

EXHIBIT 9

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**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF VIRGINIA
Norfolk Division**

LEE SCHMIDT and CRYSTAL ARRINGTON,

Plaintiffs,

v.

**CITY OF NORFOLK and MARK TALBOT, in
his official capacity as the Norfolk Chief of Police,**

Defendants.

Civil Action No. 2:24-cv-621

DECLARATION OF VALENTIN ESTEVEZ, PH.D.

I, Valentin Estevez, declare as follows:

1. I am over the age of 18 and am competent to testify about the matters in this Declaration based on my personal knowledge.

2. I am a Vice President at Charles River Associates (CRA), a leading global consulting firm that offers economic, statistical, financial, and strategic expertise to law firms, corporations, and governments. Counsel for the City of Norfolk asked me to review the opinions and calculations in the expert reports submitted by the Plaintiffs' experts, Dr. Chad Higdon-Topaz and Dr. Andrew Wheeler, and to assess whether their opinions are consistent with and supported by the data from Flock cameras produced in this matter and publicly available data related to the City of Norfolk's roads, traffic, and establishments. I make this declaration based on personal knowledge.

3. Attached as **Exhibit A** is a true and correct copy of my expert report submitted in this case. The exhibits attached to my Report are true and correct copies.

4. I authored the attached Expert Report and understood at the time I signed it that it was being prepared for use in this litigation. I understood at the time I made my Report that my statements were being made under oath and under penalty of perjury.

5. If called as a witness, then I could and would testify competently to the opinions stated herein.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge.

Executed on this 12 day of September, 2025, at Middleburg, Virginia.

A handwritten signature in black ink, appearing to read 'Valentin Estevez', written over a horizontal line.

Valentin Estevez

EXHIBIT A

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF VIRGINIA
NORFOLK DIVISION

LEE SCHMIDT et al,

Plaintiffs,

vs.

Civil Case No. 2:24-cv-621

CITY OF NORFOLK et al,

Defendants.

EXPERT REPORT OF
VALENTIN ESTEVEZ, PH.D.

**CONTAINS AND REFERENCES CONFIDENTIAL MATERIAL
SUBJECT TO PROTECTIVE ORDER**

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I. Introduction

a. Background and Qualifications

1. I am a Vice President at Charles River Associates (CRA), a leading global consulting firm that offers economic, statistical, financial, and strategic expertise to law firms, corporations, and governments. I am a member of the American Economic Association and the American Statistical Association. I hold a bachelor's degree in economics from Universidad Autónoma de Chiriquí (Panamá) and M.A. and Ph.D. degrees in economics from the University of Chicago. From 2000 to 2005, I taught undergraduate courses in microeconomics, macroeconomics, and econometrics at the University of Chicago. Econometrics is the application of statistical methods to economic data. I am also a lecturer in the economics department at Texas A&M University in College Station, Texas, where I teach a course on applying economic principles to studying of current world events.
2. My consulting experience involves the application of economics, econometrics, and statistics to data analysis. I have applied statistical methods to a wide variety of types of large data sets. For example, I have been engaged in matters involving discrimination allegations in employment practices, such as hiring, compensation, promotions, performance reviews, and terminations. I have also been engaged to examine large and complex timekeeping, payroll, and badge-swipe databases to determine whether those data record the entirety of a worker's day in matters involving allegations of violations of wage and hour laws related to time worked, meal periods and rest breaks, unpaid minimum wages, unpaid on-call time, unpaid travel time, unreimbursed expenses, regular rate of pay miscalculation, and exempt status misclassification. I have also been engaged to evaluate the performance of artificial intelligence (AI) tools in human resource management applications from a labor economics and statistical perspective.
3. One important aspect of the statistical analyses I have performed in my career is an assessment of the information available in a set of data to determine whether and to what extent the data could enable an analyst to draw inferences or conclusions from the data. This is a fundamental step when preparing statistical or econometric analyses.
4. Appendix A contains my resume. Appendix B lists the cases in which I have testified in court or given deposition testimony. My billing rate in this matter is \$750 per hour. The rates of CRA's professional staff working on this matter range from \$320 to \$750, depending on their qualifications and experience. Neither CRA's nor my compensation are contingent on the outcome of this litigation or my conclusions.

b. Assignment

5. Counsel for the City of Norfolk asked me to review the opinions and calculations in the expert reports submitted by the Plaintiffs' experts, Dr. Chad Higdon-Topaz¹ and Dr. Andrew Wheeler,² and to assess whether their opinions are consistent with and supported by the data from Flock cameras produced in this matter and publicly available data related to the City of Norfolk's roads, traffic, and establishments.
6. Appendix C contains the tables and exhibits referenced in this report. Appendix D lists the documents and data I relied upon to form my opinions in this report.

II. Summary of Conclusions

7. After reviewing Dr. Higdon-Topaz and Dr. Wheeler's expert reports as well as Flock camera data for Plaintiffs' vehicles for the period February 15, 2025 through July 3, 2025, Flock camera data for other license plates for the period February 15, 2025 to June 9, 2025, and other information, I reached the following conclusions:
 - a. Dr. Wheeler has not provided a methodology for inferring an individual's location from Flock camera data or demonstrated that Flock cameras enable law enforcement to track the whole of an individuals' movements in Norfolk. Dr. Wheeler based his opinions on examining a subset of Flock camera records on selected days and relying on information supplied by Plaintiffs about certain locations that they frequent.
 - b. Dr. Higdon-Topaz also has not demonstrated that Flock camera data enable Defendants to track the whole of individuals' movements in Norfolk. Instead of relying on Flock camera data, Dr. Higdon-Topaz analyzed simulated hypothetical trip data with known origins, routes, and destinations. Flock camera data show that Dr. Higdon-Topaz's simulated routes and the assumptions that he uses to analyze them do not accurately reflect the actual performance of the Flock cameras or the actual movements of individuals in Norfolk, which makes his entire analysis unreliable. Further, Dr. Higdon-Topaz's own analysis of "slack time" shows that Flock cameras cannot track the whole of individuals' movements in Norfolk.
 - c. Dr. Higdon-Topaz and Dr. Wheeler cannot demonstrate that Flock cameras enable tracking of the whole of individuals' movements in Norfolk because Flock cameras collect only limited information about vehicles. The data do not include any information about a vehicle's driver, origin or destination or travel by pedestrians or

¹ Expert Witness Report of Chad Higdon-Topaz, Ph.D., July 8, 2025.

² Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, July 7, 2025.

bikers. The data also do not include any information about a vehicle's location between captures by the cameras. Without this information, the Flock camera data cannot be used to "track the *whole of*"³ Plaintiffs' movements and thus cannot reveal their "*intimate details*."⁴

- d. Flock cameras are typically located in "clusters" of two or more cameras in high-traffic areas close to commercial or office areas or near highway entry points. These cameras are designed to identify the license plate and certain other identifiers of vehicles driving on public roads. The Flock cameras operated by the NPD cover just 0.1131% of all city roads and 0.0068% of the City of Norfolk.
- e. Flock cameras capture Plaintiffs' license plates infrequently, and these infrequent captures are far apart in time. Plaintiffs' license plates were not captured at all on many days and on most days were captured three times or less within the City of Norfolk.
- f. Flock camera data for all vehicles captured in Norfolk shows that vehicles are infrequently captured by Flock cameras. The average vehicle is captured less than once per day. Even the top 5 percent of vehicles captured most often are not captured on more than half of the days in the data I analyzed and are captured once or less on 65% of days. This shows that the Flock camera data are not collecting information on "the whole of" individuals' movements and thus cannot be used to "track" those movements.

III. Overview of Flock Cameras in Norfolk, Virginia

- 8. Founded in 2017, Flock Safety (Flock) develops and markets technology solutions to private and public entities, such as cities, businesses, law enforcement agencies, educational institutions, and neighborhoods.⁵ One of Flock's technology solutions is its Standard License Plate Reader (LPR or Flock camera), a stationary motion-activated camera without zoom, tilt, pan, audio, or video capabilities. The Flock camera is designed to take photos at a single point in time as a vehicle passes by the fixed camera location. The Flock camera uses computerized algorithms to attempt to identify a passing vehicle's license plate and other identifiers such as body style, make, and color.⁶

³ Complaint for Declaratory and Injunctive Relief, ¶ 9.

⁴ Defendants' Memorandum in Support of their Motion to Dismiss the Complaint, pg. 8.

⁵ <https://www.flocksafety.com/media-kit>.

⁶ <https://www.flocksafety.com/devices/lpr-cameras>.

Flock cameras cannot tell the NPD who is driving a vehicle and they “do not collect personal information, facial recognition, or anything tied to individuals.”⁷

9. Flock only shows customers information regarding vehicles. However, data from the American Community Survey (ACS),⁸ a nationally representative survey conducted by the U.S. Census Bureau, shows that in 2023, 5.2% of 16 and older workers in Norfolk do not have access to a car.⁹ Flock cameras likely would not capture any of these individuals’ movements.
10. The ACS data also shows that 29.5% of workers in Norfolk do not drive a car or motorcycle when commuting to work. Carpooling (12.8%), walking (4.1%), using public transportation (2.7%), biking (1%), or working from home (8.9%) are the most common alternatives.¹⁰ Trips for citizens using transportation modes other than driving their own vehicles within Norfolk could not be captured by Flock cameras.
11. In 2022, the City of Norfolk, Virginia, contracted with Flock to install 172 LPRs in selected locations throughout the city.¹¹ In May 2023, the City of Norfolk announced that these 172 cameras were “up and running.”¹² Since then, the City of Norfolk has added three more Flock cameras, for a total of 175 LPRs.¹³ In deciding where to place the Flock cameras, the City of Norfolk considered data on violent crimes, calls for service, and ingress and egress points for the City.¹⁴
12. The City of Norfolk also has access to Flock camera data from certain other law enforcement agencies and select non-law enforcement Flock customers who have elected to share information gathered by their Flock cameras with the Norfolk Police Department (NPD).¹⁵

⁷ *Id.*, FAQs.

⁸ <https://www.census.gov/programs-surveys/acs>. The Census long-form became the ACS after the 2000 Census.

⁹ <https://data.census.gov/table/ACSDT1Y2023.B08541?q=mode+of+transportation+norfolk+va>.

¹⁰ <https://www.norfolk.gov/5092/Data-How-are-we-doing>.

¹¹ <https://www.norfolk.gov/5967/Cameras>.

¹² <https://www.wtkr.com/news/hampton-roads-law-enforcement-seeing-results-from-flock-safety-cameras>.

¹³ Four additional cameras were purchased since May of 2023, one of which is not operational.

¹⁴ Thomas Deposition Rough Draft, p. 41-42, 74-75, 87.

¹⁵ For example, Norfolk State University’s Police Department shares its data with the Norfolk PD.

13. Table 1 lists the data fields I understand Flock makes available to its customers when the Flock system is queried.¹⁶ Each capture has a unique record identifier that is associated with the specific image taken of a vehicle as it passed by a Flock camera. A Flock data record identifies the camera capturing the image and the camera's location, the time of the capture, and optical character recognition (OCR) values for the vehicle's license plate. OCR is a technique for converting images into machine-readable text.¹⁷ Type, make, and other characteristics are captured through machine learning. As Table 1 shows, the Flock data available to customers does not contain information about who is driving a vehicle, who owns the vehicle, the vehicle's origin, or the vehicle's final destination.¹⁸ Under current law and NPD Policy, NPD can retain data from Flock cameras for only 21 days, unless the data is "part of an ongoing investigation, prosecution, or civil action."¹⁹

IV. Data and Methodology

14. In this matter, Flock and the City of Norfolk each produced the following information regarding vehicles captured by Flock cameras.

a. Flock Raw Data Production

- i. Flock camera captures inside the City of Norfolk from February 15, 2025, to June 9, 2025.
- ii. Flock camera captures by Flock cameras operated by law enforcement agencies in eight Hampton Roads municipalities whose data had been shared with the City of Norfolk (Chesapeake, Suffolk, Hampton, Newport News, Isle of Wight, Franklin, Virginia Beach, and Portsmouth) from April 9 to June 9.

b. City of Norfolk Production

- i. Flock camera captures from February 15, 2025 to July 3, 2025 compiled by querying Plaintiffs' license plates.

15. In the course of my review, I identified that Flock camera captures inside the City of Norfolk for May 3, 2025 are missing from the City of Norfolk Production and Flock Raw data. The calculations in this report take this omission into account. To calculate Flock

¹⁶ The data fields, all of which have to do with the external characteristics of a vehicle, are derived from photographs. When a user queries the Flock database, all these data fields are associated with an image of the vehicle, which is also made available to the user.

¹⁷ <https://www.forbes.com/sites/technology/article/what-is-ocr-technology/>.

¹⁸ <https://www.flocksafety.com/faq>.

¹⁹ NORF021152, Norfolk Police Department Memo 25-097; General order OPR-493.

camera captures for [REDACTED] vehicles, I consolidated the City of Norfolk productions and the Flock Raw Data and de-duplicated entries.

16. I observed in the data that the same vehicle can be captured multiple times by a single camera within a short period of time. In my review of the way Flock cameras work and the cycle of traffic lights, I consider these circumstances to be a single “capture” because the vehicle in question is likely sitting at an intersection. I understand that traffic lights in Norfolk do not cycle in fixed periods but are “activated signals” that operate when a vehicle triggers a sensor.

17. I also examined the Flock camera data for [REDACTED] and found that their closest captures by a single camera are between 0.2 and 61 seconds apart, and the remaining consecutive captures by a single camera are at least 6.5 minutes apart. Given this variability, I selected one minute as a reasonable period of time that a vehicle would sit at a traffic light and be captured by a single Flock camera multiple times.

a. Figure 1 below shows an example of five camera captures for [REDACTED] vehicle within seconds of each other by the same Norfolk PD camera. These records appear to reflect a single instance of [REDACTED] vehicle at the same intersection at the same time. Thus, treating each of these data points as the identification of a vehicle in a different location or a different time would overstate the frequency with which Flock camera data captures a vehicle’s location.

Plate	Camera Name	Time Stamp
[REDACTED]	032 SB TIDEWATER AT LAFAYETTE	[REDACTED] 06:38:10 PM
[REDACTED]	032 SB TIDEWATER AT LAFAYETTE	[REDACTED] 06:38:39 PM
[REDACTED]	032 SB TIDEWATER AT LAFAYETTE	[REDACTED] 06:38:47 PM
[REDACTED]	032 SB TIDEWATER AT LAFAYETTE	[REDACTED] 06:39:03 PM
[REDACTED]	032 SB TIDEWATER AT LAFAYETTE	[REDACTED] 06:39:11 PM

Figure 1. 5 Camera Captures Within Seconds for [REDACTED]

18. In light of these observations, throughout this report, my calculations reflect data as follows:

- a. May 3, 2025 is omitted from the calculations.
- b. “Plaintiff’s data” is the deduplicated, consolidated data regarding captures of Plaintiffs’ vehicles provided by the City of Norfolk and Flock where captures by a single camera within one minute of one another are considered a single capture.

- c. Data referring to all license plates in Norfolk is the consolidated Norfolk and non-Norfolk data from the Raw Flock Production where captures of the same vehicle by a single camera within one minute of one another are considered a single capture.

V. Flock Camera Placement and Coverage

- 19. Exhibit 1 shows the NPD-operated camera locations within the City of Norfolk. A single Flock camera covers two lanes in a single direction and cannot pan, tilt, or zoom. This Exhibit shows that most Flock cameras are located in clusters of multiple cameras. These clusters generally consist of two cameras across the street from one another capturing traffic in opposite directions or three or more cameras located at the same intersection. Four cameras are required to capture vehicles traveling in all four directions at an intersection of two two-lane roads.
- 20. For example, Exhibit 2 shows four Flock cameras at the intersection of Granby Street and Little Creek Road, and another three are at the nearby intersection of Granby Street and E Admiral Taussig Boulevard, close to an Interstate Highway 564 entrance. Similarly, Exhibit 3 shows two Flock cameras positioned on Strand Street across from one another to capture vehicles traveling along this stretch of road in both directions.
- 21. The placement of cameras in clusters means that the number of locations in the City of Norfolk with Flock cameras operated by NPD is less than the total number of cameras. According to my analysis, 86% of Flock cameras in the City of Norfolk *operated by* NPD are placed within 500 feet of at least one other camera and 41.2% of cameras are located within 500 feet of four or more cameras. Defining a cluster of Flock cameras as a set of cameras located within 500 feet of each other, there are 75 clusters of Flock cameras operated by the Norfolk Police Department within the City of Norfolk. The average distance between camera clusters is 3.7 miles. Exhibit 4 shows the location of camera clusters within the City of Norfolk.
- 22. Similarly, 83% of all Flock cameras in the City of Norfolk that NPD *can access* are within 500 feet of at least one other camera and 37.6% of cameras are within 500 feet of four or more cameras. Applying the same definition of a camera cluster to all Flock cameras in the City of Norfolk that NPD can access, there are 97 Flock camera clusters in the City. Table 2 lists the cameras within each cluster.
- 23. My review of the camera placement indicates that Flock cameras are typically located in high-traffic areas close to commercial or office areas or near highway entry points.

Exhibit 5 combines information on traffic volume in the City of Norfolk with camera cluster locations in the City and shows that camera clusters are generally in intersections with high traffic volume. Table 3 lists total captures by camera grouped by camera cluster, showing that the ten clusters with the most captures (32% of all captures) are in areas that average 34,000 daily vehicle trips.²⁰ I also found that more than 99% of the camera captures are in clusters where at least one of the cameras covers an area zoned as non-residential. Exhibits 6a to 6c show Flock camera clusters with high traffic volume that are located at or near non-residential areas.

24. By contrast, there are fewer Flock cameras in residential areas in the City of Norfolk. Just 16 of 175 cameras operated by NPD are in areas exclusively zoned as residential. Even in these areas, Flock cameras are positioned to only capture information regarding vehicles traveling on public roads.
25. The Flock cameras operated by NPD have an optimal capture range between 40 and 70 feet from the camera location, meaning the optimal capture zone is 30 feet.²¹ Exhibit 7 provides an example of the potential range of the Flock cameras at a particular camera cluster in the City of Norfolk, showing that Flock cameras at their optimal range reach a small fraction of the area where they are located.
26. According to public records,²² there are approximately 9,276,960 feet of road in the City of Norfolk. Assuming that every Flock camera the NPD has access to within the City of Norfolk captures the optimal range roadway, or 30 feet, a conservative estimate is that the cameras cover 0.1384% of all city roads.²³ Likewise, there are 1,839,974,400 square feet²⁴ in the City of Norfolk. Assuming that every Flock camera the NPD has access to within the City of Norfolk captures data at the optimal range of 30 feet, a conservative estimate is that Flock cameras cover 0.0083% of the City area.²⁵ Restricting the

²⁰ Average annual daily traffic is an estimate of the mean annual traffic volume at a particular location along a roadway (<https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/traffic-operations/traffic-counts/>).

²¹ Uncertified Rough Draft Transcript of the Deposition of Davis Lukens (7/29/2025), pg. 45-46.

²² 2024 Annual Comprehensive Financial Report <https://www.norfolk.gov/DocumentCenter/View/97172/2024-Annual-Comprehensive-Financial-Report-PDF> and Norfolk Open Data Portal https://norfolkgisdata-orf.opendata.arcgis.com/datasets/2559632f99f04b438f283e9e255e63fa_11/explore?location=36.894692%2C-76.260700%2C12.68.

²³ 214 cameras times 30 feet times 24 feet (two lanes of coverage) = 154,080. 9,276,960 total feet in roadway length times 12 feet in width = 111,323,520. Finally, $100 * 154,080 / 111,323,520 = 0.1384\%$.

²⁴ 66 sq. miles * 27,878,400 sq. feet/mile = 1,839,974,400 sq. feet, per <https://www.norfolk.gov/430/Facts-About-Norfolk>.

²⁵ 214 cameras times 30 feet times 24 feet (two lanes of coverage) = 154,080. $100 * 154,080 / 1,839,974,400 = 0.0083\%$.

calculation to NPD-operated cameras, these cameras cover 0.1131%²⁶ of all city roads and 0.0068%²⁷ of the City area.

27. These estimates are conservative because the calculations assume a standard road width of one lane each way and unobstructed capture ranges. Placement angles and characteristics of the placement area can reduce the effective capture range of the cameras.

28. For comparison, I reviewed Flock camera coverage in the City of Richmond. As of July 2024, there were approximately 100 Flock cameras in the City of Richmond.²⁸ The figure below compares the percentage of land and road coverage by Flock cameras in both Norfolk and Richmond.

City	Total Number of Flock Cameras	Total Land Area (Sq. Ft)	Total Lane Feet	Optimal Field of Vision Land Area Coverage Percentage of 30 Feet	Optimal Field of Vision Road Area Coverage Percentage of 30 Feet
Norfolk	214	1,839,974,400	9,276,960	0.00837%	0.13841%
Norfolk (NPD only)	175	1,839,974,400	9,276,960	0.00685%	0.11318%
Richmond	100	1,742,400,000	9,688,800	0.00413%	0.06193%

Figure 2. Flock Camera Land and Road Coverage

VI. Flock Camera Data Does Not Enable Tracking of the Whole of an Individual's Movements.

29. Plaintiffs allege that the City of Norfolk collects or has access to Flock camera data that would make it "easy"²⁹ to track the "whole of their physical movements."³⁰ Dr. Wheeler asserts that Flock cameras "make[] it possible to draw deductions and inferences"³¹ about Plaintiffs' lives. Dr. Higdon-Topaz opines that the Flock camera data "appears capable of revealing patterns in citizens' regular movements throughout the city."³² My analysis of the Flock camera data shows that these assertions are not correct.

²⁶ 175 cameras times 30 feet times 24 feet (two lanes of coverage) = 126,000. 9,276,960 total feet in roadway length times 12 feet in width = 111,323,520. Finally, $100 * 126,000 / 111,323,520 = 0.1131\%$.

