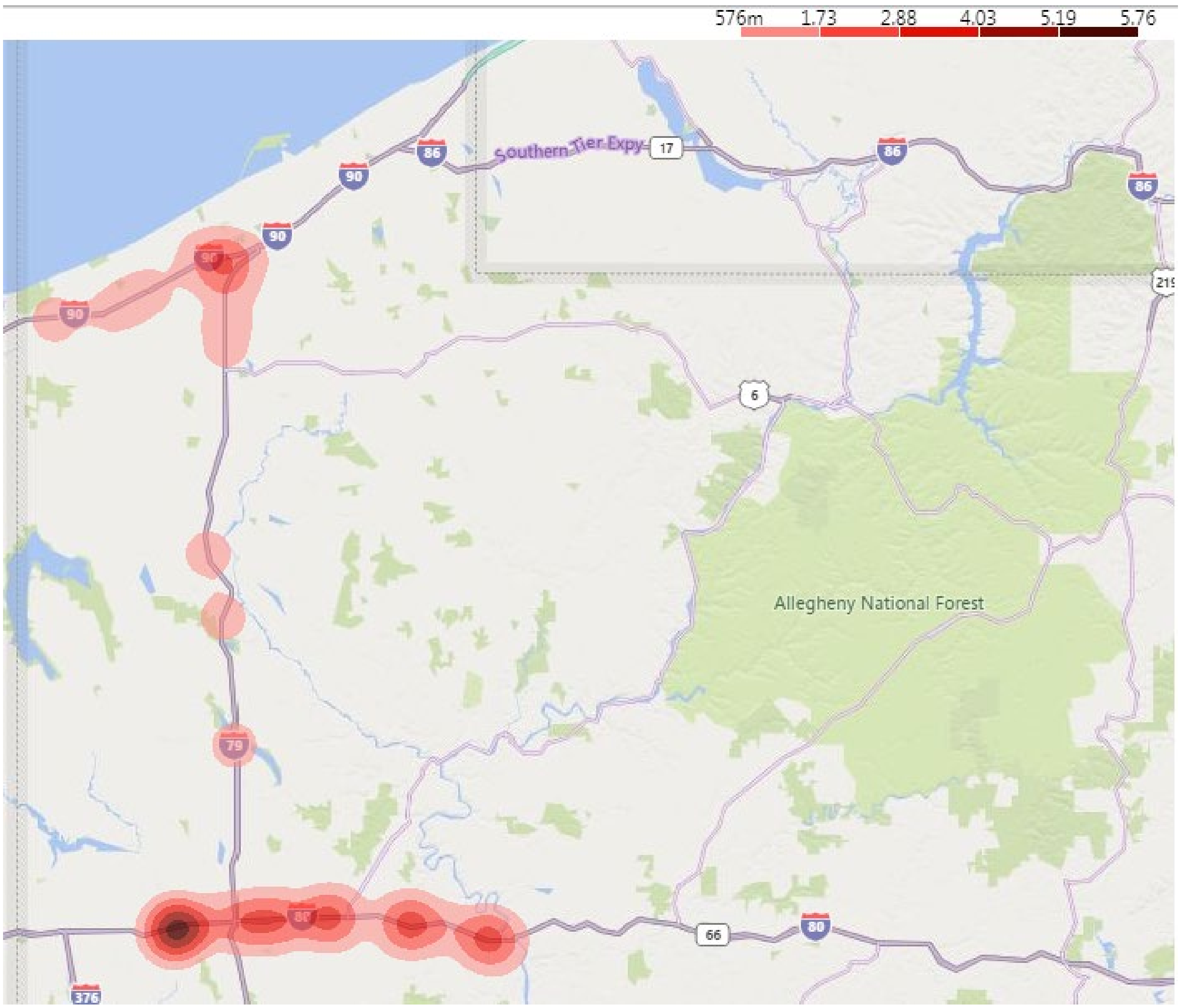
Both tables are presented to provide insight into areas and locations where incident response and management can be improved. TMC TIM Team involvement needs to be consistently increased on a statewide level.

The Traffic Systems and Performance Unit is currently developing a Traffic Incident Management (TIM) report for the Western RTMC that will allow any TMC to quickly generate and easily share TIM related metrics with TIM partners. This report will eventually have the capability to drill down to municipality, so TMC management staff can collectively evaluate performance by TIM provider areas and core network roads. The first version of this report should be released in 2020.