²⁷ 175 cameras times 30 feet times 24 feet (two lanes of coverage) = 126,000. $100 * 126,000 / 1,839,974,400 = 0.0068\%$.

²⁸ *United States v Martin*, 753 F. Supp. 3d 454, 458 n.4 (E.D. Va. 2024). I am aware that, as of April 2023, there were 66 cameras within the City of Richmond. *Id.* at 454. Regardless of which time period is used, the relevant fact remains that Flock cameras in both Norfolk and Richmond cover a tiny fraction of the road mileage and a negligible portion of the total area.

²⁹ Complaint for Declaratory and Injunctive Relief, ¶ 4.

³⁰ *Id.*, ¶ 99.

³¹ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 6.

³² Expert Witness Report of Chad Higdon-Topaz, Ph.D., pg. 5.

30. As discussed above, the Flock data available to the City of Norfolk consists solely of information about a vehicle's characteristics. The Flock data does not contain information about the driver of a vehicle, the origin, destination or length of a particular trip, or any of the stops or activities an individual undertook—including any trips an individual took via a different vehicle—between camera captures. The Flock data only provides information relating to the time and location at which a given vehicle passed by a Flock camera. That information is further limited by the City of Norfolk's requirement that Flock data be retained for only 21 days in the ordinary course.³³ The sparsity of this data makes it unsuitable to draw inferences about the whole of someone's movements.
31. Plaintiffs' expert reports prove the point that Flock camera data does not enable tracking of the whole of an individual's movement. Neither Dr. Wheeler nor Dr. Higdon-Topaz relies solely on Flock camera data in attempting to prove that Flock cameras permit the City of Norfolk to draw inferences about an individual's movements. Indeed, neither Dr. Wheeler nor Dr. Higdon-Topaz undertake any systematic review of the Flock data made available in this litigation at all.
32. Dr. Wheeler's opinions instead are based on reviewing a limited selection of capture records to reveal a handful of purported "inferences" he supposedly can draw relating to Plaintiffs' movements. Many of those inferences depend heavily on information from *Plaintiffs* regarding their movements in Norfolk—information that cannot be gleaned from the Flock data alone.
33. For his part, Dr. Higdon-Topaz ignores the actual Flock data entirely for purposes of his analysis,³⁴ choosing instead to rely on "simulated trips" to assess the extent to which the Flock cameras operated by the NPD could be used to "reconstruct drivers' routes" in Norfolk.³⁵ This analysis, however, is possible only because the model on which Dr. Higdon-Topaz relies provides him with key pieces of information about these simulated routes—including a driver's origin and destination—that are unavailable in Flock camera data. Dr. Higdon-Topaz does not claim, and does not attempt to show, that by relying solely on Flock camera data his methodology would permit the City of Norfolk to reconstruct a particular driver's route on a particular date. In fact, Dr. Higdon-Topaz only provides [REDACTED] illustrative routes [REDACTED] to demonstrate the "degree of

³³ NORF021152

³⁴ There is one exception: an illustrative example of the concept of slack time based on three captures of a license plate associated with a vehicle primarily driven by [REDACTED].

³⁵ Expert Witness Report of Chad Higdon-Topaz, Ph.D., pg. 3.

surveillance possible” but does not use any actual data to vet his analysis. These examples show that Dr. Higdon-Topaz’s methodology does not identify a route’s origin or destination, as I discuss in detail below.

a. Flock Cameras Capture Images of Vehicles Only Sporadically

34. Given the 21-day retention period for Flock camera data, for each Plaintiff, I calculated the average number of captures of Plaintiffs’ vehicles across all 21-day periods starting with the period February 15 to March 8, 2025 and ending with the 21-day period June 13 to July 3, 2025.³⁶ NPD-operated cameras account for 99.1% of captures of Plaintiffs’ vehicles within the City of Norfolk. The following calculations regarding captures of Plaintiffs’ vehicles from NPD-operated cameras are the same to one decimal as the calculations that include captures for other cameras in the City of Norfolk the NPD can access.

35. [REDACTED] as the license plate of the [REDACTED] primarily operates.³⁷ Table 4 shows that, on average, [REDACTED] primary license plate was not captured by any Flock camera in the City of Norfolk on 28.5% of days in a 21-day retention period and only once on 8.8% of days in a 21-day retention period. Table 4 also shows that [REDACTED] license plate was captured an average of 3.2 times per day in a 21-day retention period.

36. [REDACTED] as the license plate of the [REDACTED] primarily operates.³⁸ Table 4 shows that, on average, [REDACTED] primary license plate was not captured by any Flock camera in the City of Norfolk on 65.3% of days in a 21-day retention period and only once on 5.1% of days in a 21-day retention period. Table 4 also shows that [REDACTED] license plate was captured an average of 2.1 times per day in a 21-day retention period.

37. Even ignoring the 21-day periods, the camera captures are sporadic, as shown in Table 5.

38. Neither Dr. Wheeler nor Dr. Higdon-Topaz contend that an individual’s movements can be ascertained using zero or one captures per day. Therefore, even Plaintiffs’ experts

³⁶These 21-day periods were generated using Plaintiff’s data, defined as consolidated City of Norfolk data and Flock Raw Data Production data.

³⁷

³⁸

cannot dispute that [REDACTED] movements in the City of Norfolk cannot be ascertained for over 37.2% of the days for which data is available, and [REDACTED] movements in the City of Norfolk cannot be ascertained for over 70.5% of the days for which data is available.

39. The Flock system data for NPD-operated cameras produced in this matter includes 8,154,653 unique license plates. Table 6 shows that 57.6% of these license plates were captured only once across the entire four-month data set, 70.6% were captured twice or less, and 76.3% were captured three times or less.³⁹ This shows that a large percentage of vehicles captured by Flock cameras in and around Norfolk are not captured with sufficient frequency to track their movements.
40. For license plates of vehicles other than Plaintiffs', I likewise examined 21-day periods of NPD-operated Flock raw data captures,⁴⁰ starting with the period February 15 to March 7, 2025 and ending with the 21-day period May 20 to June 9, 2025. On average, license plates captured by NPD-operated cameras during this timeframe were captured only 0.5 times per day. Table 7 shows that 84.3% of all vehicle captures were the only capture of that vehicle on that day and 91.6% of vehicle captures were one of two or fewer captures on that day. Considering data for the same period for all cameras within the City of Norfolk the NPD has access to increases the number of unique license plates to 8,372,846, but the capture statistics are the same to one decimal point.
41. [REDACTED] license plates were in the top 5% of license plates with captures in the Flock data that I reviewed. Focusing on this group of license plates captured on the highest number of days, on average, such license plates were not captured on 55.5% of the days in the data set and once or less on 65% of the days in the period. That is, on almost two-thirds of days, even the vehicles captured most often by cameras operated by NPD are not even captured twice. As noted above, not even Plaintiffs' experts believe a single capture a day permits inferences regarding an individual's movements.

b. Flock Camera Data Do Not Enable Tracking Plaintiffs' Locations

42. A particular capture of a vehicle by a Flock camera does not provide information about where the vehicle was before or after the capture or what the person in the vehicle was doing in that area. Indeed, because Flock cameras are often located in commercial areas with substantial traffic, there are often a significant number of potential

³⁹ We defined license plates as OCR license plate values in the Flock camera data with four or more characters.

⁴⁰ Flock Raw Data for the period February 15, 2025 to June 9, 2025.

destinations within the vicinity of a given Flock camera. That fact, paired with the significant gaps in time and distance between captures of Plaintiffs' vehicles, make it impossible to infer the whole of an individual's day from Flock camera data.

43. On average, when Plaintiffs' vehicles were captured more than once on the same day, the captures were 3.5 miles⁴¹ apart and 47.5 minutes apart for [REDACTED]. [REDACTED] captures were 2.5 miles apart and 49.5 minutes apart. Notably, even when Plaintiffs' vehicles were captured consecutively by the same two cameras at different times, the time between the captures could vary significantly.
44. Exhibits 8a to 8d demonstrate the significant intervals between captures of Plaintiffs' vehicles in the Flock data. In these exhibits, I have depicted the portions of time between 7:00am and 9:00pm for the 21-day windows in [REDACTED] data with the most and least time in which two or more Flock camera captures occurred within 30 minutes of each other.⁴² Areas in pink indicate a time period in which two or more Flock camera captures have occurred within thirty minutes of one another. Areas in green indicate that no such captures have occurred. Black lines indicate the captures that have occurred on a particular day.
45. As Exhibits 8a to 8d make clear, the overwhelming majority of the time between 7:00am and 9:00pm consisted of time with no Flock camera captures of Plaintiffs' vehicles within 30 minutes of another capture. Indeed, Table 8 shows that for [REDACTED], only 1.1% of this time period involved such sequential captures. For [REDACTED], the same figure is only 0.8%.
46. Data regarding all vehicles in the data set shows a similar pattern. In the period covered by the Flock camera data, less than 0.5% of the time between 7:00am and 9:00pm across all 21-day periods in the available data was between captures less than 30 minutes apart. Likewise, consecutive captures in this data were 5.9 miles apart and 108.8 minutes apart on average. For the top 5% of license plates with captures, consecutive captures were 3.8 miles and 89.7 minutes apart on average. The farther apart two Flock camera captures are—whether measured by time or distance—the larger the universe of potential locations that an individual might have visited between those two captures.

⁴¹ Driving distance.

⁴² In Dr. Higdon-Topaz's simulated route data, the duration of the longest route is 30 minutes.

47. I compared the Flock camera data with a series of locations [REDACTED]
[REDACTED] These locations include [REDACTED]
[REDACTED] The data demonstrates that
Flock camera data cannot be used to reasonably infer specific locations [REDACTED]
[REDACTED].

a. [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

b. [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

c. [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

⁴³ [REDACTED]
[REDACTED] .⁴⁴ Expert Report of Andrew P. Wheeler on Behalf of
Plaintiffs, pg. 3.

VII. Plaintiffs' Experts Have Not Shown that Flock Camera Data Enables Tracking the Whole of Individuals' Movements

a. Dr. Wheeler Overstates What Can Be Inferred about Plaintiffs from the Flock Camera Data

48. Dr. Wheeler's report states that Flock data *"about the individual plaintiffs can be used to infer their habits, personal characteristics, and routes."*⁴⁴ Dr. Wheeler does not explain why he reaches this conclusion and does not provide any detail about the frequency or accuracy with which the Flock data would permit the City of Norfolk to draw such inferences. Dr. Wheeler also does not undertake any systematic analysis of the data produced in this litigation.

49. Dr. Wheeler's report contains only five examples of what he called "reasonable inferences" that he claims to be able to draw about Plaintiffs' location in Norfolk. They consist of conclusory statements: [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] He also purports to infer the location of [REDACTED] and produces maps of Norfolk showing the location and frequency of certain captures of Plaintiffs' vehicles by Flock captures, which he contends enable the City of Norfolk to infer where Plaintiffs "travel regularly."

50. Dr. Wheeler did not explain how he selected these examples. Setting aside the errors in Dr. Wheeler's analysis of each of these examples, which I describe in more detail below, a significant flaw in Dr. Wheeler's report is his failure to explain whether these few examples are representative of the types of inferences that can be drawn solely from Plaintiffs' Flock camera data.

51. Dr. Wheeler does not provide a methodological approach for drawing "inferences" from Flock data. He does not describe the steps he took to identify a particular "route" or how he located the "patterns" he discusses in his report. He does not describe any alternative explanations he considered or why he rejected those alternatives in favor of the inferences he presents. He does not even state that he arrived at his "inferences" about Plaintiffs' locations based solely on the data produced by the City of Norfolk that

⁴⁴ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 3.

he reviewed. Instead, he appears to have relied on information from *Plaintiffs* about the locations they frequent in Norfolk to “infer” Plaintiffs’ likely destinations.

52. Dr. Wheeler makes no effort to verify whether the inferences he has drawn regarding Plaintiffs’ movements are accurate even though he should have access to information regarding Plaintiffs’ real-world movements from Plaintiffs themselves.

53. Finally, it is worth emphasizing the data that Dr. Wheeler failed to analyze in his report. There are 139 days between February 15, 2025 and July 3, 2025, the period covered by data produced by NPD. Of these days, Dr. Wheeler examined just one day when [REDACTED] [REDACTED] was captured, a few selected captures of [REDACTED] at a busy intersection, and selected captures of [REDACTED] on three other days. Dr. Wheeler analyzed one of the locations in Norfolk that [REDACTED] stated that [REDACTED] visited frequently and only [REDACTED] locations that [REDACTED] identified in [REDACTED] responses.

VIII. The Flock Camera Data Does Not Support Dr. Wheeler’s Inferences about [REDACTED] Movements in Norfolk

a. Dr. Wheeler’s Inference that [REDACTED] Is Entirely Unsupported by the Flock Data

54. Dr. Wheeler claims that a review of Flock data regarding [REDACTED] over a two-month period reveals “over 30 northbound captures and 18 southbound captures” on a portion of Granby Street⁴⁵. Dr. Wheeler claims that it is reasonable to infer from this information that [REDACTED] near 7550 Granby Street. Dr. Wheeler does not provide a methodology or approach for arriving at this conclusion and there does not appear to be any way that he could have reached this conclusion solely based on the Flock camera data. My review of the capture and establishment data shows that Dr. Wheeler did not consider other plausible explanations for captures of [REDACTED] in this area.

55. Dr. Wheeler does not provide any analysis to support his assertion that, after passing these Flock cameras, [REDACTED] paused or ended a trip, as opposed to continuing to drive to a different area in Norfolk, or even outside of the city.

⁴⁵ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 9.

56. Following Dr. Wheeler’s methodology, which assumes that a camera capture indicates the driver stopped somewhere in the vicinity of a particular location, would also lead to non-sensical conclusions. For example, Dr. Wheeler states that on [REDACTED] [REDACTED] A list of all of [REDACTED] is below. Two of the cameras Dr. Wheeler highlights in his report, which captured [REDACTED] on that date, are highlighted in blue below.

Plate	Camera Name	Time Stamp
[REDACTED]	115 SB GRANBY ST AT E TAUSSIG	[REDACTED] 10:05:55 AM
[REDACTED]	149 EB LITTLE CREEK AT GRANBY	[REDACTED] 10:07:14 AM
[REDACTED]	114 NB 460 AT WB 564 ENTRANCE RAMP	[REDACTED] 10:27:01 AM
[REDACTED]	115 SB GRANBY ST AT E TAUSSIG	[REDACTED] 05:29:38 PM
[REDACTED]	148 NB GRANBY AT LITTLE CREEK	[REDACTED] 07:41:38 PM

Figure 3. Camera Captures of [REDACTED]

57. Dr. Wheeler’s methodology, which presumes that any capture by one of these cameras suggests that an individual is shopping at [REDACTED], would suggest that [REDACTED] went to [REDACTED] twice in one day—a conclusion at odds with Dr. Wheeler’s suggestion that [REDACTED] has a “pattern” of shopping at [REDACTED] not [REDACTED].

58. Even if [REDACTED] did decide to pause in the general vicinity of Granby Street [REDACTED] vehicle was captured by one of the cameras that Dr. Wheeler identifies in his report, there would still be no basis to conclude that [REDACTED] rather than one of the many other establishments nearby. Google mapping data shows that the area surrounding [REDACTED] is a heavily commercial area close to highway entrances. For example, Exhibit 12 shows that there are 127 establishments within one mile of the location of the first camera that captured [REDACTED] on [REDACTED] including 34 commercial establishments, 43 food and drink establishments, 5 financial services establishments, and one entertainment and recreation establishment. Based on the Flock data alone, [REDACTED] have visited any one of these establishments rather than [REDACTED]. Dr. Wheeler does not discuss what data, if any, he examined to conclude that [REDACTED] instead.

59. Indeed, if one assumes—as Dr. Wheeler did—that [REDACTED] visited an establishment in this area, all establishments in the area were equally likely to be a potential destination [REDACTED] based only on the Flock camera data for the captures Dr.

⁴⁶ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 11.

Wheeler examined. Dr. Wheeler could do no better than pick an establishment at random had he relied only on a Flock camera capture at this intersection to make inferences. Dr. Wheeler had a 2.9% chance of being right ($= 1/34$) had he randomly picked one of the commercial establishments in the data, or a 1.3% ($= 1/77$) chance to be right had he picked randomly among commercial and food and drink establishments, or a 0.79% chance to be right had he picked among the 127 establishments in the area.

60. Even these odds overstate Dr. Wheeler's real chances of inferring correctly [REDACTED] on this day because [REDACTED] have been in the area for reasons other than visiting one of the establishments in Google's database, delayed due to traffic,⁴⁷ or [REDACTED] to a destination away from the area.
61. Figure 4 below shows the timestamps of *all* captures of [REDACTED] on [REDACTED] and [REDACTED], when Dr. Wheeler asserts that [REDACTED] of his report. I have highlighted captures at the intersection of Granby Street and Little Creek Road in blue.

Plate	Camera Name	Time Stamp
[REDACTED]	115 SB GRANBY ST AT E TAUSSIG	[REDACTED]
	149 EB LITTLE CREEK AT GRANBY	
	114 NB 460 AT WB 564 ENTRANCE RAMP	
	115 SB GRANBY ST AT E TAUSSIG	
	148 NB GRANBY AT LITTLE CREEK	
	#05 - NANSEMOND PKWY @ DAYLE ACRES RD - WB	
	103 NB TIDEWATER AT GUY AVE	
	103 NB TIDEWATER AT GUY AVE	
	115 SB GRANBY ST AT E TAUSSIG	
	149 EB LITTLE CREEK AT GRANBY	
	116 EB E TAUSSIG BLVD AT GRANBY	
	114 NB 460 AT WB 564 ENTRANCE RAMP	

Figure 4. All Captures of [REDACTED]

62. The Flock camera data does not support the conclusion [REDACTED] visited this [REDACTED] or even stopped anywhere near it. Exhibit 13 shows that on [REDACTED], the Flock camera data shows that [REDACTED] was captured for the first time on that day at [REDACTED], was captured twice more [REDACTED] before leaving the same area at [REDACTED] and was captured again in the area more than [REDACTED]

⁴⁷ <https://www.vdot.virginia.gov/news-events/news/hampton-roads-district/traffic-shift-on-granby-street-scheduled-for-express-lanes-norfolk-construction.php>.

later, at [REDACTED]. On [REDACTED] was first captured at [REDACTED], then again [REDACTED]. Dr. Wheeler does not explain how his methodology led him to conclude that [REDACTED] on these days solely by examining this Flock camera data. The records on these days do not indicate when or where [REDACTED].

63. Dr. Wheeler ignored other captures of [REDACTED] in the Flock camera data on the selected days he reviewed, and more importantly, the long periods of time when [REDACTED] was not captured. On [REDACTED] no information exists on [REDACTED]. Dr. Wheeler offers no opinion as to [REDACTED].

**b. Dr. Wheeler's Inference That [REDACTED]
[REDACTED] Is Not Supported by the Flock Data**

64. Dr. Wheeler states that he reviewed "repeated captures around [REDACTED]. Dr. Wheeler opines that, based on this information, "Defendants' employees can probably figure out [REDACTED], particularly if they can determine the registered owner of the car and consult other sources of information, like license and address information (generally available to law enforcement) or public open-source intelligence (like a LinkedIn or Facebook profile detailing an individual's work)." ⁴⁹ The data on which Dr. Wheeler draws does not support these claims.

65. First, it is notable that Dr. Wheeler does not claim that employees of the City of Norfolk could determine where [REDACTED] in this area based solely on the Flock camera captures he has identified. Rather, Dr. Wheeler appears to claim only [REDACTED] movements can be inferred through reliance on "other sources of information," [REDACTED] LinkedIn or Facebook profile.

66. Second, Dr. Wheeler does not explain why he elected to analyze this particular set of "repeated captures." He does not assert that the number of "repeated captures"—4—would suggest that this is a "common area" [REDACTED] to visit. One possible explanation is that Dr. Wheeler focused on this example because [REDACTED].

⁴⁸ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, p. 9.

⁴⁹ *Id.*

identified [REDACTED] frequently visits in the City of Norfolk. Exhibit 14 shows establishments near [REDACTED]

[REDACTED] As noted, this mode of analysis, in which Dr. Wheeler *begins* his analysis with information about Plaintiffs' movements in Norfolk and then attempts to show that Flock data can be used to infer the information he already knows to be true is entirely uninformative about whether Flock data can be used to infer an individual's movements.

67. Third, Dr. Wheeler does not justify his assertion that this is a "common area" where [REDACTED] ⁵⁰ Figure 5 below reflects all of the captures of [REDACTED] [REDACTED] The "repeated captures" Dr. Wheeler highlights in Figure 4 of his report are highlighted. All of these captures occurred [REDACTED]. Dr. Wheeler does not explain how a visit to an area on [REDACTED] would lead an analyst to conclude it was "common" [REDACTED] visit that area.

Plate	Camera Name	Time Stamp
[REDACTED]	141 NB MARYLAND AT ADMIRAL TAUSSIG BLVD	[REDACTED]
[REDACTED]	144 EB ADMIRAL TAUSSIG AT MARYLAND	[REDACTED]
[REDACTED]	141 NB MARYLAND AT ADMIRAL TAUSSIG BLVD	[REDACTED]
[REDACTED]	144 EB ADMIRAL TAUSSIG AT MARYLAND	[REDACTED]
[REDACTED]	114 NB 460 AT WB 564 ENTRANCE RAMP	[REDACTED]

Figure 5. Showing "Repeated captures" Near [REDACTED]

68. Finally, Dr. Wheeler does not explain why he believes that the four Flock captures he has identified in the vicinity of [REDACTED] that [REDACTED] "went" anywhere in this area or stopped to visit one of the establishments near these cameras (much less [REDACTED] vehicle appears to have been in the vicinity of [REDACTED] for fewer than [REDACTED] minutes. After exiting this area, and being captured by another camera at [REDACTED] was not captured again on [REDACTED]

c. Dr. Wheeler's Analysis of [REDACTED] Supposed "Travel Routes" On [REDACTED]

69. Dr. Wheeler examined three Flock camera captures on [REDACTED] and claims that these three captures permit him to create an "approximate travel path" taken by [REDACTED] on that date. Those captures occurred at [REDACTED]. Thus, Dr. Wheeler is asserting that, on [REDACTED], he can determine the

⁵⁰ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 10.

approximate travel path of [REDACTED] on public roads for approximately [REDACTED] minutes—much of which took place—according to Dr. Wheeler—on a highway.⁵¹

70. Dr. Wheeler does not provide information regarding the origin or destination of this supposed travel path—information that is not available from a Flock camera. The next capture of [REDACTED] after [REDACTED] on [REDACTED] occurred more than [REDACTED] minutes later at [REDACTED]. Dr. Wheeler does not assert that he knows where [REDACTED] was between [REDACTED] and that capture or between [REDACTED] and the next capture at [REDACTED].

d. Dr. Wheeler's Analysis of [REDACTED] Supposed "Travel Routes" On March 24

71. Dr. Wheeler claims that it is possible to use "areas where individuals are not captured" by Flock cameras "to make inferences about where people stop, for how long, and what routes they take." In support of this claim, he notes that after [REDACTED] was captured traveling southbound on Chesapeake Boulevard at 11am on March 24, [REDACTED] not captured "further south on Chesapeake" by a subsequent cluster of Flock cameras. Dr. Wheeler infers from that fact [REDACTED] did not visit Rosemont Middle School on this date.

72. I note two limitations of Dr. Wheeler's analysis of the data on [REDACTED]. First, Dr. Wheeler says that the "best inference" one can draw from the Flock data on this date is [REDACTED] "entered the highway" rather than proceeding down Chesapeake. Even if this inference is accurate, Dr. Wheeler's assertion appears to simply be that it is possible to tell [REDACTED] traveled under a mile down Chesapeake Boulevard before entering the highway over the course of one minute and fifteen seconds.

73. Second, Dr. Wheeler opines that [REDACTED] not going to Rosemont Middle School on this day because [REDACTED] was captured traveling southbound on Chesapeake Boulevard but was not captured on Johnstons Road. Notably, Dr. Wheeler did not identify other locations in Norfolk where Flock cameras are positioned in such a way that he could draw a similar "inference" [REDACTED] supposed movements on any other day or in any other part of Norfolk. For example, Exhibit 15 shows that had [REDACTED] been captured on Johnston Road, [REDACTED] could have continued on Johnstons Road past North Military Highway or headed north on North Military Highway without being captured.

⁵¹ The distance between [REDACTED] captures is 7.3 miles. Dr. Wheeler claims that much of this trip took place on Hampton Roads Beltway South.

74. Dr. Wheeler’s discussion of the captures of [REDACTED] on [REDACTED] also underscores the sparse information provided by the Flock camera data. Figure 6 below shows all captures of [REDACTED] on [REDACTED]. Notice that the first capture in the day—the first ‘capture’ indicated in Dr. Wheeler’s Figure 8—is at [REDACTED]. There is also a [REDACTED] gap between the [REDACTED] capture depicted in Dr. Wheeler’s Figure 8 and the following camera capture. The Flock camera data provides no information regarding [REDACTED] during this time. And, as Dr. Higdon-Topaz’s discussion of “slack” time makes clear, there are many possibilities for where an individual could have traveled in a [REDACTED] window.

Plate	Camera Name	Time Stamp
[REDACTED]	155 SB CHESAPEAKE AT LITTLE CREEK	[REDACTED]
[REDACTED]	072 SB CHESAPEAKE AT JOHNSTON	[REDACTED]
[REDACTED]	122 SB CHESAPEAKE BLVD AT JOYNER	[REDACTED]
[REDACTED]	098 SB MILITARY HWY AT POPLAR	[REDACTED]
[REDACTED]	101 SB WESLEYAN AT NORTHAMPTON	[REDACTED]
[REDACTED]	157 SB SHORE AT LITTLE CREEK	[REDACTED]
[REDACTED]	156 NB SHORE AT LITTLE CREEK	[REDACTED]

Figure 6. All Captures of [REDACTED]

e. The Flock Camera Data Also Does Not Support Dr. Wheeler’s Inferences About [REDACTED] Movements in Norfolk

75. Dr. Wheeler treats “[REDACTED]” as “an example day” that “can be inferred based on the fourteen separate capture dates and times.”⁵² Dr. Wheeler does not explain why he decided to analyze this particular day or whether this day is representative of other dates in the data regarding [REDACTED]. Based on my own review of the data, this date appears to be an outlier as 86% of [REDACTED] have fewer captures than this day.

76. Figure 7 shows all the captures of [REDACTED] by Flock cameras on [REDACTED]. I note that only 9 occurred in Norfolk. I have highlighted in blue all of the captures that occur 30 minutes or more after the preceding capture as well as the distance between each of these cameras.

⁵² Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 15.

Camera	Time	Minutes to Next Captures	Miles to Next Capture
#04 - HAMPTON ROADS PKWY @ RESPASS BEACH RD - WB	7:50:36 AM	48.3	0.4
#46 HAMPTON ROADS PKWY @ LEE HALL AVE EB	8:38:51 AM	69.1	0.9
#02 TOWNE POINT RD EB @ TWIN PINES RD	9:47:57 AM	109.4	0.0
#02 TOWNE POINT RD EB @ TWIN PINES RD	11:37:22 AM	24.3	14.6
097 NB MILITARY HWY AT POPLAR	12:01:38 PM	63.2	3.2
048 SB INGLESIDE AT CAPE HENRY	1:04:47 PM	0.2	0.1
047 NB INGLESIDE AT CAPE HENRY	1:04:58 PM	1.8	0.8
044 SB BALLENTINE AT CHESAPEAKE	1:06:45 PM	0.2	0.0
043 NB CHESAPEAKE AT LAFAYETTE	1:06:55 PM	0.5	0.0
046 WB LAFAYETTE AT BALLENTINE	1:07:24 PM	68.2	1.0
029 SB TIDEWATER AT SHOOP	2:15:37 PM	4.7	1.3
080 WB 27TH AT MONTICELLO	2:20:21 PM	25.8	2.1
169 SB HAMPTON AT REDGATE	2:46:08 PM	7.5	6.4
#01 TOWNE POINT RD NB @ HIGH TOWER RD	2:53:41 PM		

Figure 7. All Captures of [REDACTED]

77. Dr. Wheeler’s report does not suggest that it is possible to infer what [REDACTED] was doing during all but one of these highlighted periods of time. Instead, at most, Dr. Wheeler says that it is possible to infer [REDACTED] “conducted some...activity” or spent some “time...in the local area” around these captures.⁵³ He provides no basis for those inferences.

78. [REDACTED]

⁵³ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, p. 16.

⁵⁴ *Id.*

⁵⁵ *Id.*

f. The Flock Camera Data Does Not Enable an Individual to “Infer”

79.

⁵⁶ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, p. 14.

g. The Maps Dr. Wheeler Has Produced Do Not Permit an Individual to “Infer” Where Plaintiffs Travel Regularly

80. Dr. Wheeler’s report includes two maps (Figures 2 and 6) purporting to represent the “locations of captures” of Plaintiffs’ primary vehicles.⁵⁷ Dr. Wheeler does not specify the timeframe used to generate these maps. It appears, however, that they are intended to be a compilation of captures from February 19 through April 10, 2025. Dr. Wheeler contends that one can infer from these maps where Plaintiffs “travel regularly.”⁵⁸ Dr. Wheeler did not explain how he is able to draw such an inference using these maps.

81. First, the City of Norfolk would typically never be able to create the maps that Dr. Wheeler did because the City of Norfolk’s Flock data can be retained for only 21 days. This means that the City of Norfolk can access only 21 days of Flock camera data at any given time, absent specific circumstances laid out in the NPD’s Flock Policy. Therefore, the City of Norfolk cannot create a compilation of captures over two months, as Dr. Wheeler has done.

82. Second, without an aggregate understanding of how often Plaintiffs travel and where, it is not possible to say whether any of the Flock camera captures illustrated on Dr. Wheeler’s maps reflect locations that a Plaintiff visits “regularly.” The majority of Plaintiffs travel could, for example, consist of trips that are not captured at all by a Flock camera. Absent such information, Dr. Wheeler cannot conclude that his maps can determine where Plaintiffs’ “travel regularly.” Instead, these maps suggest only that Plaintiffs’ vehicles pass some Flock cameras more frequently than others. As I discussed in section VI, captures of Plaintiffs’ vehicles are sparse, with many days with no or single captures, and consecutive captures separated in time and space. Those cameras with substantial captures of Plaintiffs’ vehicles tend to be in high-traffic commercial areas, where it is not surprising to see Plaintiffs’ vehicles and there are numerous reasons why Plaintiffs’ vehicles might be in those areas.

h. Dr. Wheeler Has Not Shown that Flock Data Can Be Used to “Monitor Public Places”

83. Dr. Wheeler’s report claims that Flock cameras enable the City of Norfolk to “monitor everyone who visits a particular location.”⁵⁹ He asserts that Flock cameras “can

⁵⁷ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 9, pg. 15.

⁵⁸ Notably, Dr. Wheeler is not stating these are locations Plaintiffs are traveling to or from, merely locations that they pass while driving.

⁵⁹ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 20.

determine the times of visits, infer the people who actually stopped at a given location based on patterns of capture and non-capture, and even consult other sources of information to figure out what was going on at a given location at a given time.⁶⁰ Dr. Wheeler, however, made no attempt to undertake any such analysis himself. He did not review the Flock data produced in this litigation to determine if or how it would be possible to identify the set of individuals who visited a “particular location” at a given time.

84. In fact, it is not possible to monitor “everyone” at a particular location using only Flock cameras. Individuals walking, biking or taking public transportation to a particular location would not be captured by the Flock cameras. Further, as noted previously, Flock cameras are designed to take pictures of license plates and do not include information about who is in a particular vehicle. Dr. Wheeler does not explain how the Flock cameras would enable an analyst to determine if an individual arrived at a particular destination in another person’s car.

85. Dr. Wheeler also fails to specify what he means when he asserts that Flock cameras can be used to monitor a particular “location.” Dr. Wheeler identifies two specific buildings as examples of “public places” that the City of Norfolk supposedly could monitor. Though he suggests Flock cameras could be used to monitor “areas” in Norfolk, he provides no explanation for how such monitoring could be accomplished or any examples of areas in the city subject to such monitoring.⁶¹

86. Dr. Wheeler does not explain how he selected the two buildings that he contends the City of Norfolk can “monitor” with the use of Flock cameras. Most importantly, he does not explain whether these buildings are outliers within the City of Norfolk or contend that it would be possible to use Flock cameras to identify individuals visiting a particular location elsewhere in the City of Norfolk. This is particularly notable because, in general, I would anticipate that inferring whether an individual is visiting a particular building in Norfolk likely would be extremely difficult, given how many establishments are located near Flock cameras and the fact that these cameras are typically placed on busy roads. Indeed, Dr. Higdon-Topaz's analysis of “slack time” seems to acknowledge that even two Flock captures do not permit an inference that a person was visiting one location rather than another.

⁶⁰ *Id.*

⁶¹ Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 21.

87. Finally, it is notable that Dr. Wheeler limits his conclusion to an assertion that Flock cameras permit monitoring of “public” places. He does not suggest that Flock cameras permit the City of Norfolk to monitor private locations, like an individual residence, anywhere within the City of Norfolk.

i. The Two Locations that Dr. Wheeler Identifies Undermine His Conclusion that Flock Cameras Permit Monitoring of Public Places

88. Dr. Wheeler provides two examples of locations that he believes the City of Norfolk would be able to “monitor” with Flock cameras: (1) Kingdom Hall of Jehovah’s Witnesses and (2) Rosemont Middle School. Dr. Wheeler’s conclusions are flawed, and he makes no claim that either Plaintiff has ever visited either location.

89. Dr. Wheeler provides no analysis of the *actual* Flock data produced from the cameras located close to either of these locations. He provides no explanation for his failure to do so.

Kingdom Hall of Jehovah’s Witnesses

90. Figure 9 below depicts the area surrounding Kingdom Hall of Jehovah’s Witnesses. The Kingdom Hall’s parking area can be accessed by turning down onto Farrell Street, which is a one-way street. The Flock camera at the intersection of Chesapeake Boulevard and Farrell Street is a southbound facing camera near the front of the Kingdom Hall. Given its placement, it would not be able to detect any vehicles entering the Kingdom Hall’s parking lot by turning down Farrell Street.

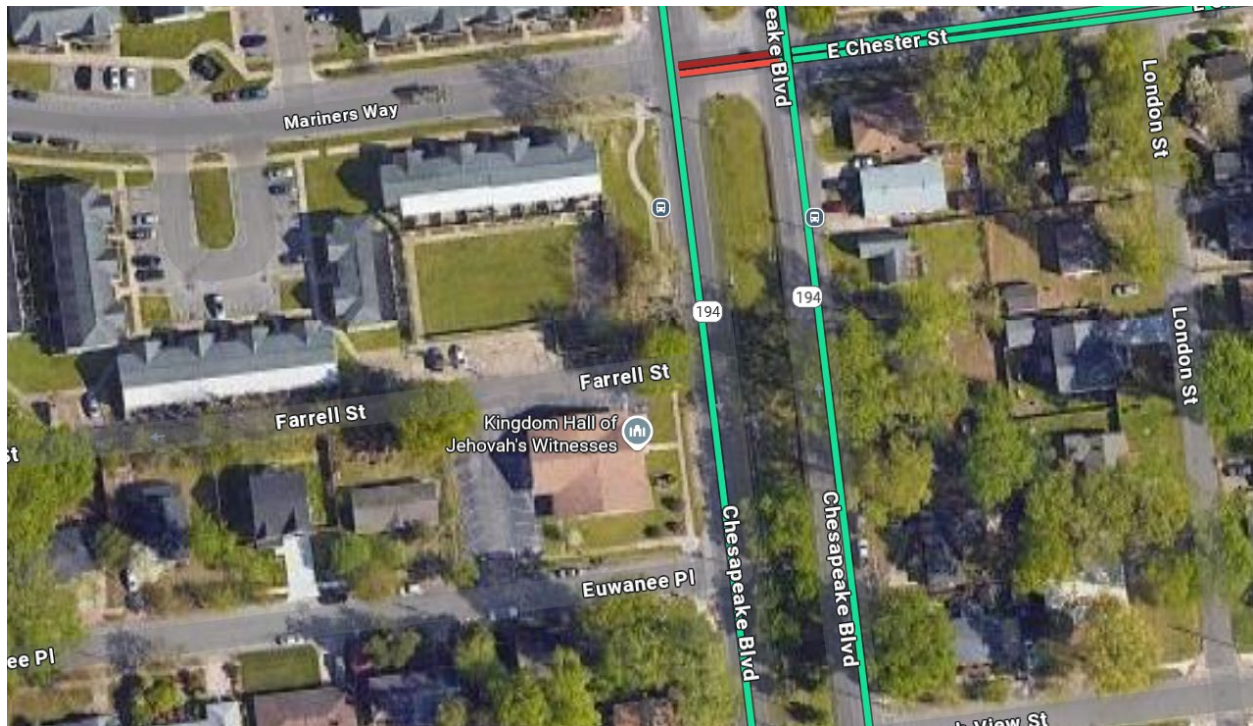


Figure 9. Area Surrounding Kingdom Hall of Jehovah's Witnesses

91. Exhibit 16 shows the location of the Flock camera, which is facing south on Chesapeake Boulevard, a one-way street. Exhibit 17 shows the optimal capture range for the Flock camera, showing that cars turning onto Chesapeake Boulevard from Euwatee Place would not be in this optimal range. Thus, if a vehicle is traveling southbound and turns onto Farrell Street to enter the Kingdom's parking lot and then exits the parking lot to Euwatee Place and goes into the neighborhood or goes southbound on Chesapeake, then it would not be captured by the Flock camera located in front of Kingdom Hall. Dr. Wheeler does not address this possibility.

Rosemont Middle School

92. Dr. Wheeler's next example is Rosemont Middle School. Exhibit 15 depicts the Flock cameras located near the school, the directions they face, and their estimated ranges. Dr. Wheeler claims that the location of these cameras, in conjunction with "date and time stamps," could "identify the vehicles that attended a particular after-hours support event" at this middle school.⁶²

⁶² Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, pg. 20.

93. As with his other examples, Dr. Wheeler overstates the reliability of his inferences. As depicted in the map in Exhibit 15, a camera at the intersection of Chesapeake Boulevard and Johnstons Road captures eastbound traffic on Johnstons Road. However, it cannot be inferred that any vehicle traveling east on Johnstons road is heading to the Rosemont Middle School. It is equally likely that cars traveling down Johnstons Road are headed toward Military Highway where there are many residences and business establishments.
94. Further, the Flock camera at the intersection of Johnstons Road and Military Highway only captures southbound traffic, or those turning right onto the road. Thus, one cannot infer that the presence of a capture at one end of Johnstons and the absence at the other indicates an individual stopped at the middle school. Likewise, a vehicle turning right from North Military Highway and exiting following the same path would not be captured by Flock cameras. Dr. Wheeler does not consider these possibilities.
95. Again, it is notable that Dr. Wheeler has not tried to address whether his methodology could be applied to other locations besides Rosemont Middle School in Norfolk.

j. Dr. Higdon-Topaz's Analysis Does Not Show that Flock Cameras Enable Tracking of the Whole of Individuals' Movements

96. Dr. Higdon-Topaz cannot opine on the Flock camera data because he did not use it in his main analysis. Instead, he chose to simulate the driving habits of Norfolk residents using data and information that is not available in the Flock camera data. Dr. Higdon-Topaz did not explain why he did not use the actual Flock data.
97. Dr. Higdon-Topaz's analysis of simulated routes is not informative about whether actual Flock camera data would enable tracking of the whole of individuals' movements because his simulated routes look nothing like the actual Flock camera data. As the Reference Manual on Scientific Evidence says, "*[d]ifferent designs are suited to answering different questions. Also, flaws in the data can undermine any statistical analysis, and data quality is often determined by study design.*"⁶³ When designing his study, Dr. Higdon-Topaz ignored Plaintiffs' central claim that the Flock camera data could be used to track the whole of their movements. Therefore, Dr. Higdon-Topaz's analysis is not properly designed to evaluate Plaintiffs' claims in this matter.

⁶³ Reference Guide on Statistics, pg. 216, Reference Manual on Scientific Evidence. National Academies of Sciences, Engineering, and Medicine. Third edition.

98. Dr. Higdon-Topaz analysis begins by simulating “*routes based on a model of human movement built on open-source and government data.*”⁶⁴ These simulated routes have known origin and destination points as well as coordinates of the route—information that is not available in the Flock camera data. Thus, as an analyst, Dr. Higdon-Topaz assumed information that the Flock cameras do not provide. Accordingly, Dr. Higdon-Topaz’s analysis is not useful in determining what inferences can be drawn using information from the Flock cameras. Dr. Higdon-Topaz creates routes and then asks whether the Flock cameras could help identify those already known routes. But law enforcement using the Flock camera data do not know the routes taken by the vehicles captured in the Flock data. The question to be studied is whether the Flock camera data enable one to identify those routes. Dr. Higdon-Topaz did not study this question, opting instead to create the answer to the question he claims to be trying to answer. That is not a reliable method of analysis.
99. Dr. Higdon-Topaz characterizes his simulated routes as “binary reconstructible” if the route passes two or more Flock cameras. Notably, Dr. Higdon-Topaz himself calculates that 45% of his simulated routes are not binary reconstructible, which means that Flock cameras would not enable tracking vehicles on these routes. Put differently, under Dr. Higdon-Topaz’s own analysis, it is essentially a coin flip whether a vehicle will be captured by more than one Flock camera during a hypothetical random trip.
100. Regardless, Dr. Higdon-Topaz’s binary reconstructibility analysis is flawed. Dr. Higdon-Topaz assumes that if Flock data shows that a vehicle was captured two or more times by Flock cameras, then those captures were part of a single, unified trip that can be reconstructed using the assumption that drivers will follow the most direct route. But my examination shows that Dr. Higdon-Topaz’s simulated data and actual Flock camera captures are nothing alike.
101. On average, consecutive captures of Plaintiffs’ vehicles are 49.5 minutes for [REDACTED] and 47.5 for [REDACTED], which is longer than the 30-minute duration of the longest route in Dr. Higdon-Topaz’s simulated set of routes. On average, consecutive captures of all vehicles are 108.8 minutes apart, more than three times the longest duration of a route in Dr. Higdon-Topaz’s set of simulated routes. And the average consecutive captures of the 5% of vehicles with the most captures were 89.7 minutes apart, almost three times longer than the duration of the longest route in Dr. Higdon-Topaz’s set of simulated routes.

⁶⁴ Expert Witness Report of Chad Higdon-Topaz, Ph.D., pg. 4.

102. Further, while Dr. Higdon-Topaz finds that about 55% of his simulated routes pass two or more Flock cameras, most captures in Norfolk in the real world were the only capture of that vehicle on that day. As noted, 84.3% of captures in the data were the only capture of that vehicle on the day of the capture and 65% of captures of the 5% of vehicles captured the most were the only capture on the day of the capture.

103. These comparisons show that Dr. Higdon-Topaz's simulated set of routes does not accurately represent how vehicles are driven in Norfolk in the real world. In the real world, most sets of two or more captures by Flock cameras are not part of a single, unified trip but instead likely reflect multiple different trips. Thus, the route in between the captures cannot be reconstructed by assuming that a driver would be using the most direct route between the two captures because the driver might not have been traveling directly between the two captures at all.