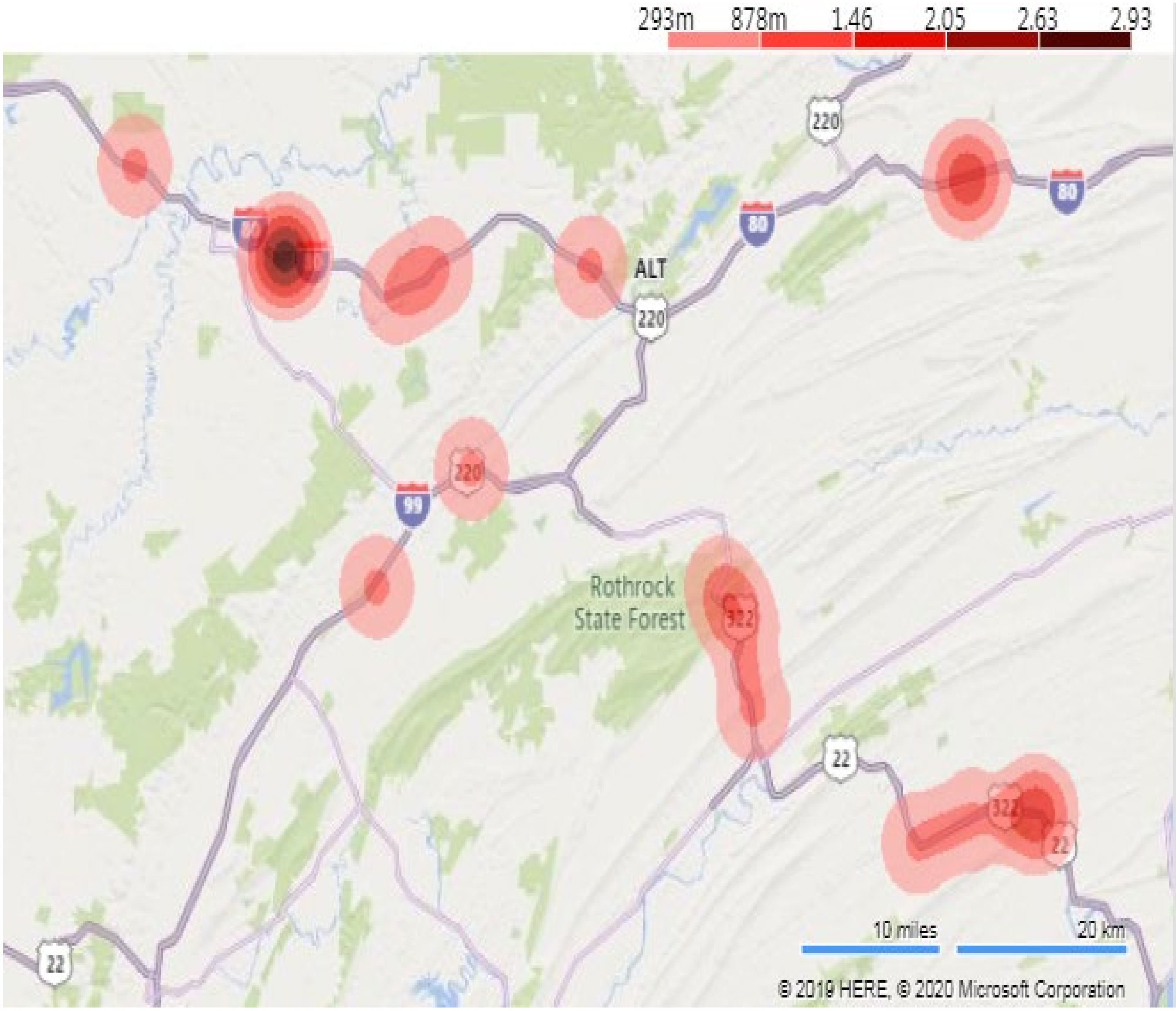
Appendix 1 – District Specific Camera Coverage Maps

The heat maps provided below are District-specific versions of the statewide map provided in the main body of the report. They illustrate heavy congestion crashes that occurred more than 2 miles away from a camera and which were not verified in RCRS. Those highlighted areas are potential locations for future camera deployments (mobile or permanent) and should be targeted roads in the Traffic Alerts Dashboard for RTMCs during all shifts.