104. Further, by focusing on simulated routes instead of actual Flock camera data, Dr. Higdon-Topaz's analysis incorrectly assumes that individuals will always choose the shortest route between two points,⁶⁵ even though he understands that drivers may choose different routes based on their personal circumstances.⁶⁶ This assumption contradicts his stated intention of modelling "human movement,"⁶⁷ because his simulated routes ignore that two individuals driving from point A to point B may choose different routes for personal reasons, or due to the traffic, weather, habits, or stops to complete errands.

105. Dr. Higdon-Topaz did not explain how his model can be used to infer the whole of any driver's movement when it starts by assuming that all drivers are alike. Indeed, the same paper Dr. Higdon-Topaz cited in support of his model describes the complex interplay between costs and transportation modes.⁶⁸

106. In addition, even on its own terms, Dr. Higdon-Topaz's binary reconstructibility classification is not informative about whether the Flock cameras enable tracking of individuals' movements. According to Dr. Higdon-Topaz's own analysis, for 7.3% of "binary-reconstructible" routes, less than 5% of the route can be reconstructed. For some "binary-reconstructible" routes, less than 50 feet of the route can be reconstructed.

⁶⁵ Expert Witness Report of Chad Higdon-Topaz, Ph.D., pg. 47.

⁶⁶ *Id.*, pg. 10.

⁶⁷ *Id.*, pg. 4.

⁶⁸ Wilson, A.G., The Use of Entropy Maximizing Models, pg. 108.

107. Dr. Higdon-Topaz's attempt to calculate the percentage reconstructed of binary reconstructible routes actually illustrates that Flock camera data cannot be used to track the whole of individuals' movements. His own analysis finds that Flock cameras could be used to reconstruct 50% or more of only 26.9% of the simulated routes he created and could be used to reconstruct 70% or more of only 13.9% of the simulated routes he created. In addition, applying Dr. Higdon-Topaz's methodology to routes of 1 or fewer miles, the approximate distance between [REDACTED] addresses and the closest Flock camera, one finds that only 0.7% of such routes could be reconstructed by 50% or more, and only one route could be reconstructed by 70% or more.
108. Another flaw in Dr. Higdon-Topaz's "percentage reconstructibility" concept is that the portion reconstructed does not provide information about origins and destinations. For example, Dr. Higdon-Topaz claims that his methodology could reconstruct 95.3% of the 16.9 miles of his simulated route 16670 with only four camera captures. Given the route's duration and distance, the average speed for this route is 40.6 miles per hour, which suggests that this route involves a majority of highway driving. I analyzed this simulated route and found that Flock cameras would capture a vehicle traveling this route only when entering and leaving the highway. The 95.3% "percentage reconstructible" metric provides no information concerning the potential origin or destination of this trip, the information not contained in the Flock camera data, contrary to what Dr. Higdon-Topaz contends.
109. The flaw in Dr. Higdon-Topaz's percentage reconstructible metric is also apparent in his Figure 7, in which he claims that he could reconstruct select routes between Plaintiffs' frequently visited locations. Similar to his simulated route 16670, the segment between squares in his Figure 7 is far away from Plaintiff's origin and destination points. Dr. Higdon-Topaz's methodology cannot help an analyst identify where Plaintiff was coming from before the first capture, or where the Plaintiff was going after the last capture.
110. Exhibit 18 shows my analysis of the two examples Dr. Higdon-Topaz provides of the distance between locations in Norfolk [REDACTED] identified [REDACTED] interrogatory responses. The yellow segment is the portion of the route between [REDACTED] that Dr. Higdon-Topaz claims he could reconstruct using his methodology. It is notable that the end points of the reconstructed portion of the route are more than 1.5 miles from [REDACTED] and almost one mile from [REDACTED] and are located near to numerous establishments.

111. Exhibit 19 shows a similar analysis of Dr. Higdon-Topaz's attempt to reconstruct the route between [REDACTED] and what he incorrectly described as [REDACTED].⁶⁹ Similar to Exhibit 18, the end points of the allegedly reconstructible portion of this route are more than one mile from [REDACTED] and even farther away from [REDACTED]. Dr. Higdon-Topaz's methodology would not aid in identifying the origin and destination of these routes.

112. Exhibit 20 shows that the endpoints of the allegedly reconstructible portion of the routes between [REDACTED] and [REDACTED] are also several miles from [REDACTED] and [REDACTED] and located in areas with numerous establishments. Again, Dr. Higdon-Topaz's methodology would not aid in identifying the origin and destination of these routes.

k. Dr. Higdon-Topaz's Discussion of Slack Time Highlights the Difficulty of Discerning the Whole of an Individuals' Movements from Flock Camera Data

113. Dr. Higdon-Topaz also offers opinions regarding what he calls "slack time" — that is, where the actual time that elapsed between detections exceeds the expected direct driving time between those cameras."⁷⁰ Dr. Higdon-Topaz's analysis of slack time contradicts the assumptions on which he relied when analyzing his simulated routes. In his analysis of simulated routes, Dr. Higdon-Topaz assumes that drivers always spend the time between two captures by Flock cameras using the shortest route to drive directly between one camera and another. This assumption permits him to calculate the "reconstructibility" of his synthetic routes. Dr. Higdon-Topaz's discussion of slack time, however, acknowledges that drivers may spend the time between two captures by Flock cameras doing many things other than simply driving between the two cameras. Dr. Higdon-Topaz makes no effort to explain how these two assumptions are consistent.

114. Dr. Higdon-Topaz posits a hypothetical example of 30 minutes of slack time. Dr. Higdon-Topaz notes that a driver could spend these 30 minutes in at least three different ways: (1) the driver could park and spend 30 minutes walking, (2) the driver could drive for 10 minutes and walk for 20 minutes, or (3) the driver could drive for 15 minutes and walk for 15 minutes. These are not the only possibilities. For example, 30 minutes of slack time when expected driving time is 60 minutes expands the range of

⁶⁹ Dr. Higdon-Topaz used [REDACTED] in this analysis. However, [REDACTED]

⁷⁰ Expert Witness Report of Chad Higdon-Topaz, Ph.D., pg. 19.

possible locations and activities the driver could engage in compared to 30 minutes of slack time when the expected driving time is 5 minutes

115. Exhibit 21 also illustrates how the number of establishments reachable by walking changes with the assumed walking time during slack-time. Allowing more time for walking rather than spending time at an establishment expands the number of reachable establishments, as Dr. Higdon-Topaz notes. This exhibit shows that if the individual walks faster than average, even more establishments to the east of the image would be reachable.
116. This is problematic because different assumptions about where an individual might have spent time between Flock camera captures could result in individuals being in very different locations. Entering a shopping establishment may take longer or shorter than visiting an ATM, depending on the time of the day and area. Even evaluating the numerous options assumes that a driver must have visited a particular location between captures instead of simply being delayed by traffic or parking and waiting to pick someone up. Dr. Higdon-Topaz did not offer any way to determine what could happen during slack time using only the Flock camera data because it is not possible.
117. Dr. Higdon-Topaz's analysis of slack time using a single set of captures by Flock cameras illustrates the flaws in his slack time opinions. According to the data that he uses, "license plate [REDACTED] was detected at two camera locations with 10.1 minutes of slack time between observations."⁷¹ Dr. Topaz "imposed the constraint that the driver allocated between 50% and 100% of the slack time to walking, rather than driving farther afield."⁷² He admits that this is an "assumption," but does not explain why this assumption was made, whether it has any basis in reality, why it makes more sense than any other possible allocation of time, or how to make such assumptions systematically and scientifically. Indeed, Dr. Higdon-Topaz admits that "these parameters could be adjusted based on information about the driver, investigative priorities, or other knowledge."⁷³ But Dr. Higdon-Topaz does not explain how any of this information could be obtained using the Flock cameras, which do not collect it. Notably, license plate [REDACTED] is associated with a vehicle driven primarily by [REDACTED].⁷⁴ Dr. Higdon-Topaz also did not discuss whether or how his assumptions about slack time would change depending on whether [REDACTED] were driving the

⁷¹ *Id.*, pg. 36.

⁷² *Id.*

⁷³ *Id.*, pg. 37.

⁷⁴ Mr. Schmidt's Responses to Defendant's First Set of Interrogatories, pg. 4.

vehicle on the day in question—information which is not available in the Flock camera data.

118. Dr. Higdon-Topaz’s report “identifies potential destinations” that the driver with license plate [REDACTED] could have reached in this period of slack time: “Sewells Point Clinic (8.2 minutes), Navy Exchange (7.8 minutes), Package Store (7.3 minutes), Wendy's (6.6 minutes), and Navy Federal Credit Union (8.9 minutes).” But Dr. Higdon-Topaz does not explain why he chose only these locations among the numerous establishments in the area, how his model could identify which of these and other possible locations the driver actually visited, or why he is even assuming that the driver visited an establishment in the area. For example, there are another 15 food establishments within 0.5 miles of this area in addition to the Wendy’s. Another possibility is that traffic in the area was congested when the vehicle was captured. Dr. Higdon-Topaz does not consider this possibility.

119. Dr. Higdon-Topaz’s example of 10 minutes of slack time shows how little can be said about what happens between camera captures. In his own example in his report in Figure 9, Dr. Higdon-Topaz shows 19 different possible destinations the driver could have visited. Given this range of possibilities, and assuming they are the only ones, he has a 5.2% chance of picking the correct location at random. As I discussed above, the average elapsed time between captures is close to 50 minutes for both Plaintiffs, implying their “slack time” will likely be greater than 10 minutes, thereby expanding the range of possible destinations

120. Finally, Dr. Higdon-Topaz does not suggest that the NPD has the capability to conduct the “slack time” analysis that he performs.

121. I reserve the right to update my opinions and report if additional information becomes available.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Executed in Bryan, Texas, on August 8, 2025.



Valentin Estevez, Ph.D.

Appendix A

Resume of Valentin Estevez, Ph.D.



Valentín Estévez, PhD

Vice President

PhD, Economics
University of Chicago

MA, Economics
University of Chicago

BA, Economics
Universidad Autónoma de Chiriquí Panamá

Dr. Valentín Estévez is a Vice President in CRA's Labor & Employment Practice.

Dr. Estévez has worked as a labor economics consultant and testifying expert in class action and single-plaintiff matters for clients in numerous industries. He helps clients proactively assess compliance with international, federal, and state regulations regarding fair/equal pay, pay equity, and wage and hour issues. In addition, he assists clients in preparing and responding to audits and investigations from government agencies such as the OFCCP, EEOC, and California's CRD.

Dr. Estévez performs economic and statistical analyses of employment discrimination claims in pay, hiring, promotions, terminations, and other employment actions and alleged violations of the FLSA and state wage and hour statutes, such as those in California, New York, and Massachusetts. He also assists clients in organizing and analyzing large and complex databases and applying Big Data and Artificial Intelligence techniques in labor and employment matters. Before joining CRA, Dr. Estévez was Senior Managing Director with Welch Consulting, where he worked for more than 17 years.

Selected casework

Expert Witness, Employment Discrimination (USERRA): Class action involving allegations of discrimination against employees who took military leave while employed by a global e-commerce company. Documented mistakes and logical flaws in plaintiff's counsel's data analyses and prepared affirmative analyses showing that employees who took military leave did not receive adverse employment actions.

Consultant, California Pay Data Reporting: Assisted a large firm in the tech industry in complying with California's CRD pay data reporting obligations. Assisted the client and its labor contractor suppliers in collecting and compiling the necessary data. Prepared the contractor pay data submission and compared trends between the employee and labor contractor reports.

Consultant, Artificial Intelligence HR Tool Audit: Examined and audited output from a candidate-matching tool powered by Artificial Intelligence developed by a professional services industry and made recommendations regarding data sourcing and validation.

Consultant, Proactive Review of Employment Practices: Prepare annual statistical analyses of performance reviews, promotions, raises, bonuses, and total compensation for a large firm in the tech industry based on employees' demographics, such as gender, race, and age.

Consultant, Wage & Hour: Assisted global e-commerce company in reviewing plaintiff's class-action allegations regarding the failure to reimburse work-from-home business expenses in violation of California's labor code. Identified several flaws in plaintiff's analyses, including data-handling and coding errors, and highlighted how the individualized nature of the claims, the plaintiff's unique circumstances, and employees' choices were inconsistent with class-wide treatment. Led the preparation of the expert report.

Consultant, Pay Discrimination: Evaluated gender promotion and pay discrimination claims against a global SaaS company. Assisted in responding to discovery requests and evaluating plaintiffs' statistical models and results.

Consultant, Wage & Hour: Assisted client in the oil & gas industry in FLSA opt-in class regarding calculating the regular rate of pay for oil rig workers. Prepared calculations for the mediation and final settlement.

Expert Witness, Wage & Hour: Class action involving damages and PAGA claims against an oil and gas industry firm. Submitted report describing the wide range of employees' circumstances and behavior and detailing inconsistencies in plaintiffs' expert's damages methodology.

Consultant, Artificial Intelligence HR Tool Audit: Examined and audited output from an external candidate sourcing tool powered by Artificial Intelligence developed by an HR software vendor. Performed data sourcing and adverse impact analyses.

Consultant, OFCCP Hiring Audit: Assisted government contractor in supplementing demographic information for job applicants using Bayesian Improved Surname Geocoding techniques. Examined the sensitivity of the adverse impact results to alternative imputation parameters. Assisted the client in sharing and explaining methodology to the agency.

Expert Witness, Wage & Hour: Class action involving PAGA claims for California flight attendants for a major national airline. Identified errors in plaintiffs' expert calculations and submitted expert report with corrected calculations.

Expert Witness, Wage & Hour: Collective action involving hair stylists in Colorado with claims related to missed meal periods and rest breaks and unpaid off-the-clock work. Showed that plaintiffs had the opportunity to take, and regularly took, meal periods and documented that differences in the recording of meal periods and work across employees and salons were inconsistent with a company-wide policy.

Consultant, OFCCP Pay Audit: Organized compensation data and prepared OFCCP-style compensation analyses for an employer in the health services industry. Assisted counsel in the presentation of findings to the agency.

Expert Witness, Wage & Hour: Class action involving agricultural workers in California who alleged violations of California's wage and hour regulations concerning meal periods, rest breaks, and payments for non-productive time, among other causes of action. The case involved coding and analyzing hundreds of thousands of paper timesheets. Documented data-handling and analytical mistakes in plaintiffs' expert calculations that caused them to overstate liability.

Charles River Associates

Consultant, Pay Equity: Examined base pay and variable compensation for worldwide employees of a large firm in the financial services industry. The audit covered almost all employees by combining standard statistical modeling with cohort-based approaches for smaller analysis units. Assisted counsel and the client in identifying and reviewing employees whose compensation was impacted by factors that could not be systematically quantified and included in the statistical model.

Expert Witness, Lost Wages: Case involving three workers in the oil industry who alleged lost wages due to their termination. Showed that plaintiffs' lost wages estimates were inflated because their expert ignored the industry-wide downturn and underestimated plaintiffs' income at alternative employment.

Consultant, Pay Equity: Assisted large firm in the tech industry in responding to allegations of gender and race discrimination in hiring, promotions, and compensation.

Expert Witness, Wage & Hour: Case involving non-exempt employees at a California construction company who alleged violations of California's labor code. Prepared report describing statistical defects in plaintiffs' proposed trial plan.

Consultant, OFCCP Pay and Hiring Audit: Assisted a contractor in responding to allegations of gender and race disparities in hiring and compensation. Identified key factors improperly excluded from the agency's models that accounted for the agency's findings and assisted the contractor in responding to questions from the agency.

Consultant, Wage & Hour: Organized payroll, timecard, and GPS data to evaluate claims of unpaid off-the-clock work for cable installers working in several states.

Expert Witness, Wage & Hour: Case involving non-exempt employees at a California Hotel who alleged violations of California's labor regulations due to off-the-clock work, timecard rounding, and missed rest breaks and meal periods.

Consultant, Pay Equity: Assisted a public entity in California in assessing compliance with California's Fair Pay Act. Prepared analyses and discussed results with the entity's leadership.

Consultant, Pay Equity: Assisted a client in the technology industry in complying with the United Kingdom's gender pay gap reporting obligations. In addition, prepared in-depth pay equity analyses of the client's United Kingdom operation.

Consultant, Wage & Hour: PAGA case involving managers for a retailer who alleged unpaid wages due to the retailer's scheduling system. Evaluated claims and assisted client during mediation.

Consultant, Pay Equity: Assisted a client in the financial services industry in complying with the UK's gender pay gap reporting obligations. Prepared a similar study for the client's US operations.

Expert Witness, Wage & Hour: Case involving California drivers who alleged unpaid wages due to off-the-clock work and unpaid meal periods and rest breaks. Opined on the statistical calculations and conclusions prepared by Plaintiff's expert.

Consultant, OFCCP Audit: Assisted a government contractor in responding to OFCCP's claims of gender pay discrimination in one of the contractor's sites. Showed that there was no gender pay difference once the analysis accounted for employees' task choices.

Consultant, Pay Equity: Prepared a pay equity study for a client in the legal services industry. The study showed the importance of accounting for prior experience and individual's choices when examining pay equity issues.

Consultant, OFCCP Audit: Assisted a government contractor in the health services industry in the review of their compensation practices prior to submitting their AAP. Collaborated with the client in developing best practices for recording and maintaining their compensation data.

Consultant, Wage & Hour: Case involving non-exempt employees working in an instant oil-change business who alleged several violations of California's labor regulations. Assisted the client with the evaluation of the claims and during mediation.

Consultant, OFCCP & Pay Equity Audit: Assisted a government contractor in the financial services industry in the review of their compensation practices under the OFCCP and Massachusetts' Pay Equity Act guidelines.

Consultant, Wage & Hour: Case involving non-exempt airport ground personnel in California who alleged violations of several of California's labor regulations. Assisted client in evaluating claims, with discovery, and during mediation.

Consultant, OFCCP Audit: Assisted a government contractor in the educational services industry with the analyses of their selections and compensation data. Prepared reports to be included in the AAPs.

Expert Witness, Age Discrimination: Case involving ground personnel in California airports who alleged they were terminated due to their age. Evaluated the claims and found that the Plaintiff's age group terminated at a lower rate than the comparison group.

Consultant, OFCCP Audit: Assisted a government contractor in the health services industry in responding to OFCCP's claims of race discrimination in hiring. Prepared analyses that showed no adverse impact once the analyses accounted for the timing of applications and openings.

Consultant, Wage & Hour: Case involving truck drivers who alleged violations of several of California's labor law regulations. Organized driver logs data and assisted client with discovery and during mediation.

Expert Witness, Wage & Hour: Case involving flight attendants who alleged a series of violations of California's labor code. Prepared an expert report and gave deposition testimony regarding issues with the class-wide damages methodology offered by plaintiffs' expert and the work experience of the plaintiffs.

Consultant, Pay Equity Audit: Conducted a base pay and equity compensation audit for an international software company. Assessed compliance under Title VII, California's Fair Pay Act, and OFCCP analysis guidelines.

Expert Witness, Wage & Hour: Case involving airport agents and ground personnel for a large nationwide airline who alleged violations of California's wage and hour laws. Submitted expert report and gave deposition testimony documenting systemic flaws in plaintiffs' expert data preparation and calculations.

Charles River Associates

Consultant, Annual Pay and Promotion Reviews: Assisted client with annual compensation reviews by providing fast-turnaround analyses of pay and promotion decisions.

Consultant, Gender Discrimination Arbitration: Prepared pay and promotions analyses in a nationwide gender discrimination case involving salespersons and managers at a large retail firm.

Consultant, OFCCP Audits: Simultaneously audited pay practices in more than 30 sites of a large provider of health services. Prepared individualized reports for each site and assisted the client in the interpretations of the results of the audit.

Consultant, Reorganization: Performed interactive, fast-turn-around adverse impact analysis for a large retailer undergoing a reorganization of its operations.

Consultant, Wage & Hour: Assisted a nationwide drugstore chain in responding to claims that it violated labor laws because supervisors could not leave the premises during their breaks.

Consultant, OFCCP Audits: Assisted a health services provider undergoing OFCCP audits in several facilities regarding the pay of registered nurses. Helped the client show that the apparent pay disparity was due to differences in prior experience.

Consultant, Wage & Hour: Helped a large health services provider address claims that its timecard rounding practices were devised to advantage the company. Verified that the rounding rules were applied consistently and found that overall the rules neither advantaged nor disadvantaged our client.

Consultant, Discrimination: Assisted a large firm in the paper industry in responding to OFCCP's failure to hire charges. Discussed data and methodological issues with OFCCP's statistics expert.

Consultant, Wage & Hour: Class action suits involving the estimation of damages arising from unpaid hours worked and overtime claims against several hospitals in the US.

Consultant, Discrimination: Assisted a firm in the semiconductor industry in responding to claims of age discrimination in a reduction in force.

Consultant, ERISA Litigation: Organized personnel, payroll, and pension records and analyzed the evolution of retirement benefits in a case against a firm in the pharmaceutical industry involving claims of violations of the ADEA and ERISA due to the conversion of its defined benefit plan to a cash balance plan.

Expert Witness, Lost Earnings: Estimated lost wages and benefits suffered by plaintiff due to almost two decades of wrongful incarceration.

Consultant, Wage & Hour: Class action suit involving the estimation of damages arising from unpaid hours worked and overtime claims against a large firm in the networks and communication industry. Assisted client during mediation proceedings.

Consultant, Wage & Hour: Computed damage estimates in a wage and hours case involving piece-rate workers in a large firm in the food industry.

Professional memberships and activities

American Economic Association

American Statistical Association

American Bar Association

Latin American & Caribbean Economic Association

Member, Advisory Council to the National Industry Liaison Group (NILG)

Professional history

Mar 2022–Present *Vice President*, Charles River Associates, College Station, TX

2022–Present *Lecturer*, Department of Economics, Texas A&M University

2021–Feb 2022 *Senior Managing Director*, Welch Consulting, Bryan, TX

2018–2021 *Managing Director*, Welch Consulting, Bryan, TX

2016–2018 *Senior Economist*, Welch Consulting, Bryan, TX

2005–2016 *Economist*, Welch Consulting, Bryan, TX

2004–2005 *Lecturer*, Department of Economics, University of Chicago

2000–2004 *Teaching Assistant*, Booth School of Business, University of Chicago

2000–2005 *Teaching Assistant*, Department of Economics, University of Chicago

Appendix B

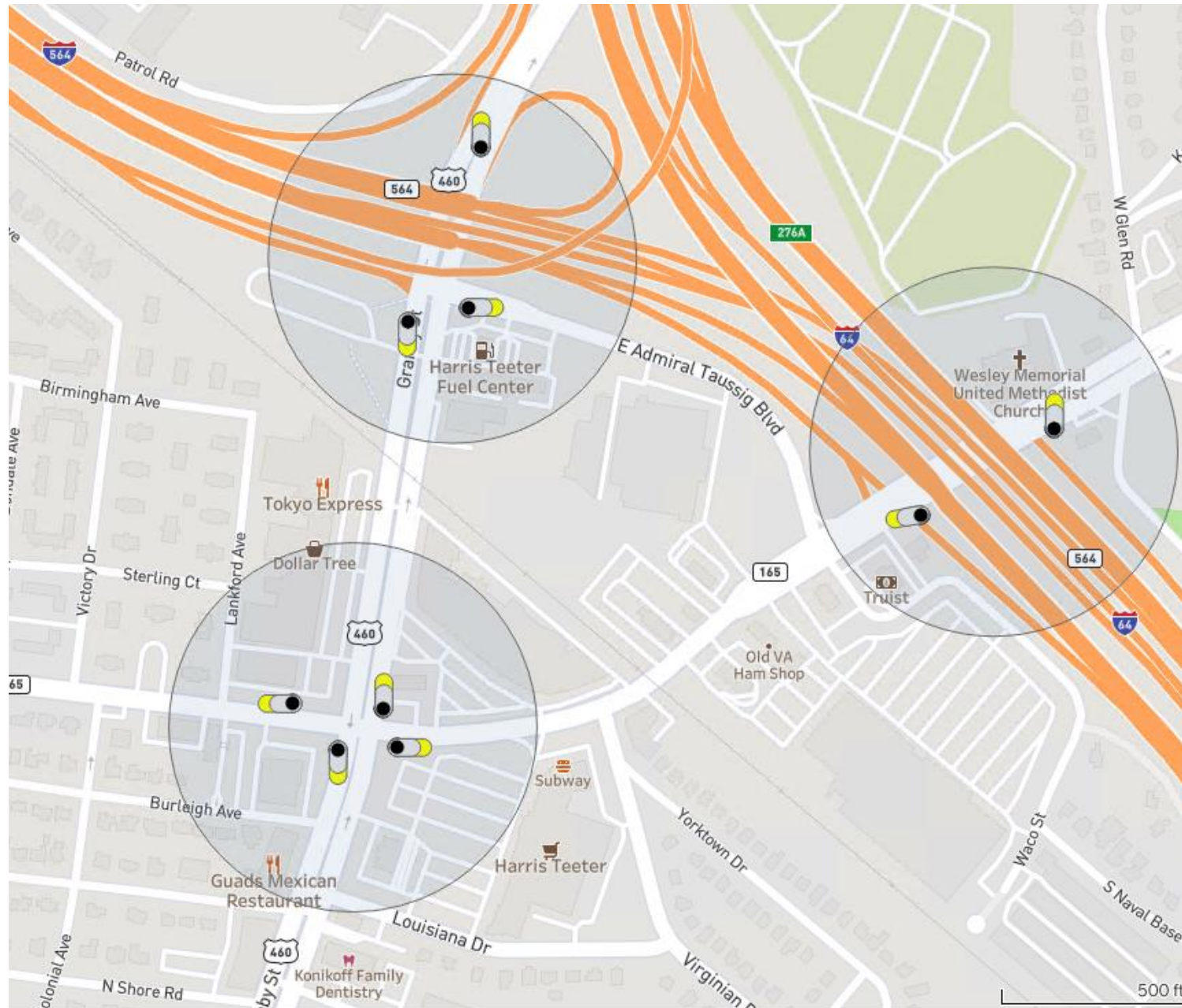
List of Cases Involving Trial and/or Deposition Testimony for Valentin Estevez, Ph.D.

LIST OF CASES INVOLVING VALENTIN ESTEVEZ'S TRIAL
AND/OR DEPOSITION TESTIMONY

TYPE	DATE	CASE	CASE NO.	COURT
Deposition	2/6/2025	Able Services Wage and Hour Cases	RG15773582 30-2016-00839857	Superior Court of California, County of Alameda Superior Court of California, County of Orange
Deposition	1/14/2025	Clancy et al. v. The Salvation Army	1:22-cv-01250	United States District Court, Northern District of Illinois, Eastern Division
Deposition	10/8/2024	Sydney Watson v. Blaze Media, LLC	3:23-cv-00279-B	United States District Court; Northern District of Texas, Dallas Division
Deposition	8/14/2024	Louis Butel, et al. v. Marathon Refining and Logistics Services LLC, et al.	2:23-cv-04547-DSF-JPR	United States District Court; Central District of California
Deposition	12/15/2021	Beatriz Aldapa, et al. v. Fowler Packing Company, Inc., et al.	1:15-cv-00420-DAD-SAB	United States District Court; Eastern District of California
Deposition	2/24/2020	Jose Vincente De La Cruz v. Standard Drywall, Inc.	BC591790	Superior Court of the State of California For the County of Los Angeles
Deposition	3/29/2018	Michael Ryan, et al. v. JBS Carriers, Inc.	BC624401	Superior Court of the State of California, County of Los Angeles, Central District
Deposition	1/9/2018	Julia Bernstein, et al. v. Virgin America, Inc.	3:15-cv-02277-JST	United States District Court; Northern District of California
Deposition	11/6/2017	Dina Rae Richardson v. Interstate Hotels & Resorts, Inc., et al.	16-cv-06772-WHA	United States District Court; Northern District of California
Deposition	9/15/2016	Julia Bernstein, et al. v. Virgin America, Inc.	3:15-cv-02277-JST	United States District Court; Northern District of California
Deposition	7/25/2016	Reynaldo Lopez, et al. v. Delta Air Lines, Inc.	2:15-cv-07302-SVW-SS	United States District Court; Central District of California
Trial	6/19/2009	George Rodriguez v. City of Houston, et al.	06-2650	United States District Court; Southern District of Texas, Houston Division
Deposition	3/4/2009	George Rodriguez v. City of Houston, et al.	06-2650	United States District Court; Southern District of Texas, Houston Division

Appendix C

Expert Report Exhibits and Tables

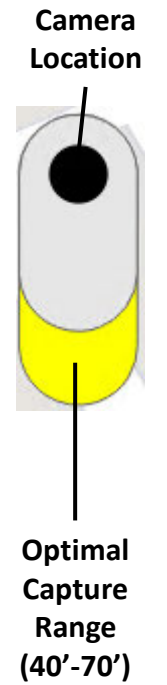
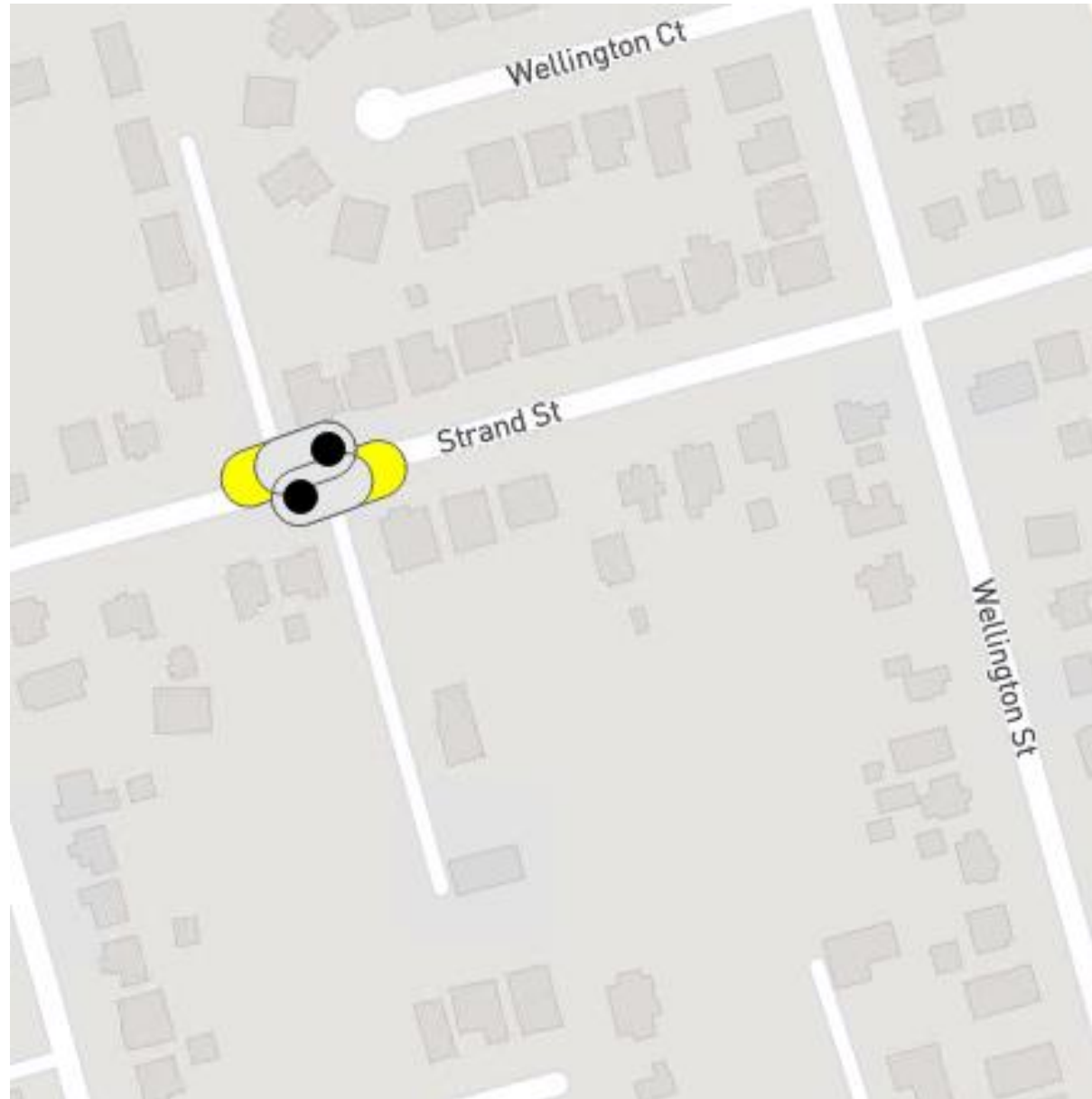


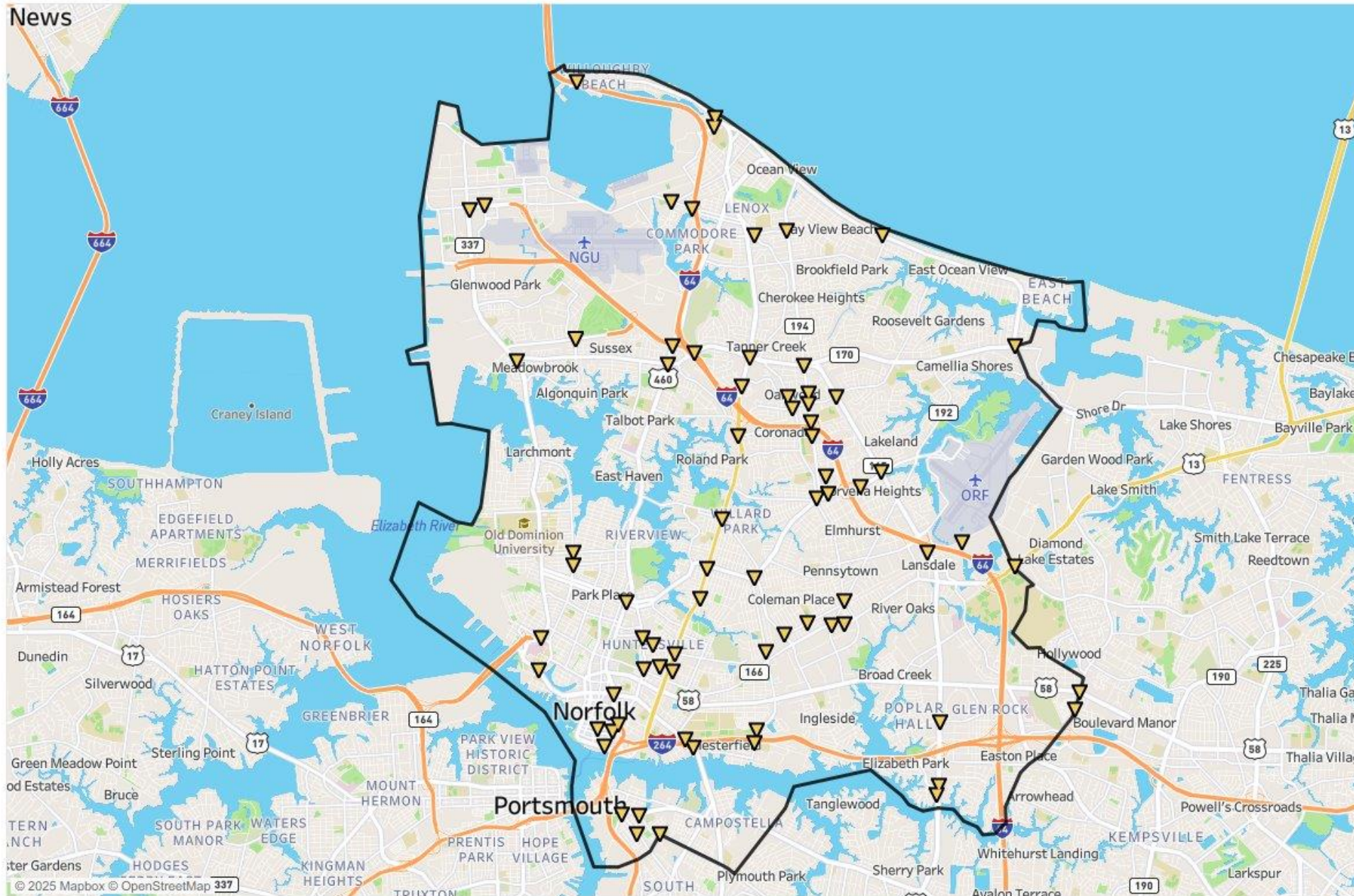
Depicting camera clusters
and certain intersections

Camera
Location

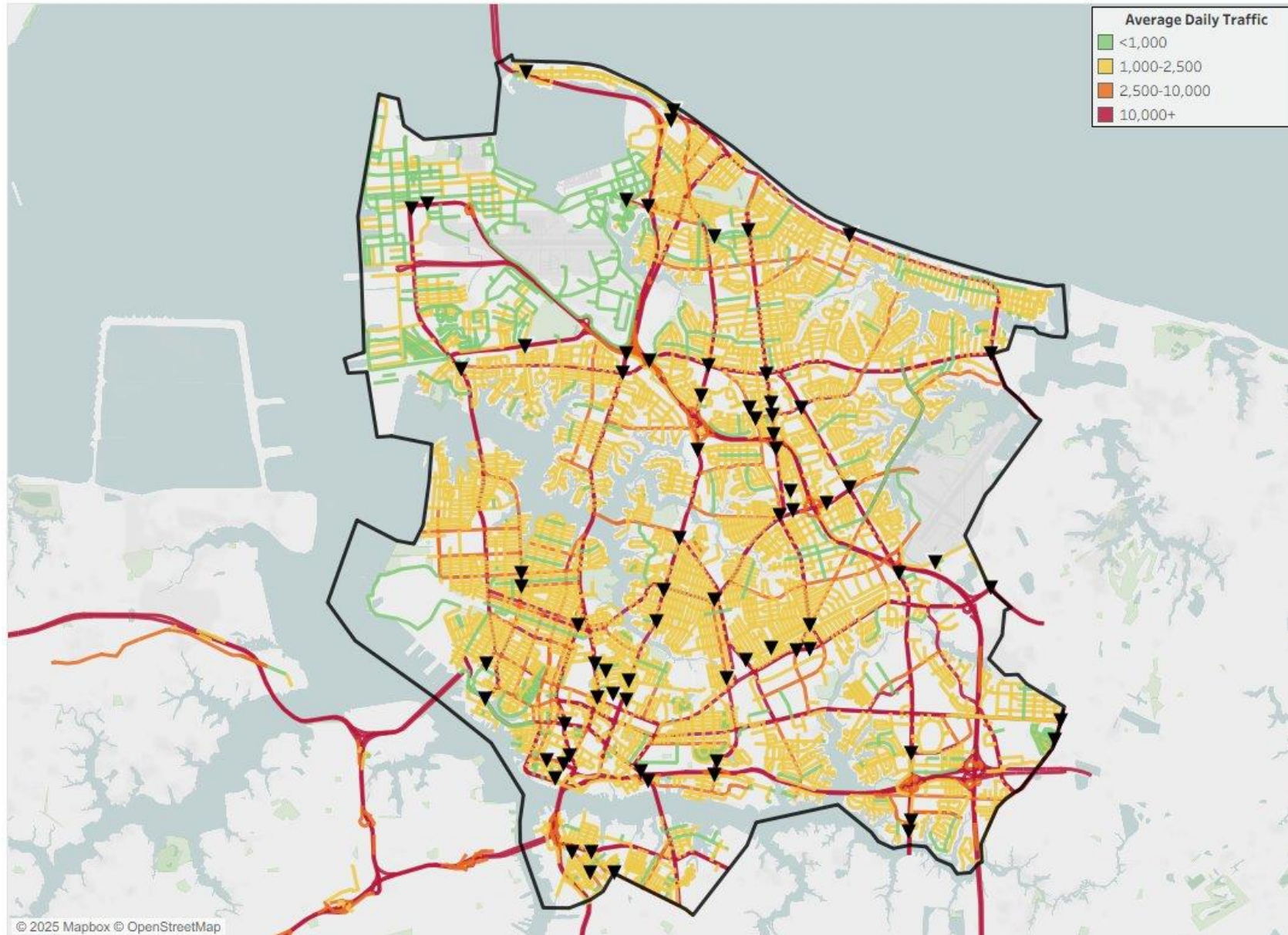


Optimal
Capture
Range
(40'-70')





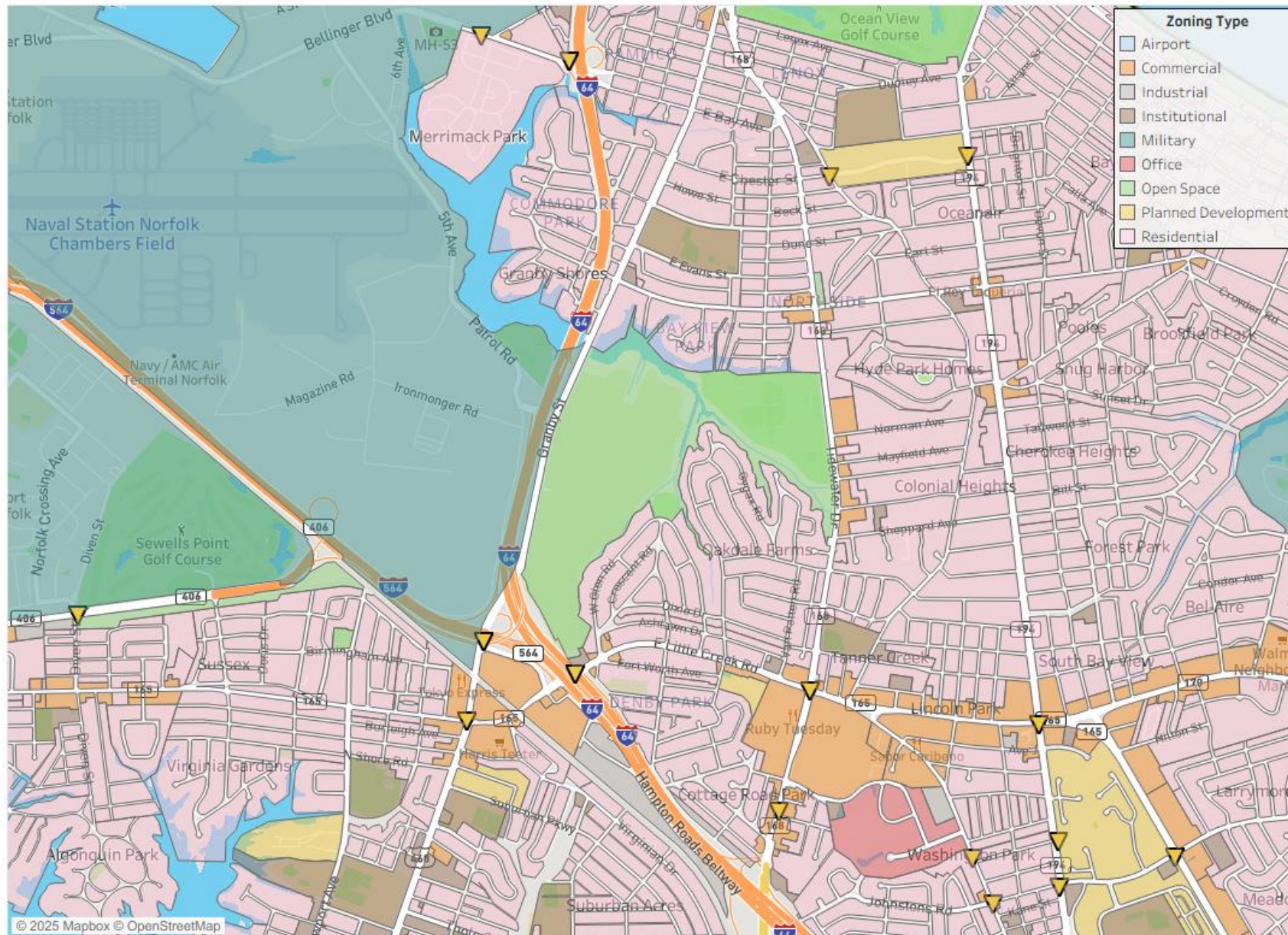
Depicting clusters of NPD-operated Flock cameras in the city of Norfolk. A cluster is defined as a set of cameras within 500 feet of one another.