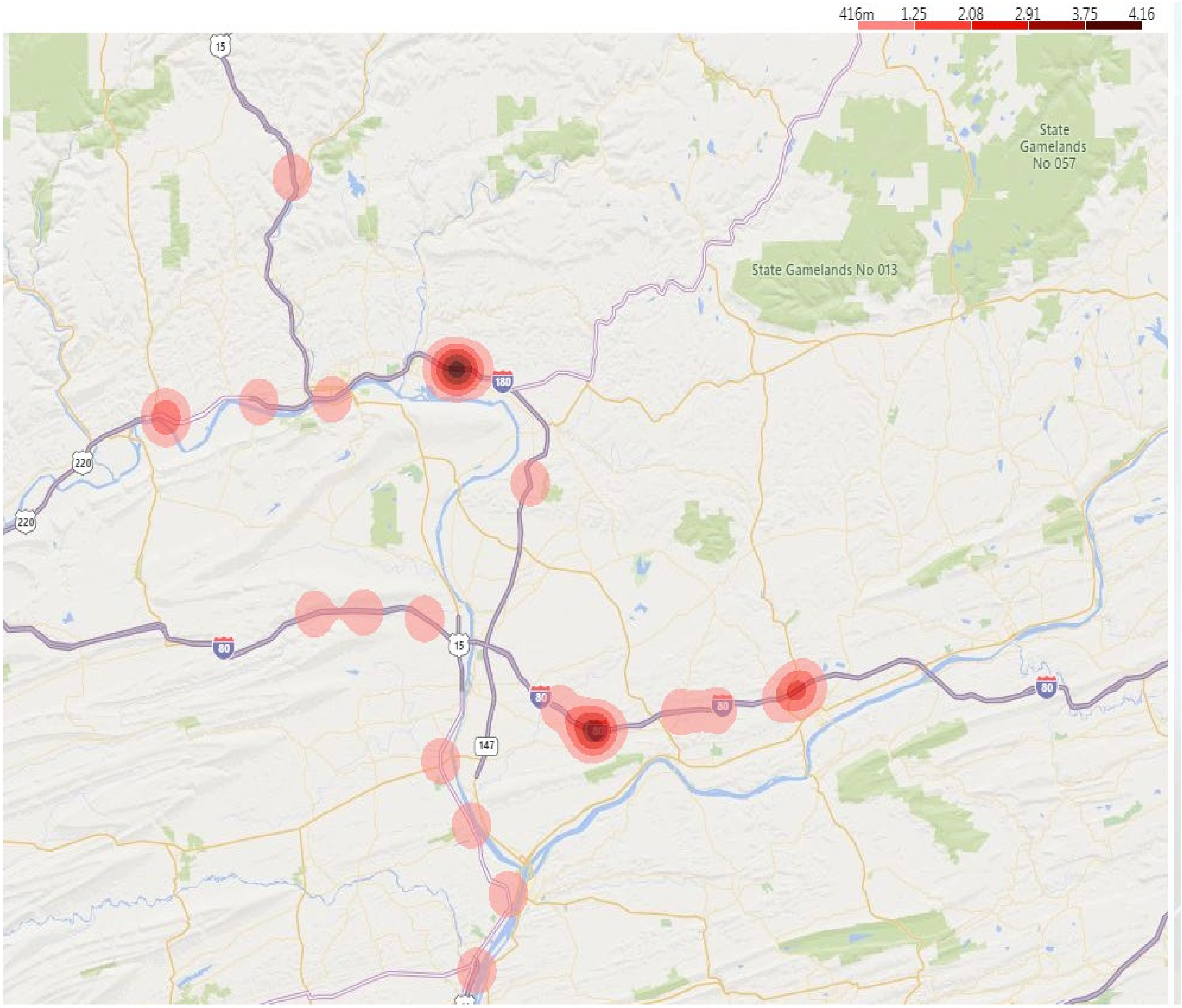
District 1



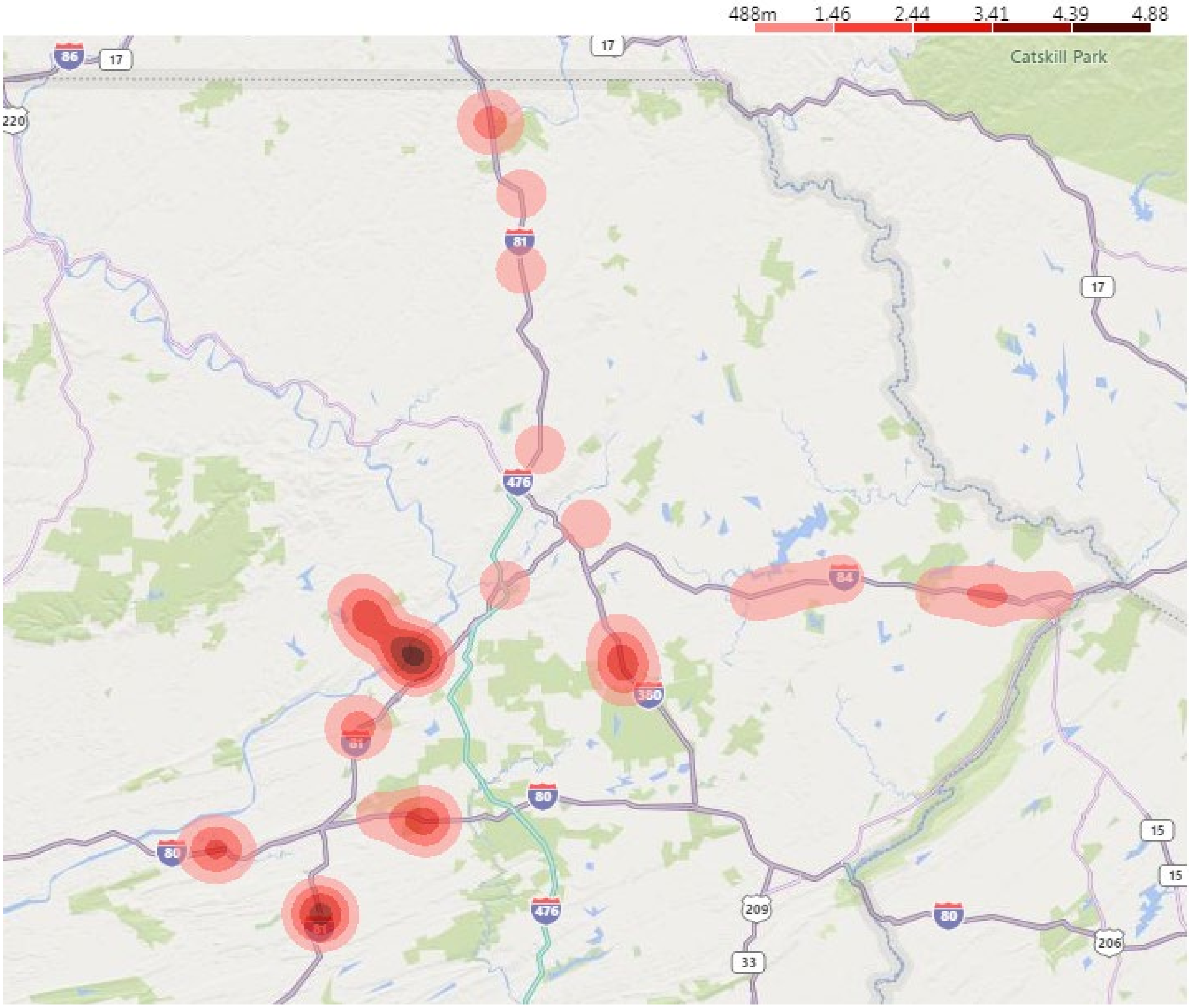
District 2


293m
878m
1.46
2.05
2.63
2.93
220
80
ALT
220
80
80
220
99
Rothrock
State Forest
322
22
322
22
22
10 miles
20 km
© 2019 HERE, © 2020 Microsoft Corporation