Depicting placement of clusters of NPD-operated Flock cameras overlaid with traffic data

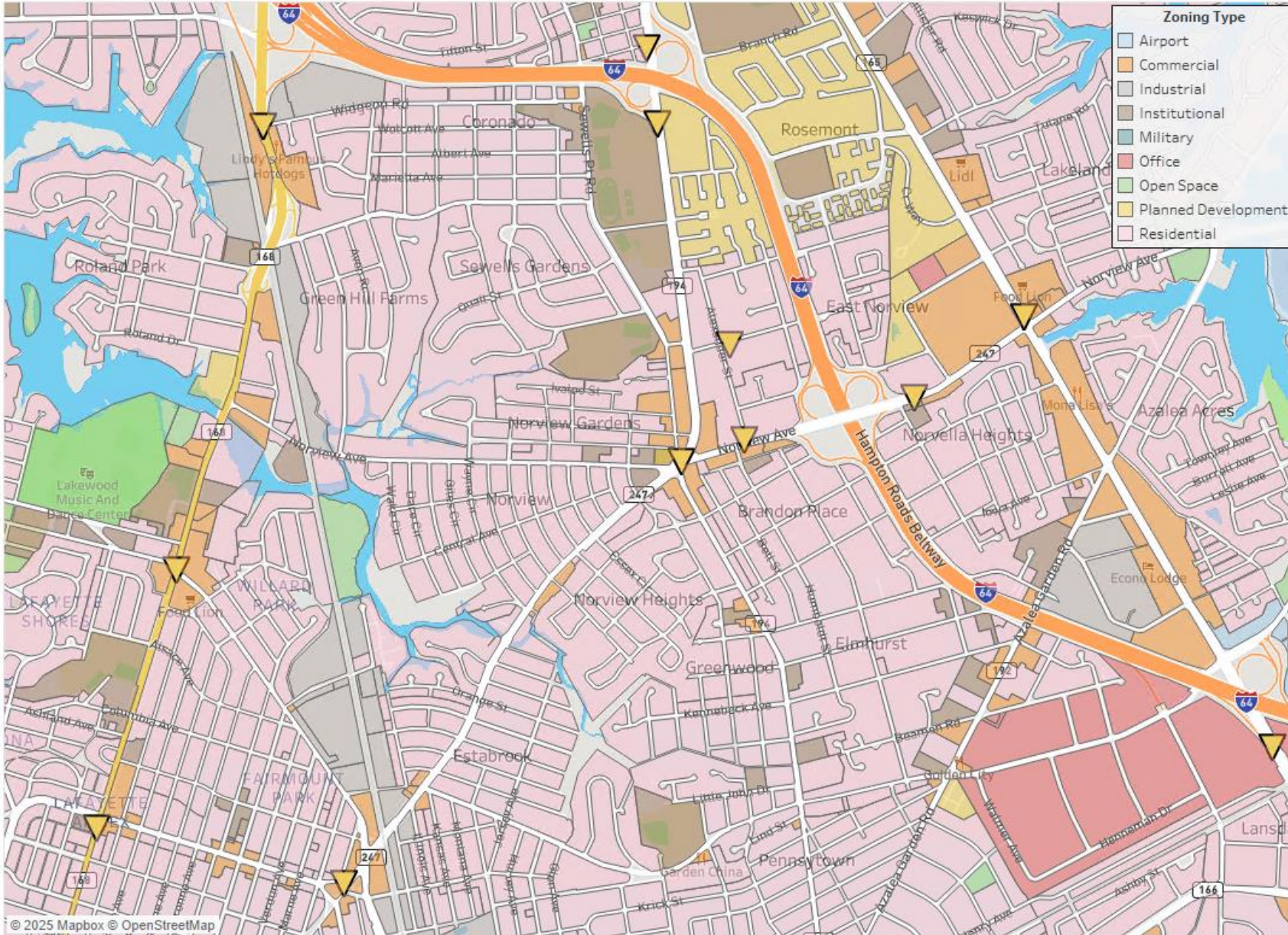
Sources:

[1] AADT 2023 Norfolk Maintenance Area, Virginia Open Data Portal
<https://data.virginia.gov/datasets/aadt-2023-norfolk-maintenance-area>



Depicting placement of clusters of NPD-owned Flock cameras overlaid on a zoning map of a sample area of Norfolk

Source:
Zoning, City of Norfolk,
<https://norfolkgisdata-orf.opendata.arcgis.com/datasets/ORF::zoning-1/about>



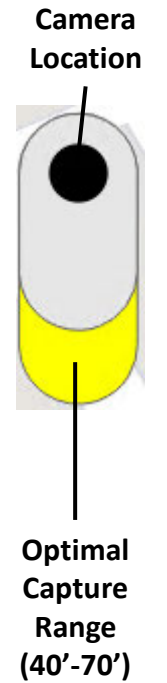
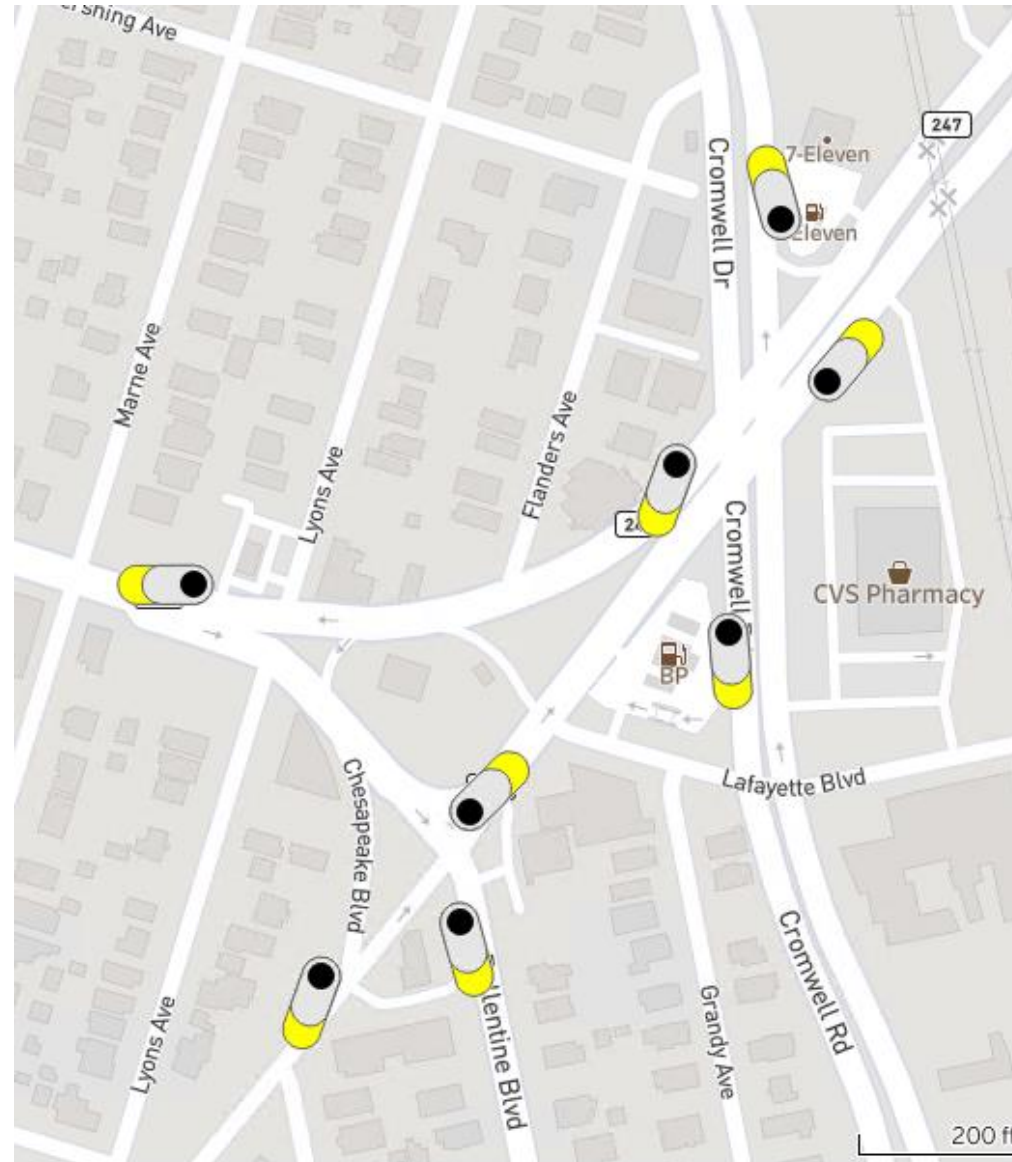
Depicting placement of clusters of NPD-owned Flock cameras overlaid on a zoning map of a sample area of Norfolk

Source:
Zoning, City of Norfolk,
<https://norfolkgisdata-orf.opendata.arcgis.com/datasets/ORF::zoning-1/about>



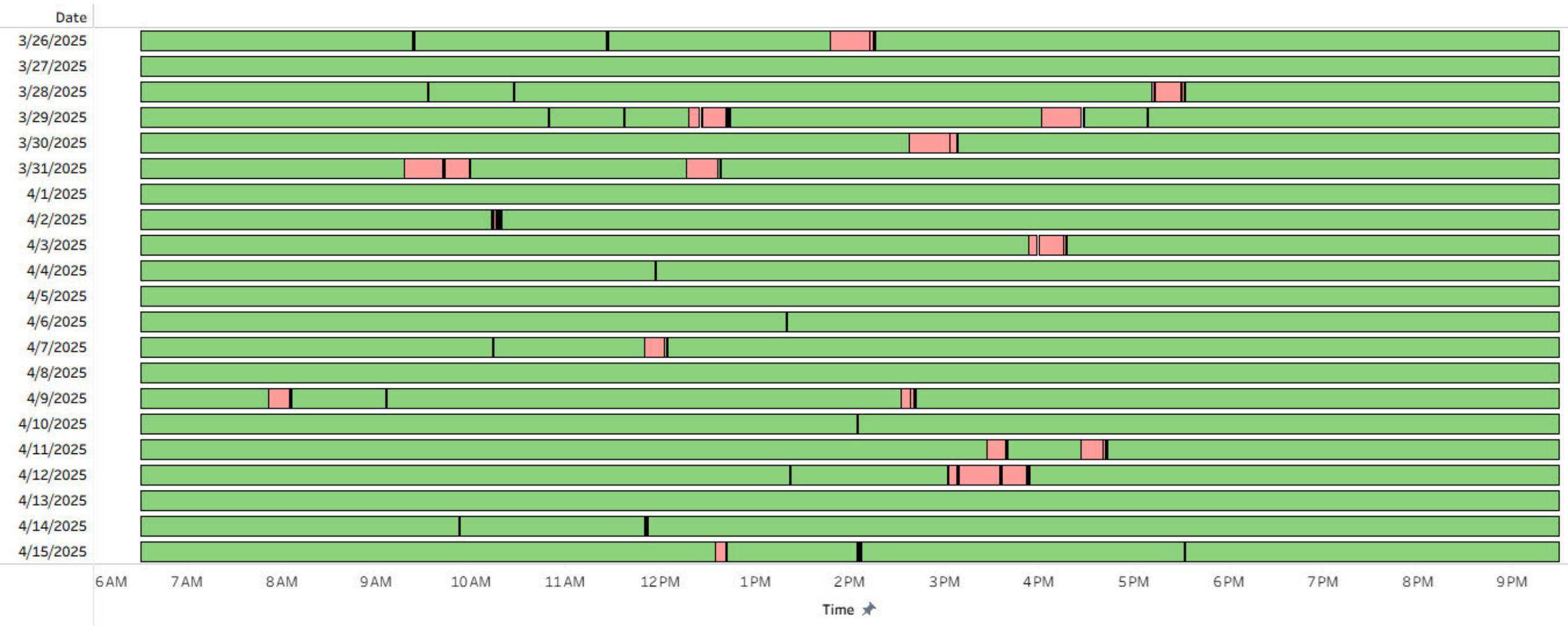
Depicting placement of clusters of NPD-owned Flock cameras overlaid on a zoning map of a sample area of Norfolk

Source:
Zoning, City of Norfolk,
<https://norfolkisdata-orf.opendata.arcgis.com/datasets/ORF::zoning-1/about>



Note: [1] These images demonstrate representative examples of approximate camera ranges based on the capability of the LPR Solar camera to optimally capture vehicles optimally from a distance of 40 feet to 70 feet away (Source: "FLO00000057.pdf"). The camera is located at the black circle and the camera's range is represented by the yellow field in front of the camera. [2] Although cameras are sometimes identified with the direction of traffic they are capturing (e.g., "SB" for "southbound") the exact angle of each camera's field of view is not known. These camera angles are approximated.

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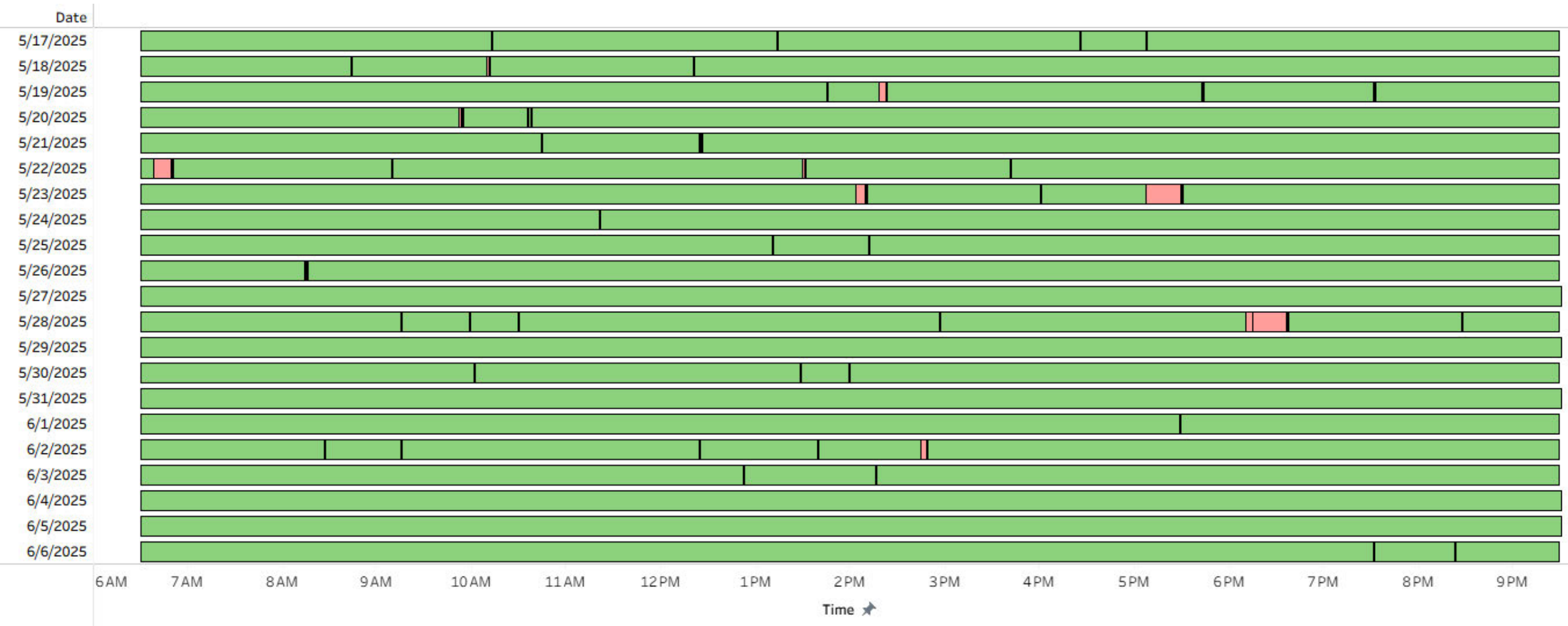


Depiction of the 21-Day Window with Lowest “Blackout” Rate (March 26, 2025 – April 15, 2025)

This chart is limited only to cameras located in Norfolk.

Captures Within 30 Minutes

CONFIDENTIAL - FOR ATTORNEYS’ EYES ONLY

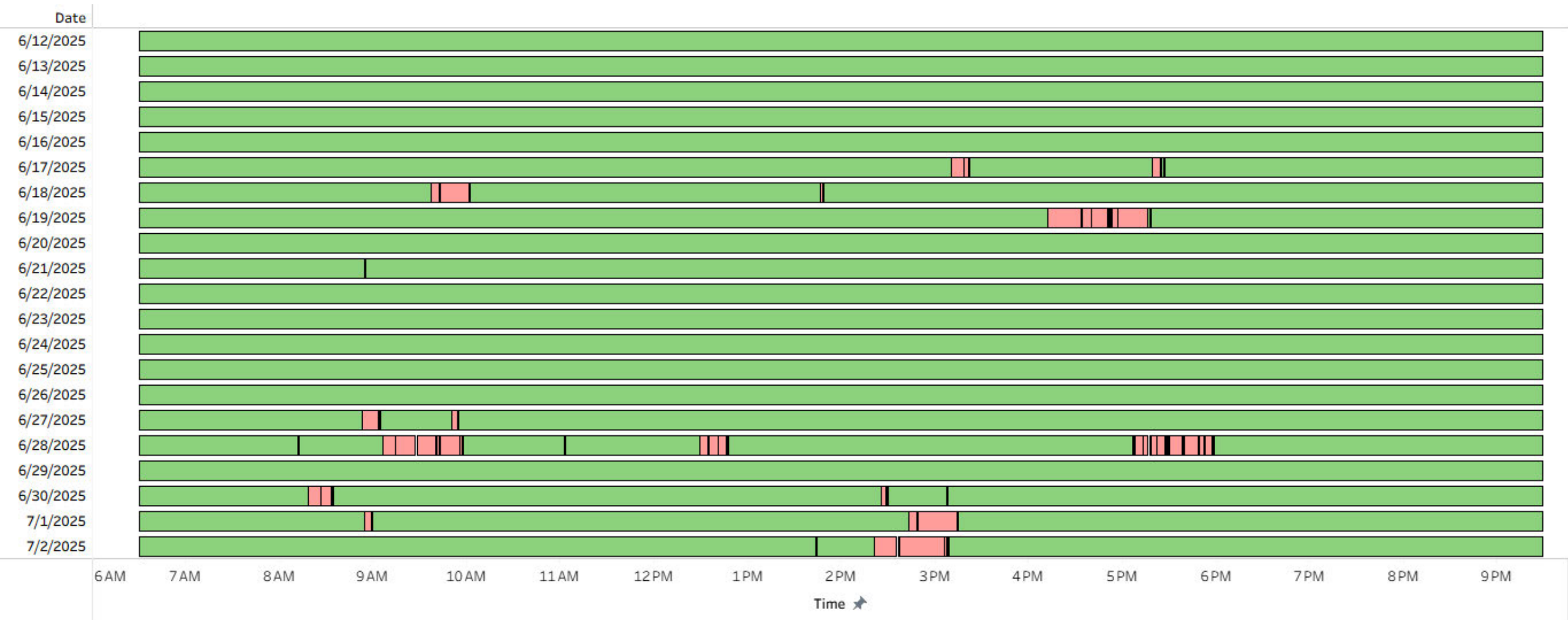


Depiction of the 21-Day Window with Highest “Blackout” Rate (May 17, 2025 – June 6, 2025)

This chart is limited only to cameras located in Norfolk.

Captures Within 30 Minutes

CONFIDENTIAL - FOR ATTORNEYS’ EYES ONLY

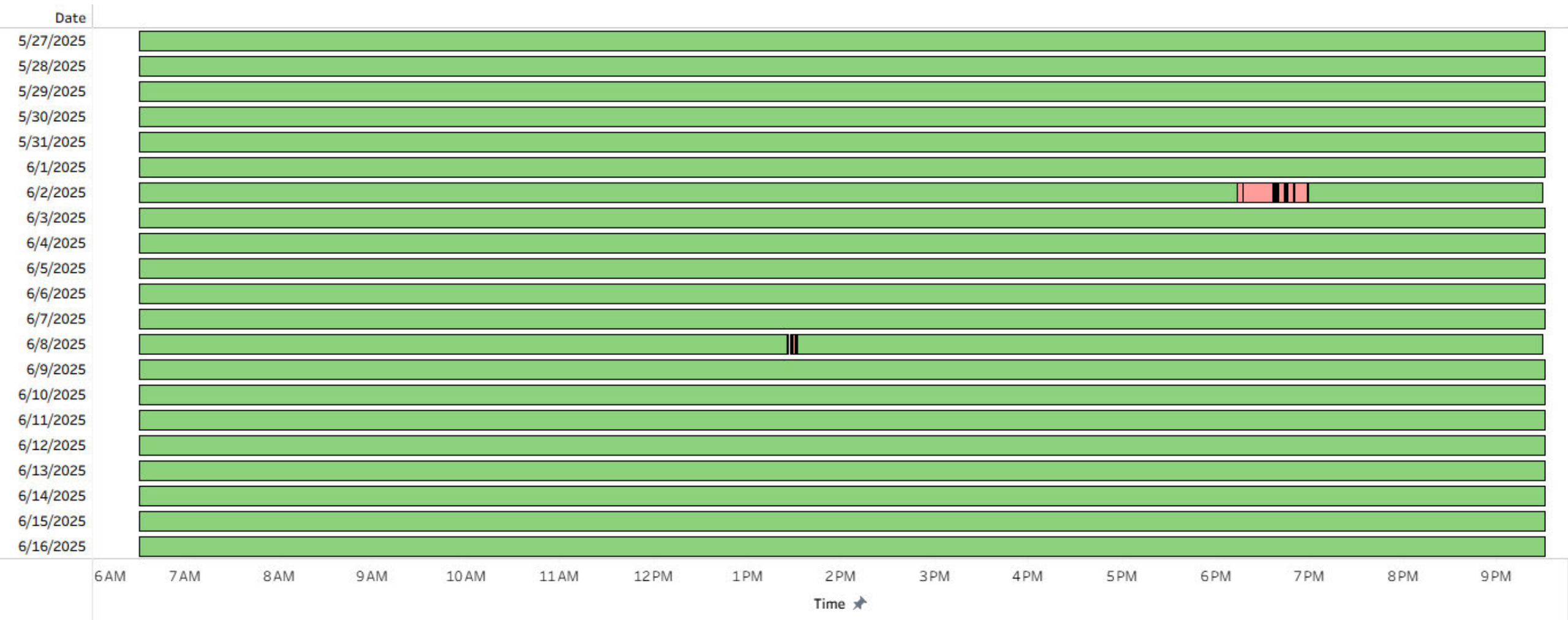


Depiction of the 21-Day Window with Lowest “Blackout” Rate (June 12, 2025 – July 2, 2025)

This chart is limited only to cameras located in Norfolk.