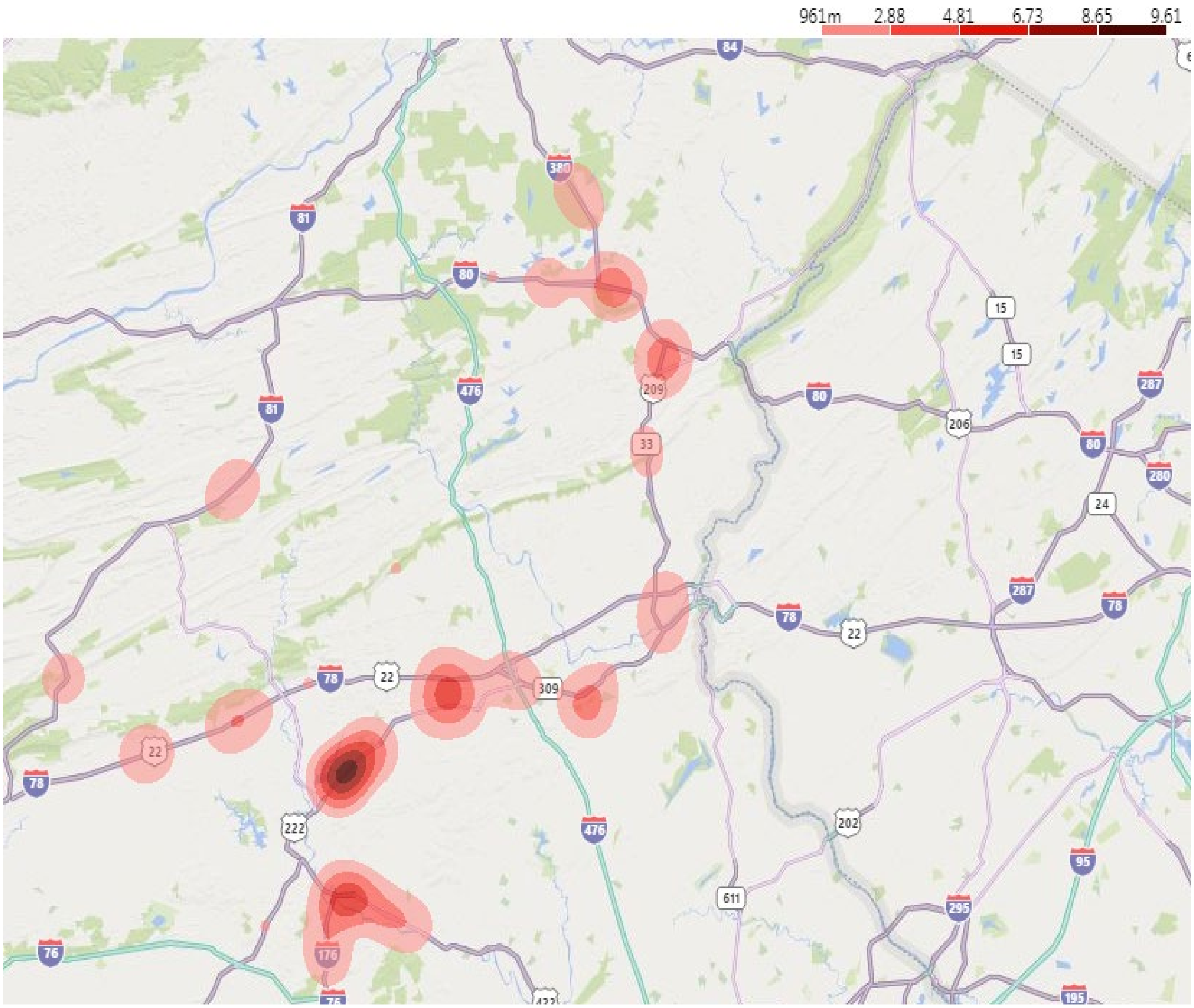
District 3


416m
1.25
2.08
2.91
3.75
4.16
State Gamelands No 057
State Gamelands No 013
15
220
180
80
147