Captures Within 30 Minutes

CONFIDENTIAL - FOR ATTORNEYS’ EYES ONLY

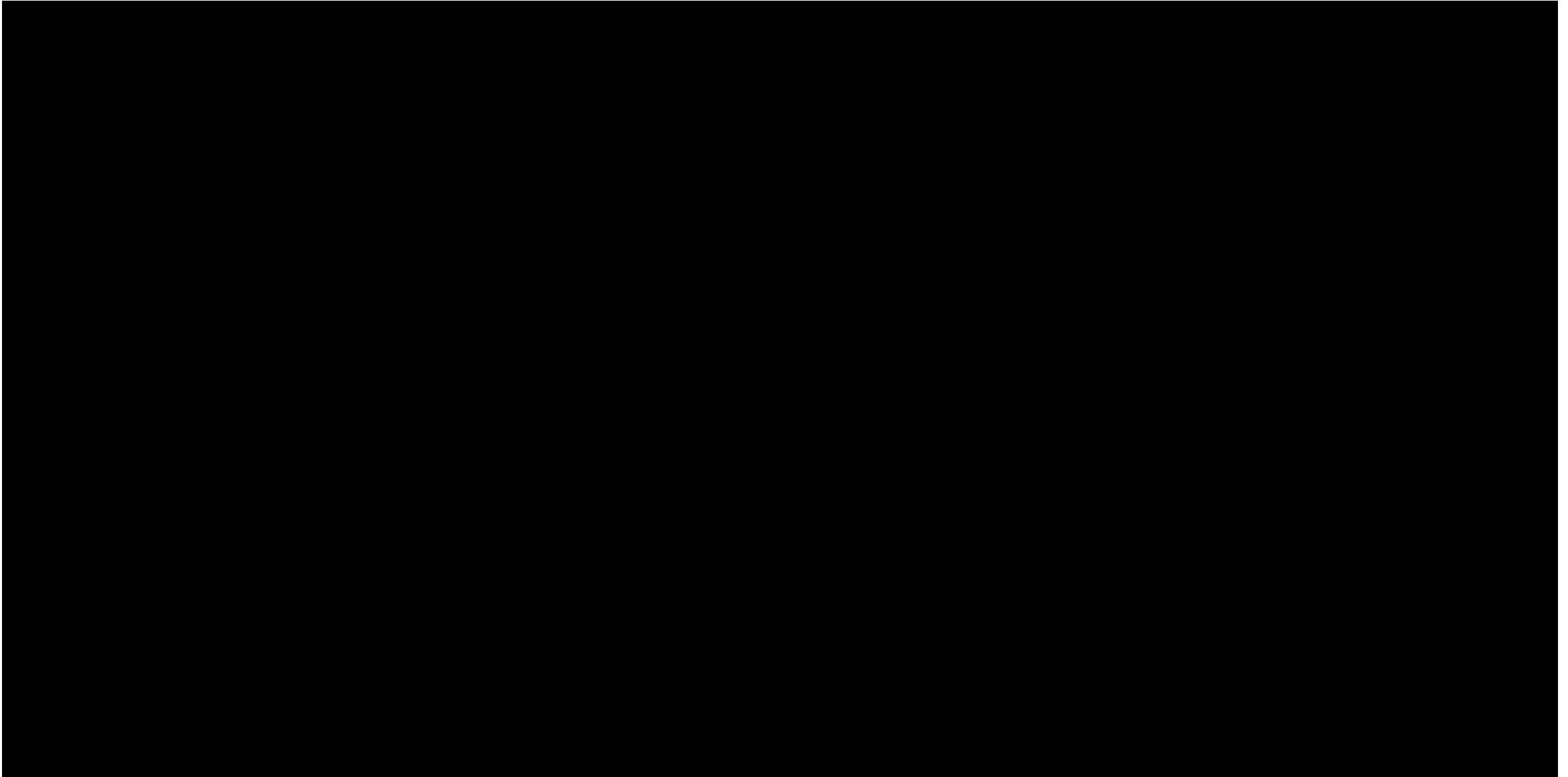


Depiction of the 21-Day Window with Highest “Blackout” Rate (May 27 – June 16, 2025)

This chart is limited only to cameras located in Norfolk.

Captures Within 30 Minutes

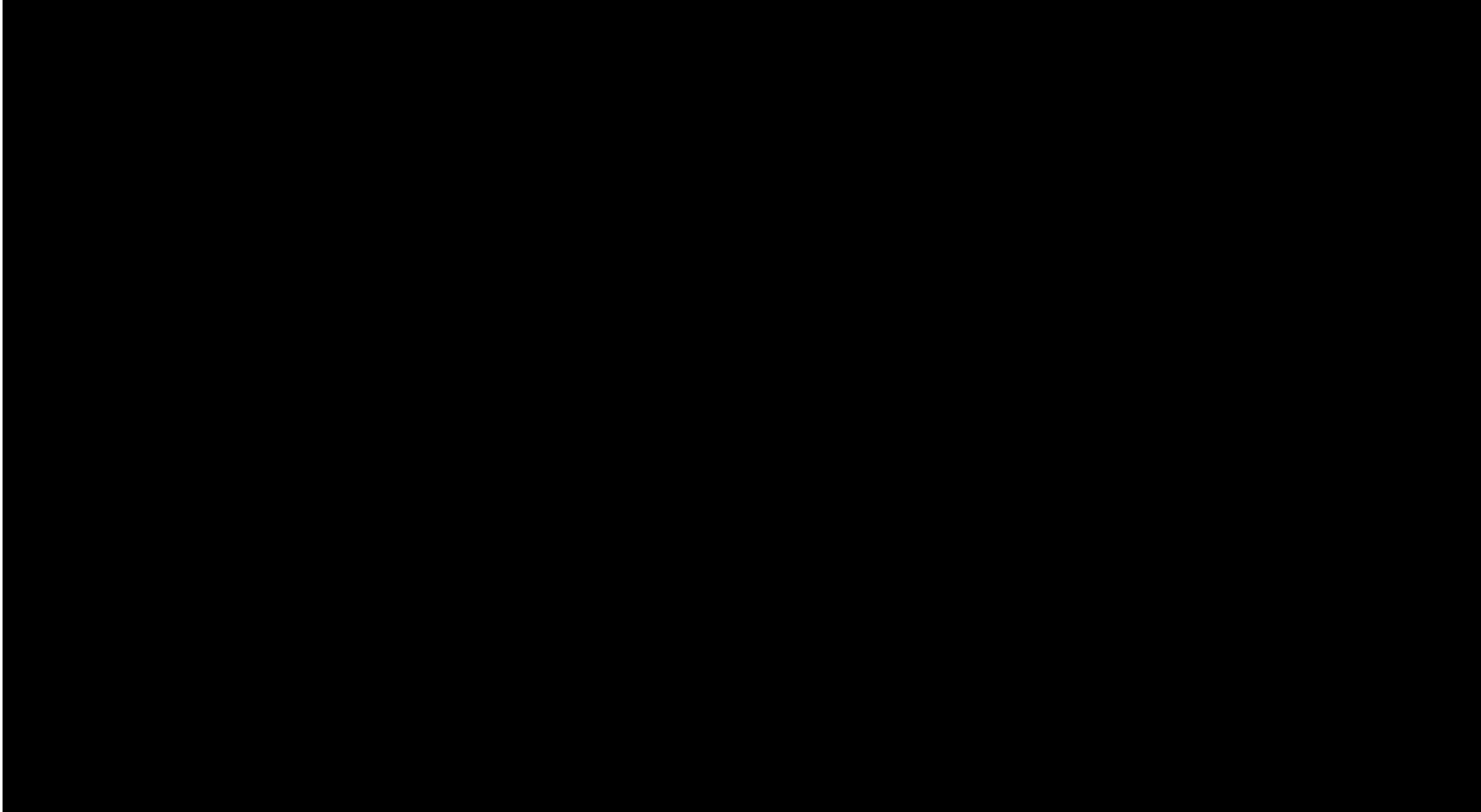
CONFIDENTIAL - FOR ATTORNEYS’ EYES ONLY

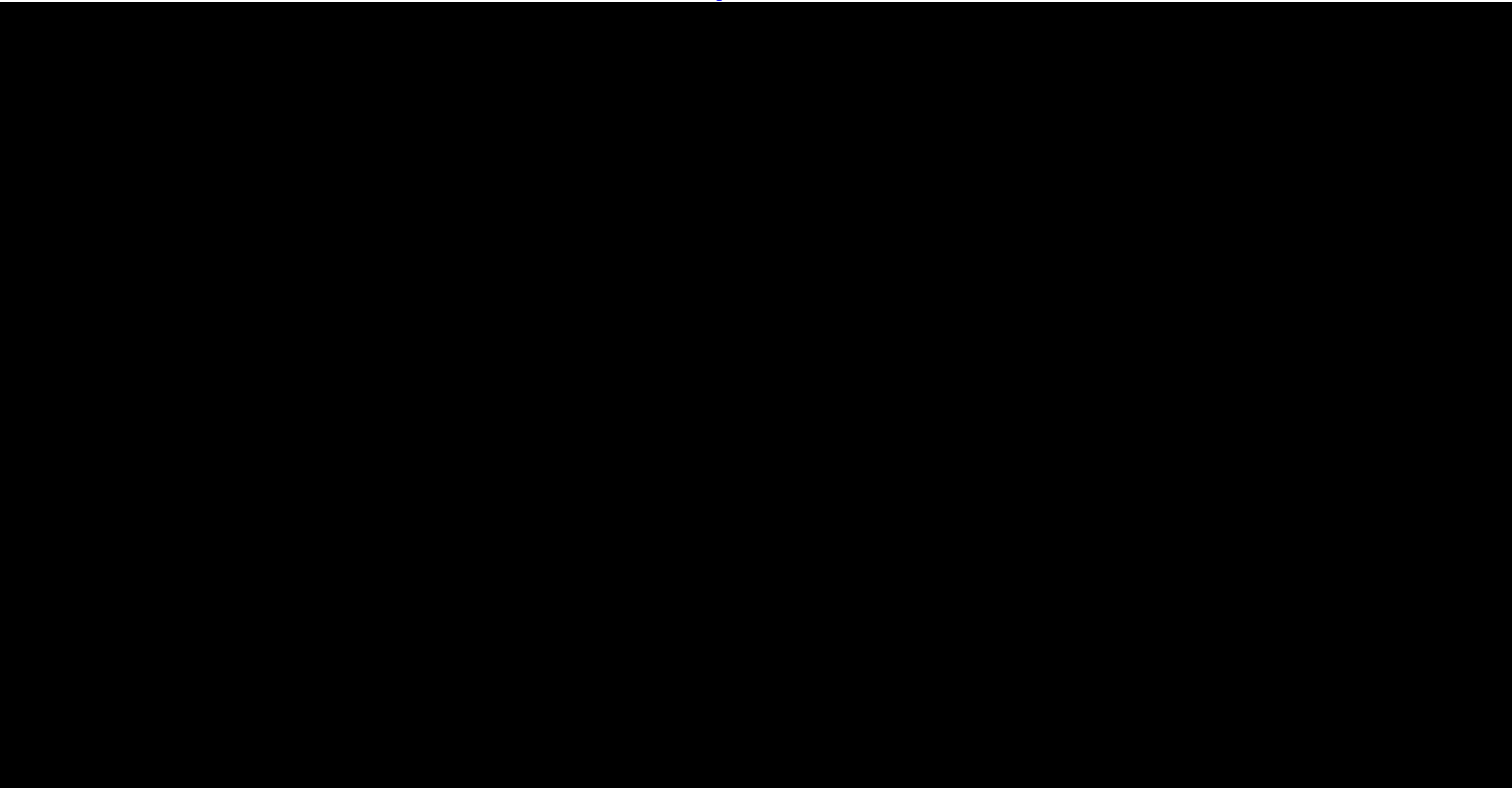


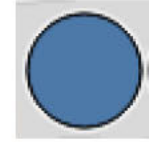
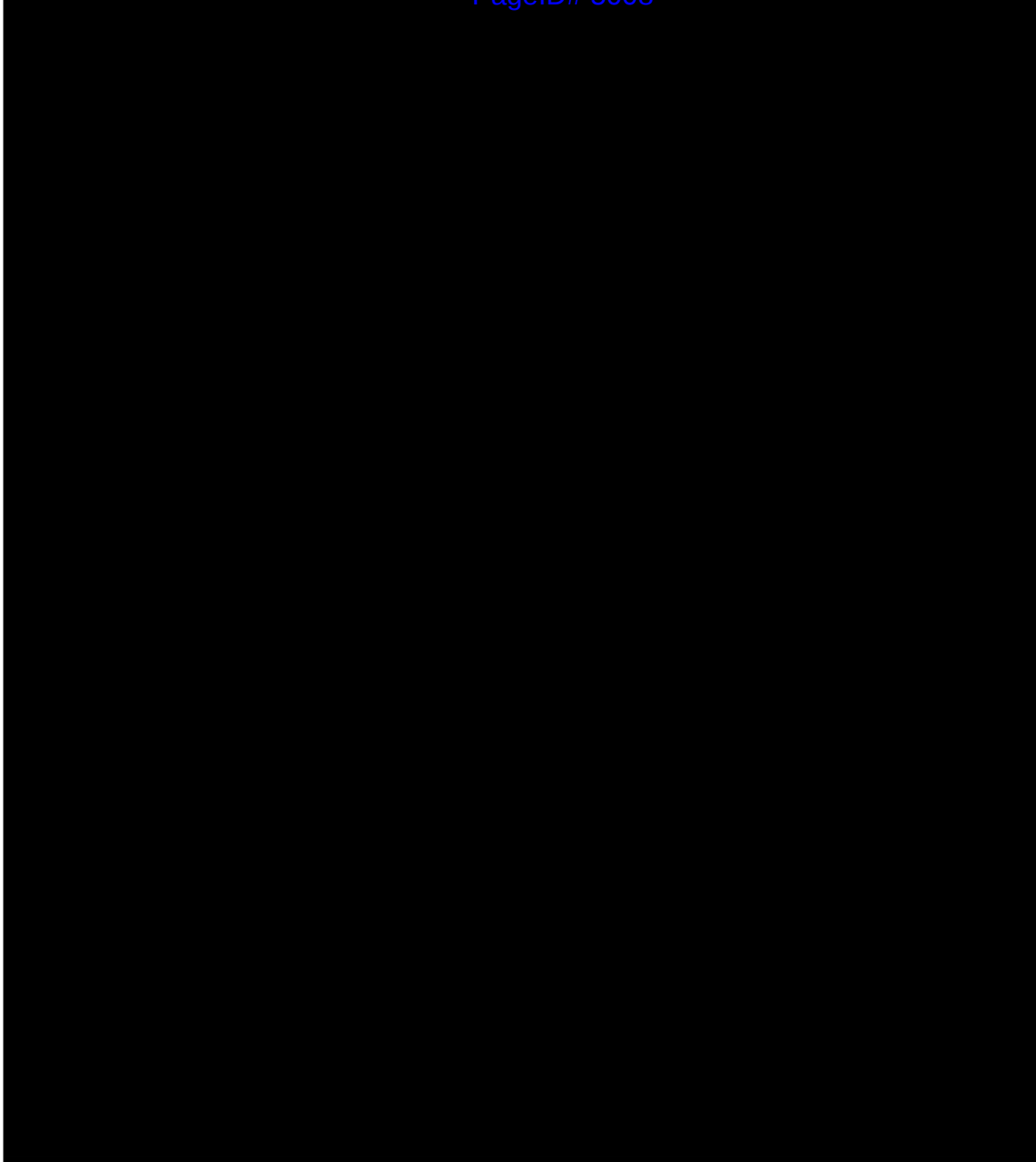
Note: [1] These images demonstrate representative examples of approximate camera ranges based on the capability of the Falcon LPR Solar camera to capture vehicles optimally from a distance of 40 feet to 70 feet away (Source: "FLO000000057.pdf"). The camera is located at the black circle and the camera's range is represented by the yellow field in front of the camera. [2] Although cameras are sometimes identified with the direction of traffic they are capturing (e.g., "SB" for "southbound") the exact angle of each camera's field of view is not known. These camera angles are approximated.

CONFIDENTIAL - FOR ATTORNEYS' EYES ONLY

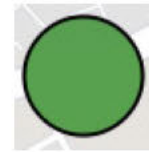
Exhibit 10: Establishments Near Flock Cameras Closest to [REDACTED]







Establishment



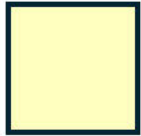
[REDACTED]

#[Order of Capture] @ [Time Captured]

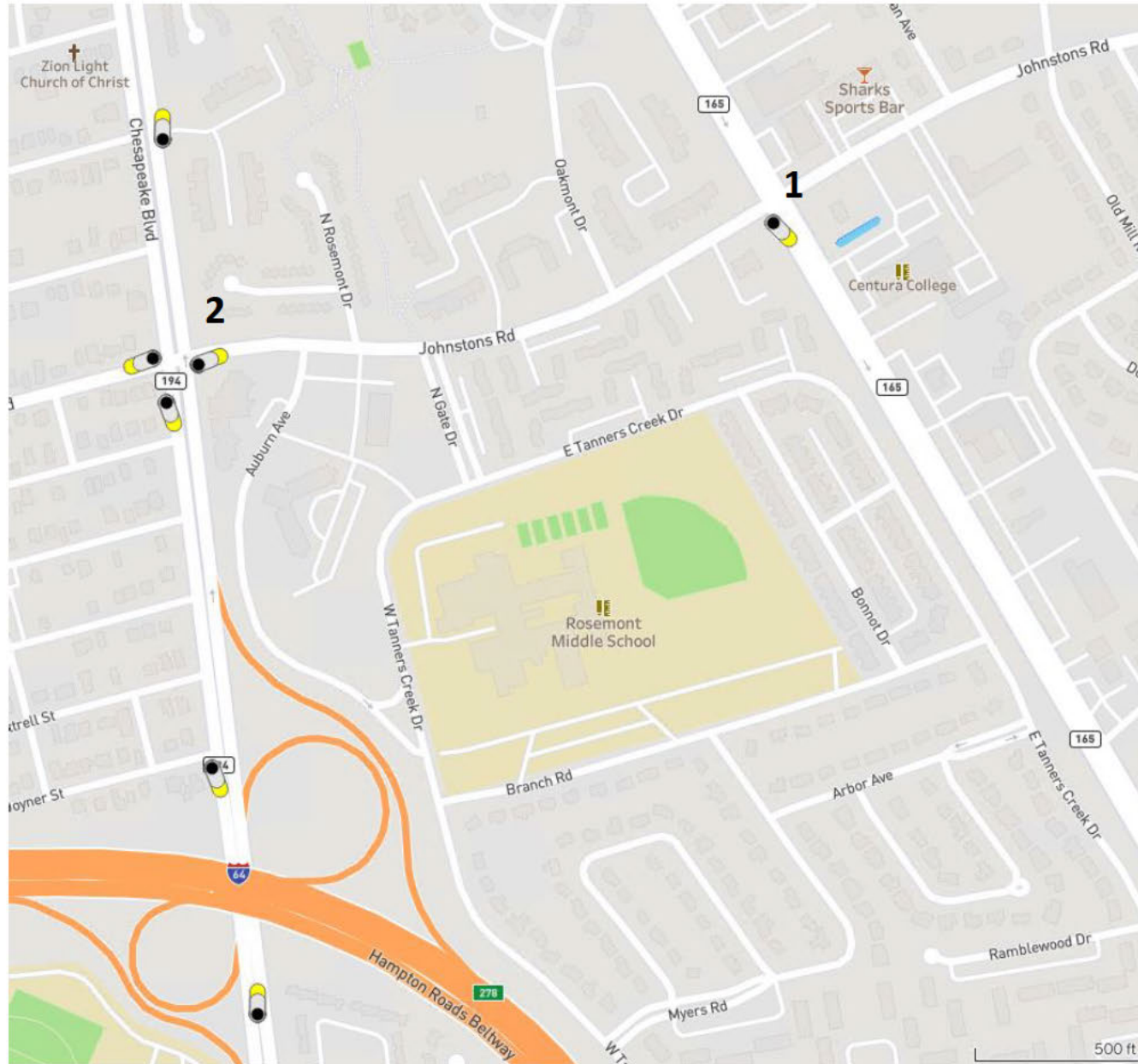
Camera
Location



Optimal
Capture
Range
(40'-70')