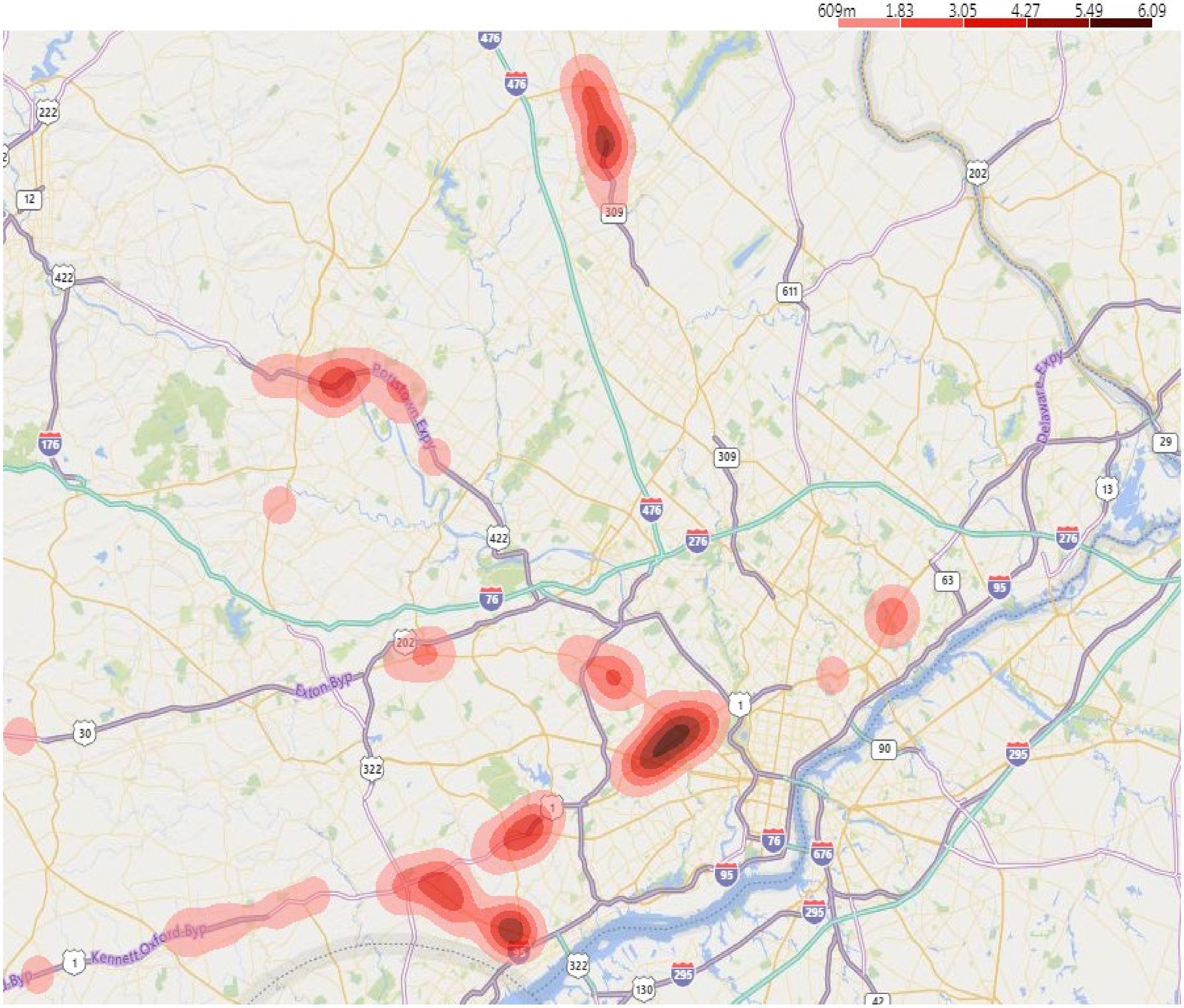
District 4



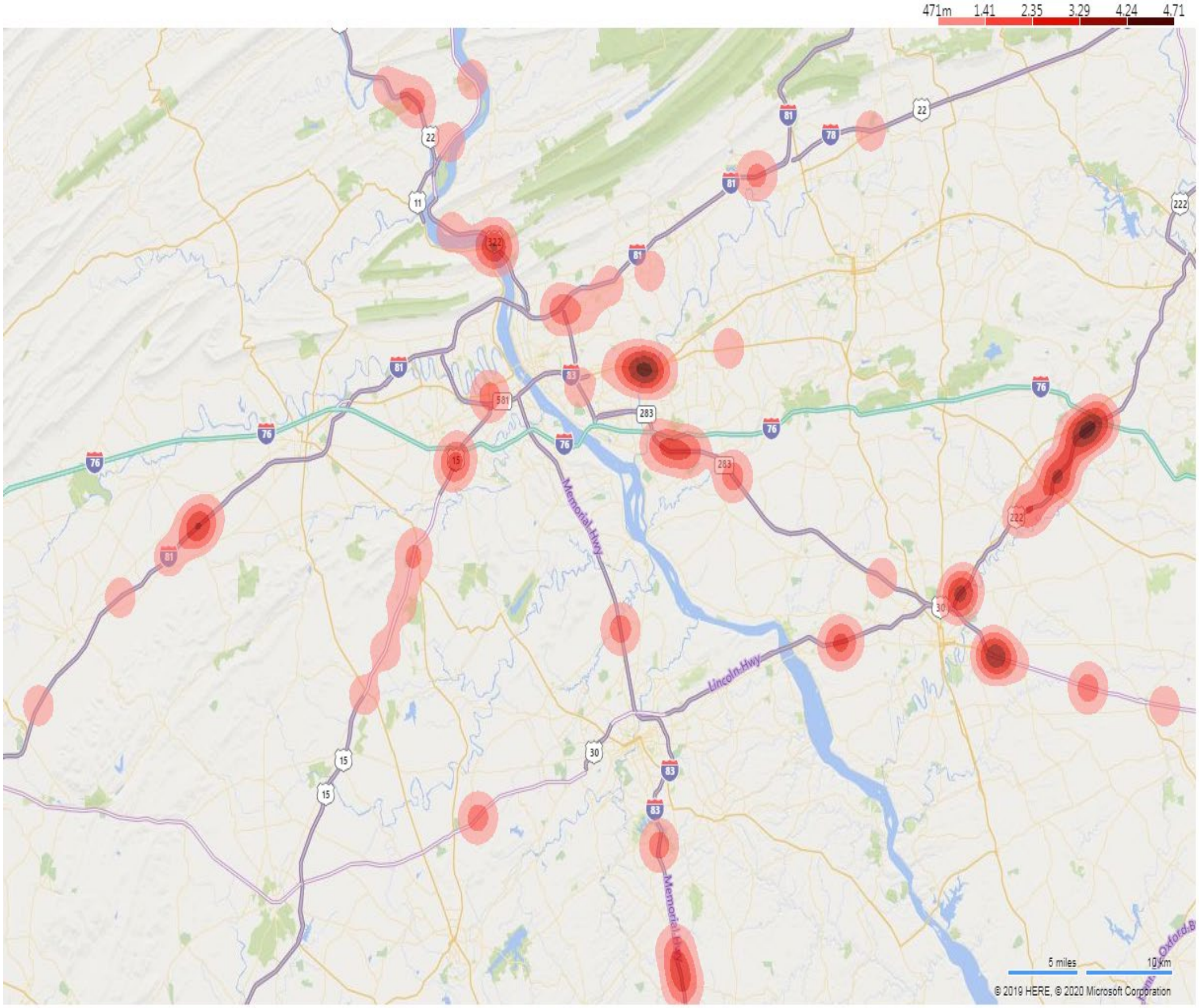
District 5



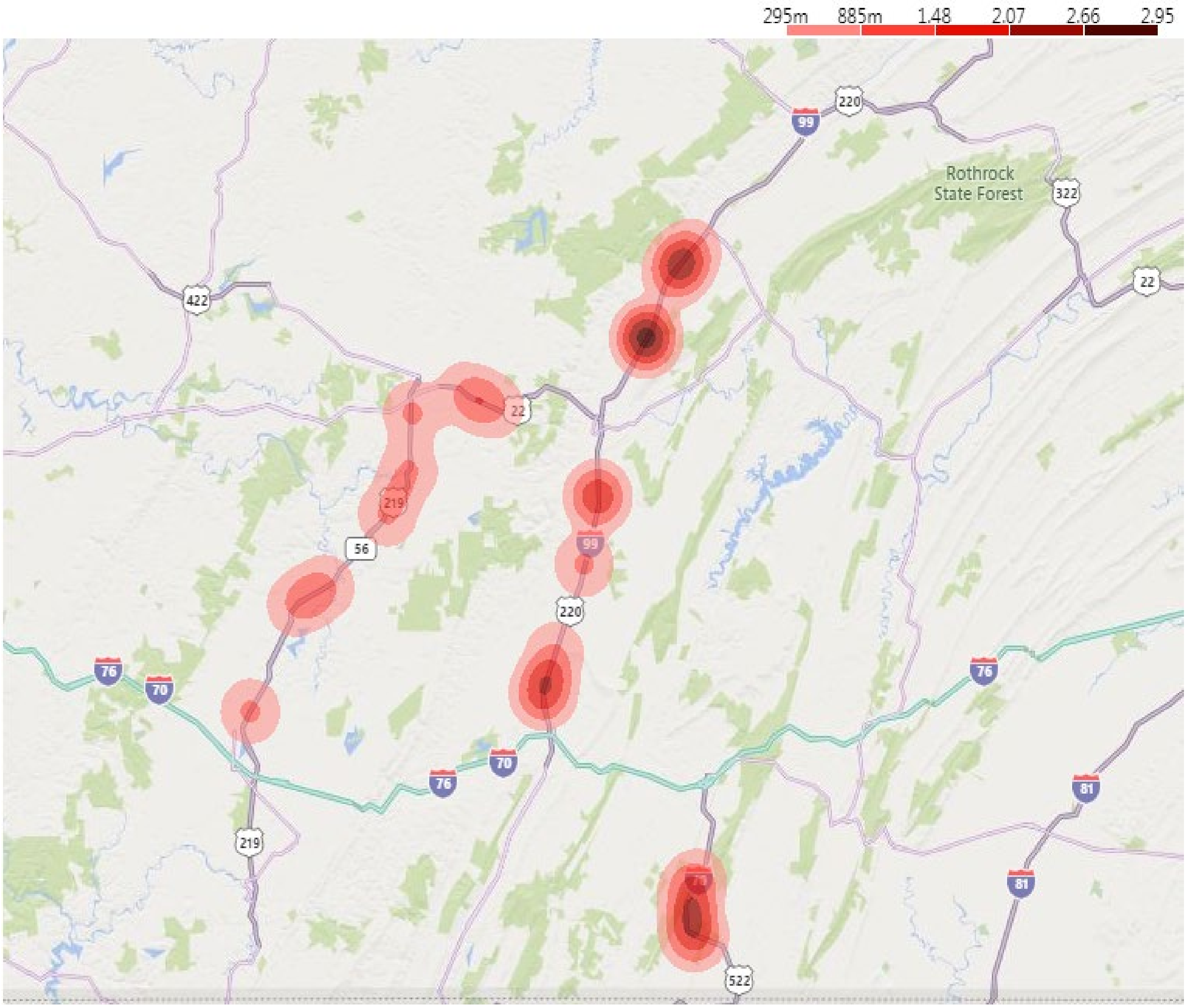
District 6


609m
1.83
3.05
4.27
5.49
6.09
Pottstown Expy
Exton Byp
Kennett Oxford Byp
Delaware Expy

District 8


471m 1.41 2.35 3.29 4.24 4.71
Memorial Hwy
Lincoln Hwy
5 miles
10 km
© 2019 HERE, © 2020 Microsoft Corporation

District 9


295m
885m
1.48
2.07
2.66
2.95
Rothrock State Forest
220
99
322
22
422
22
219
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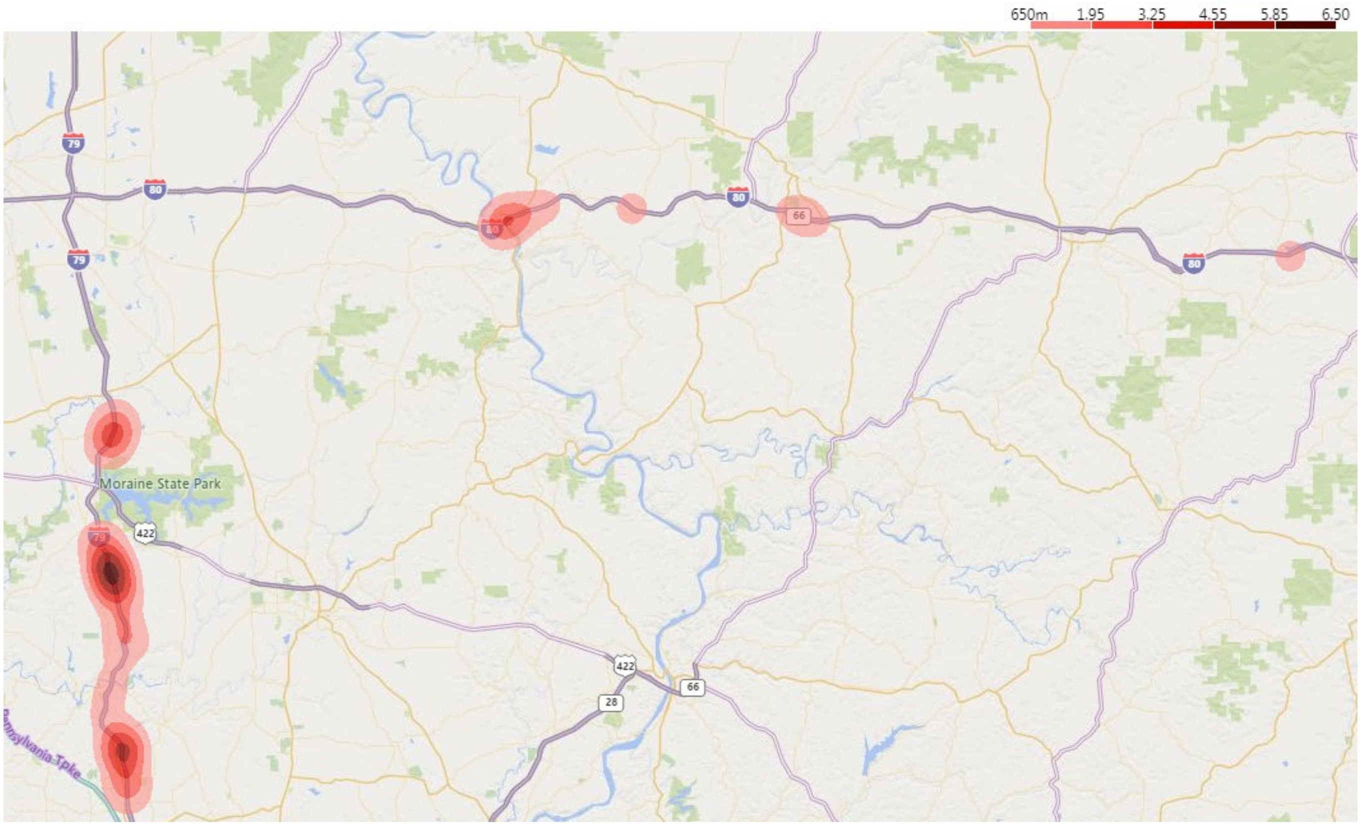
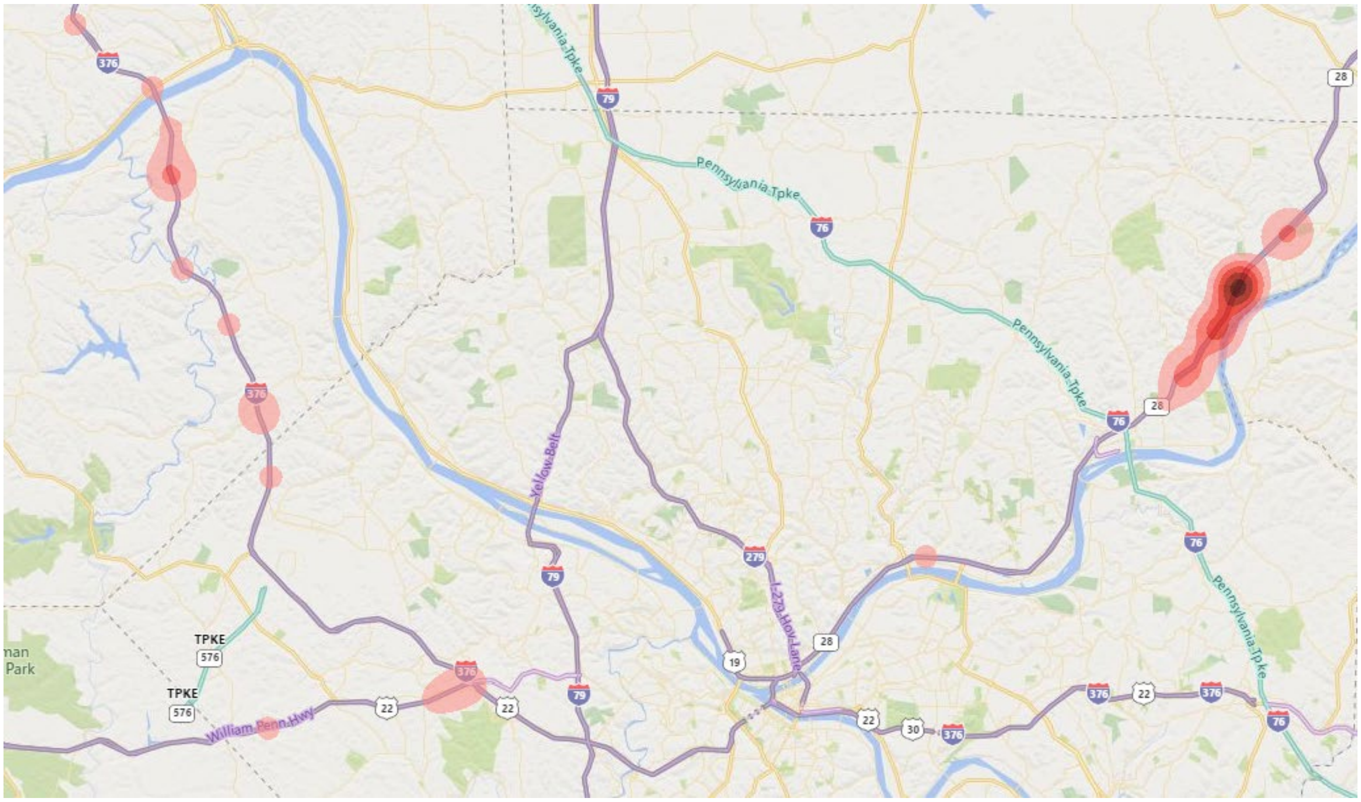
81
219
81
522

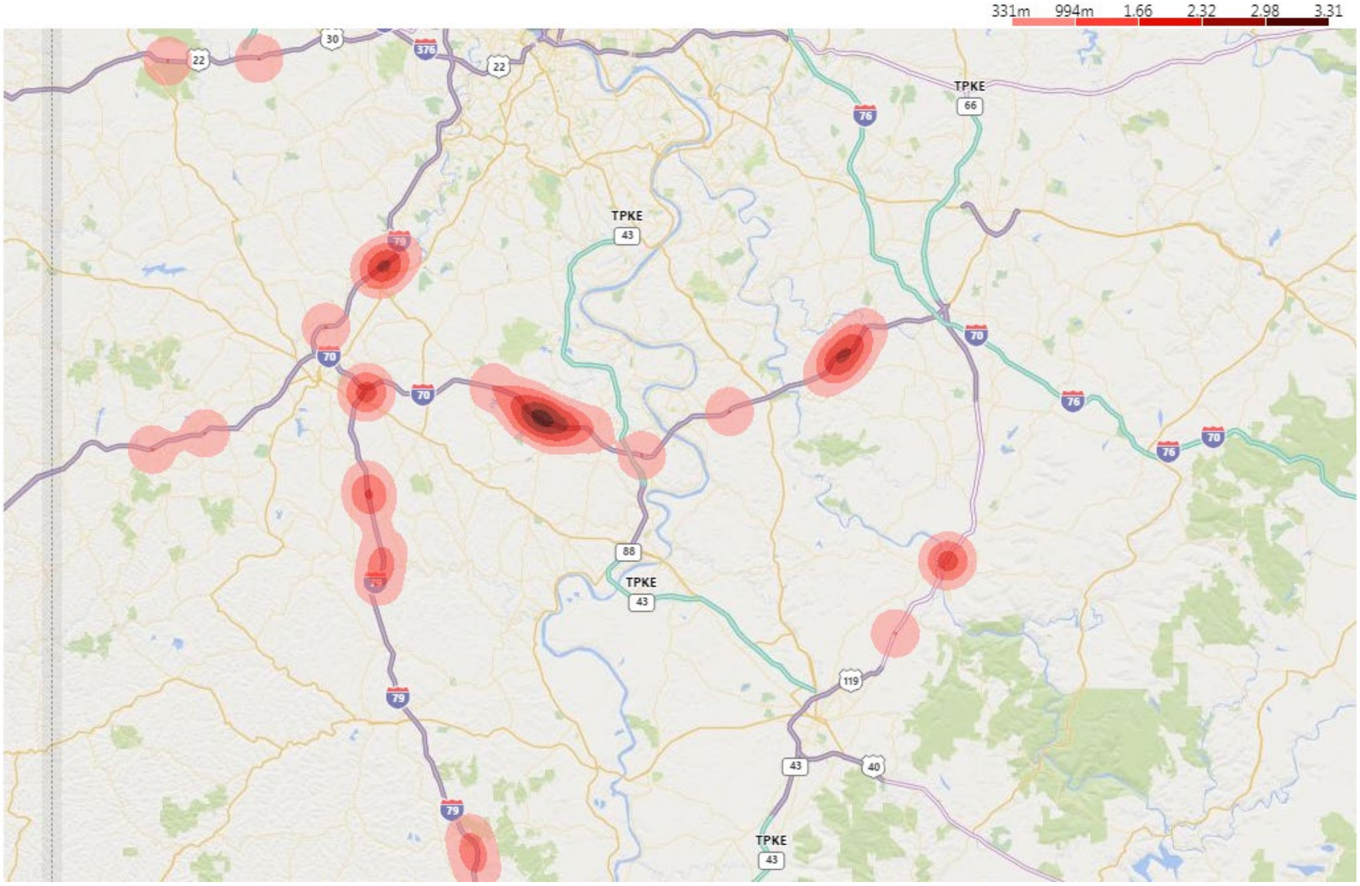
District 10


650m 1.95 3.25 4.55 5.85 6.50
Moraine State Park
Pennsylvania Tpke
79
80
66
422
28

District 11


Pennsylvania Tpke
Yellow Belt
I-279 Hov Lane
William Penn Hwy
TPKE
576
376
79
76
279
28
22
19
30
man
Park

District 12


331m
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2.32
2.98
3.31
TPKE
66
76
TPKE
43
79
70
70
70
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70
88
TPKE
43
79
119
43
40
79
TPKE
43
22
30
376
22