Approximate
camera field
of vision



1



2

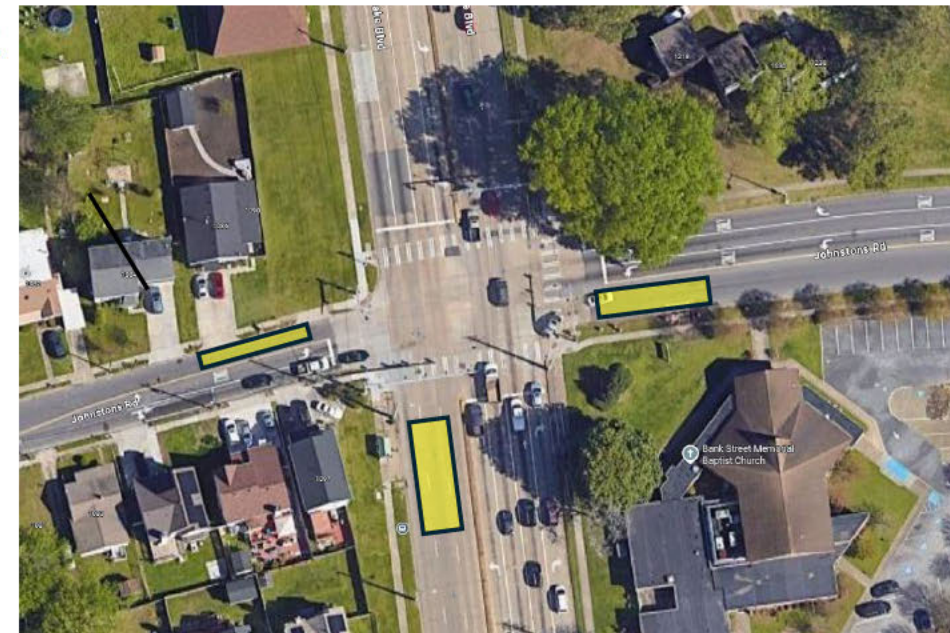
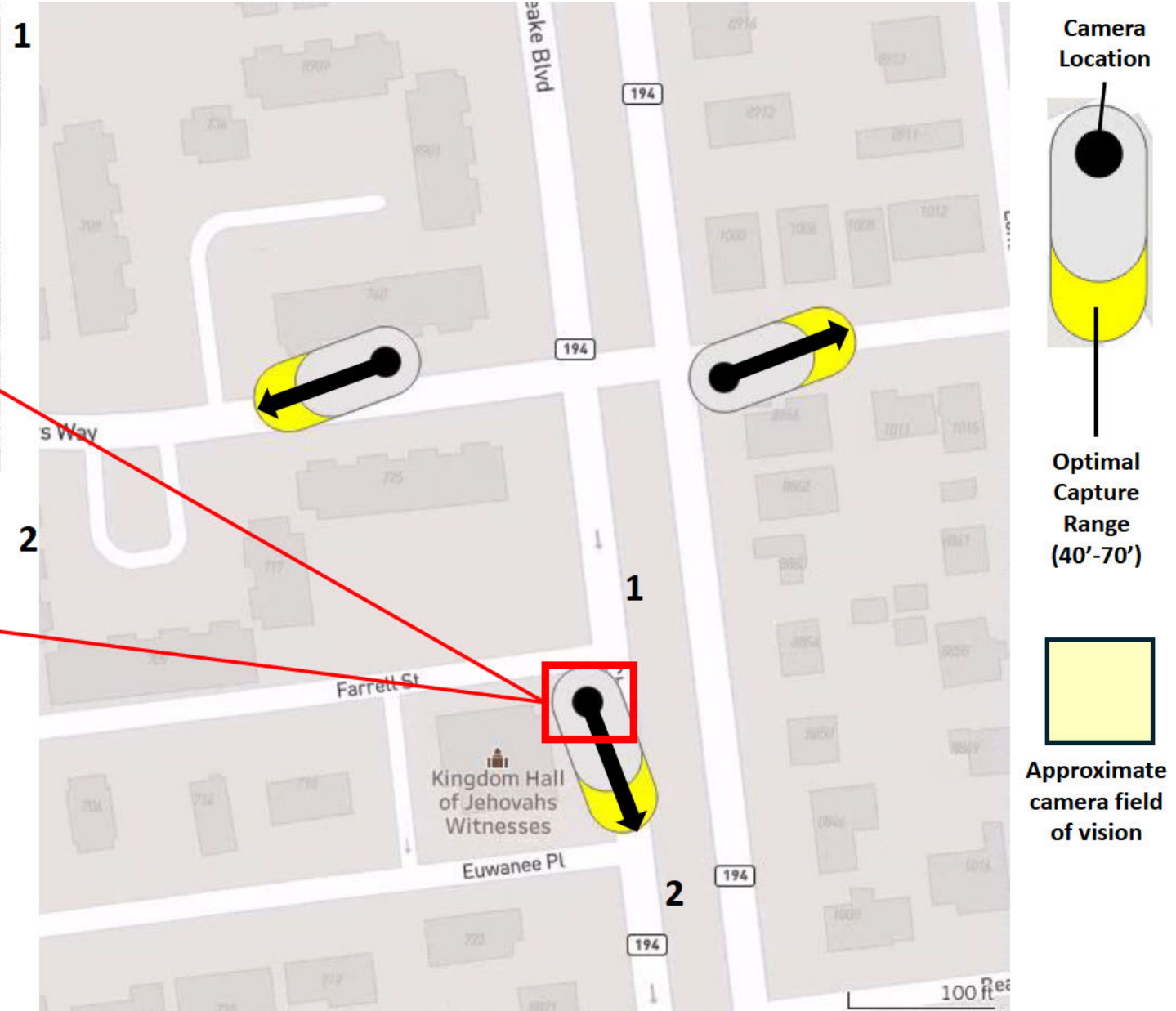
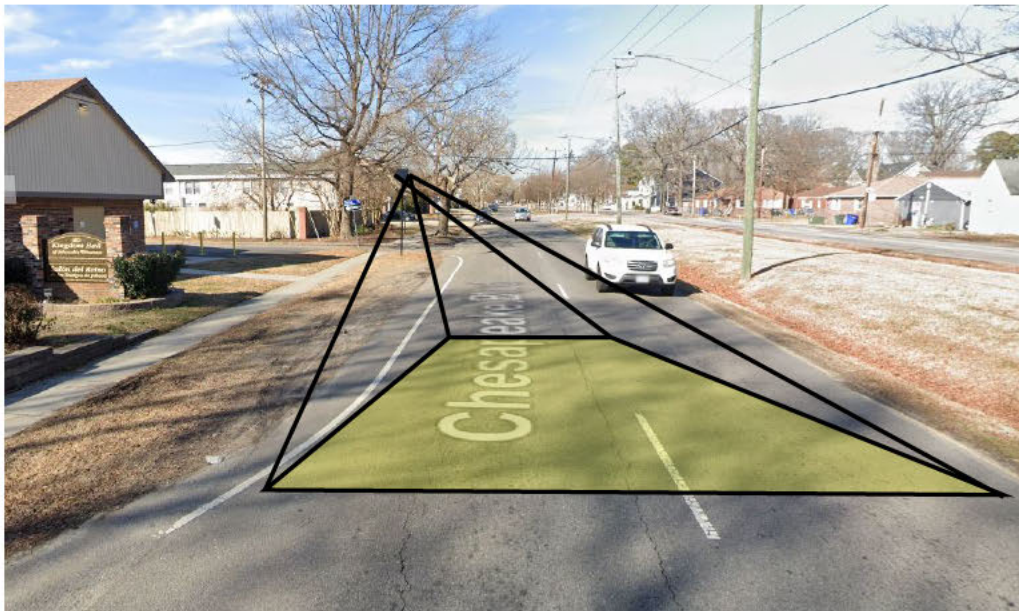
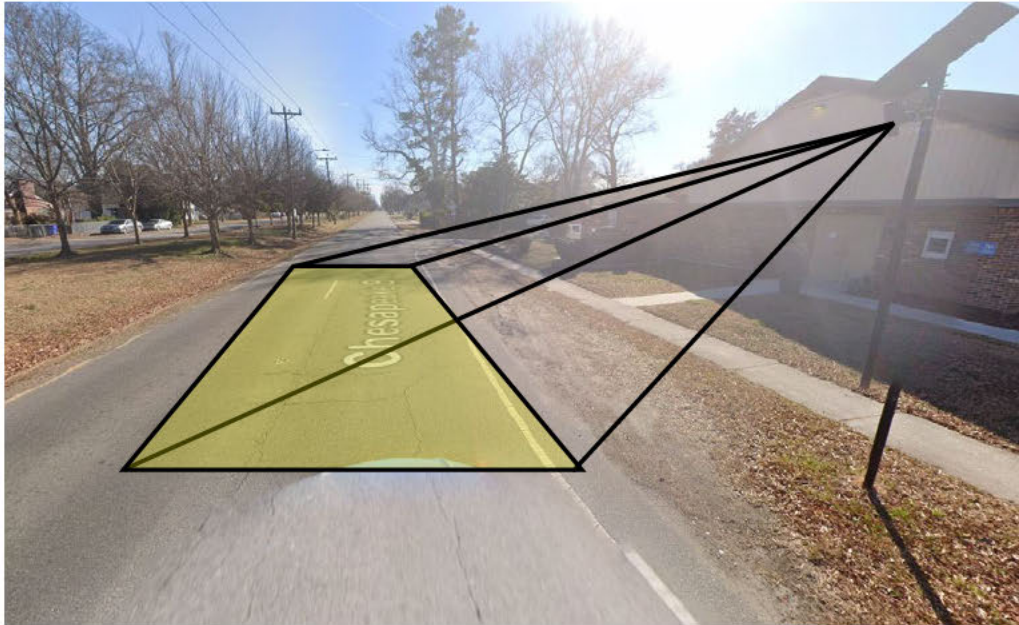


Exhibit 16: Flock Camera Near Kingdom Hall of Jehovah's Witnesses Does Not Capture Cars Entering from Chesapeake Boulevard



CONFIDENTIAL - FOR ATTORNEYS' EYES ONLY



1



2

Camera Location

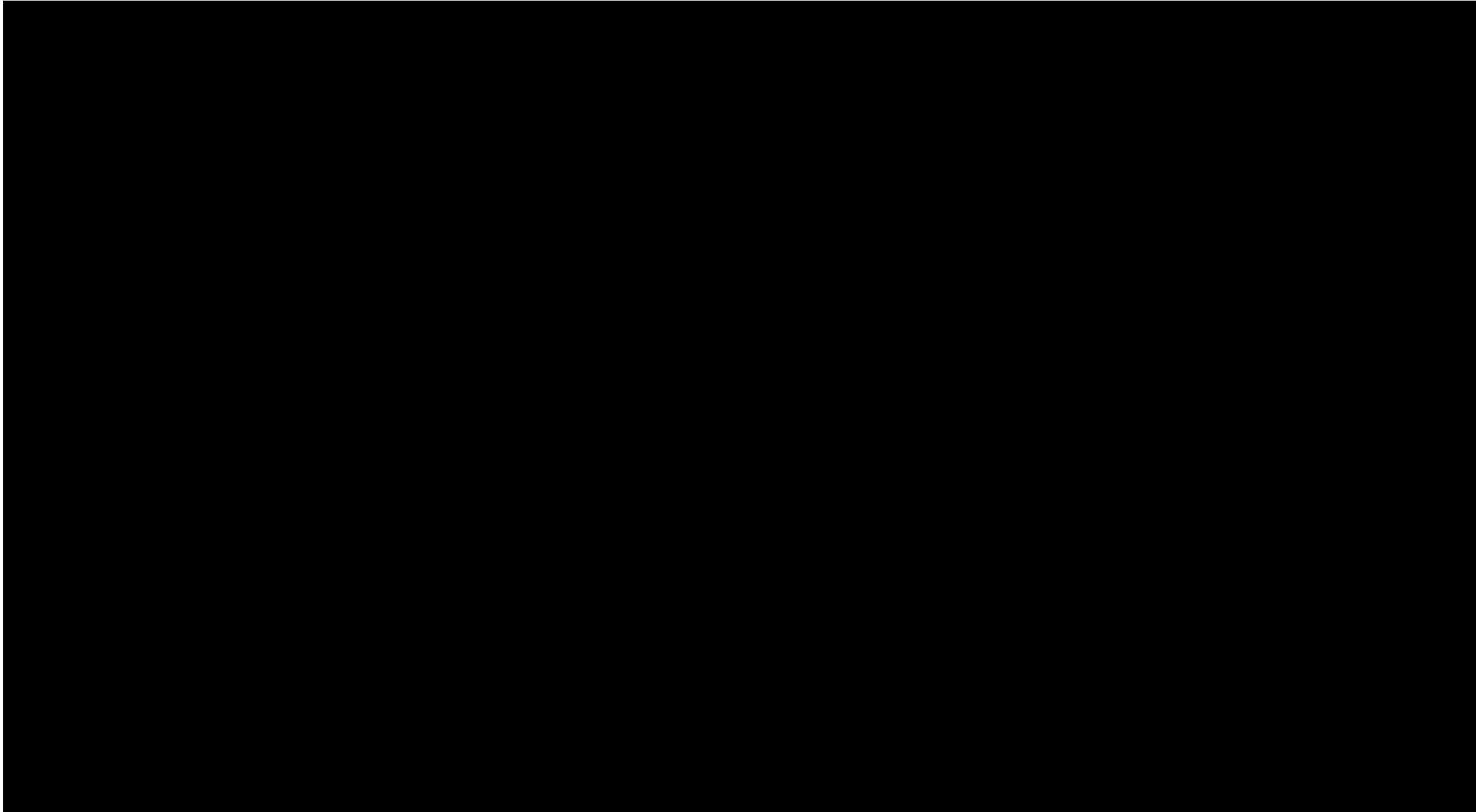


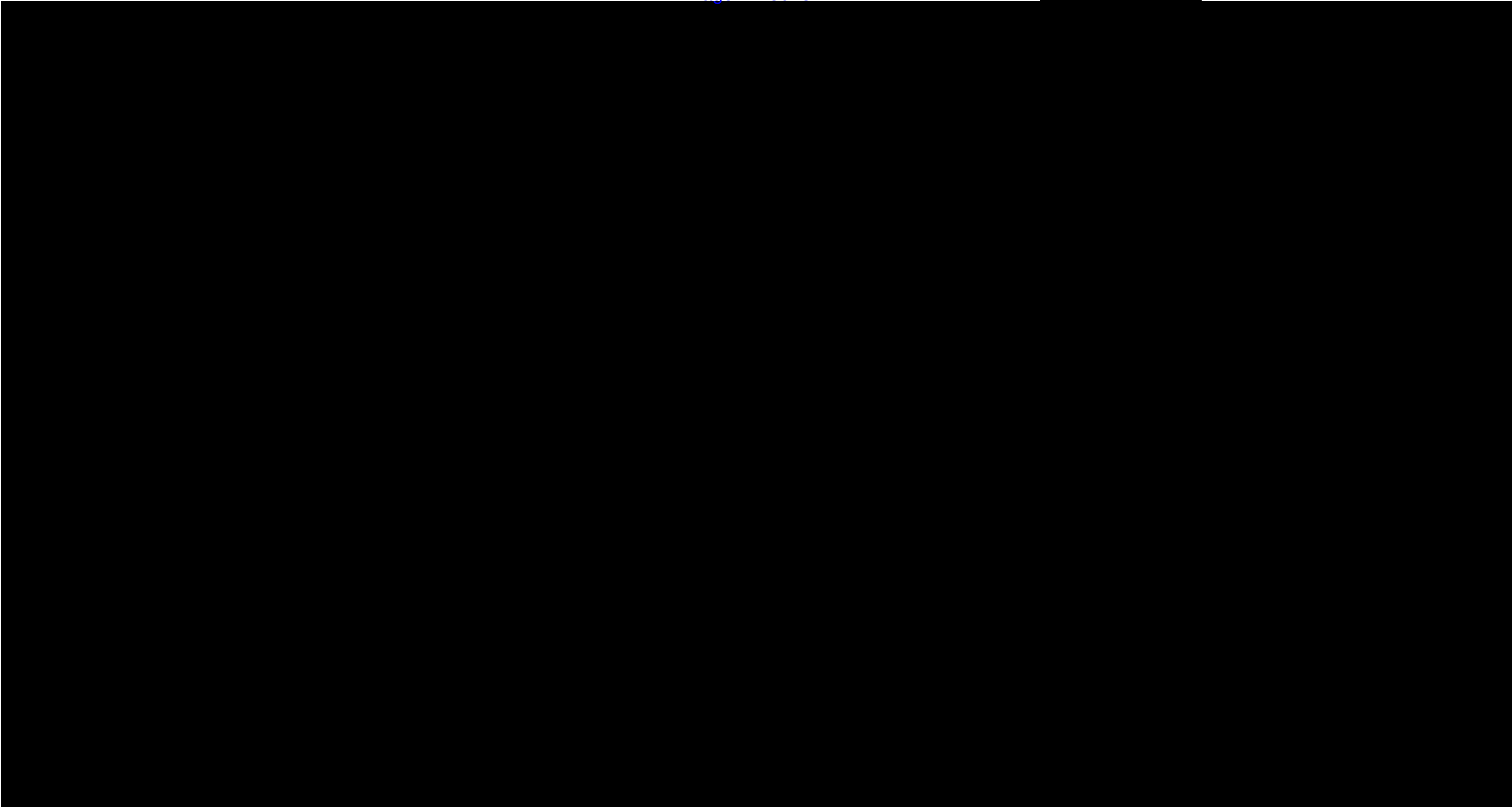
Optimal Capture Range (40'-70')



Approximate camera field of vision







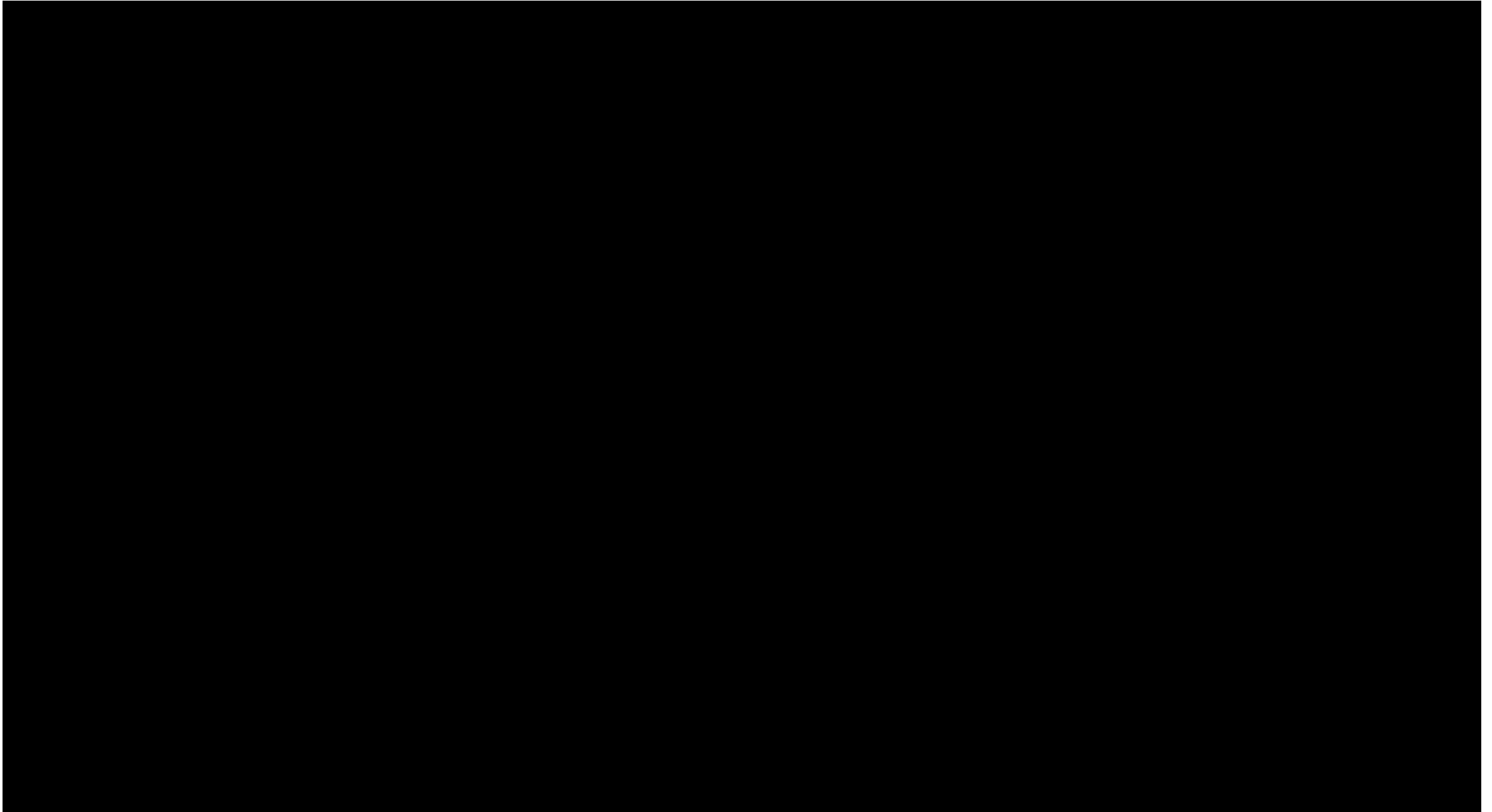


Table 1. The Data Collected by Flock Cameras Does Not Record Who Drove a Vehicle that Passed by a Camera, Where It Came From, or Where It Was Headed

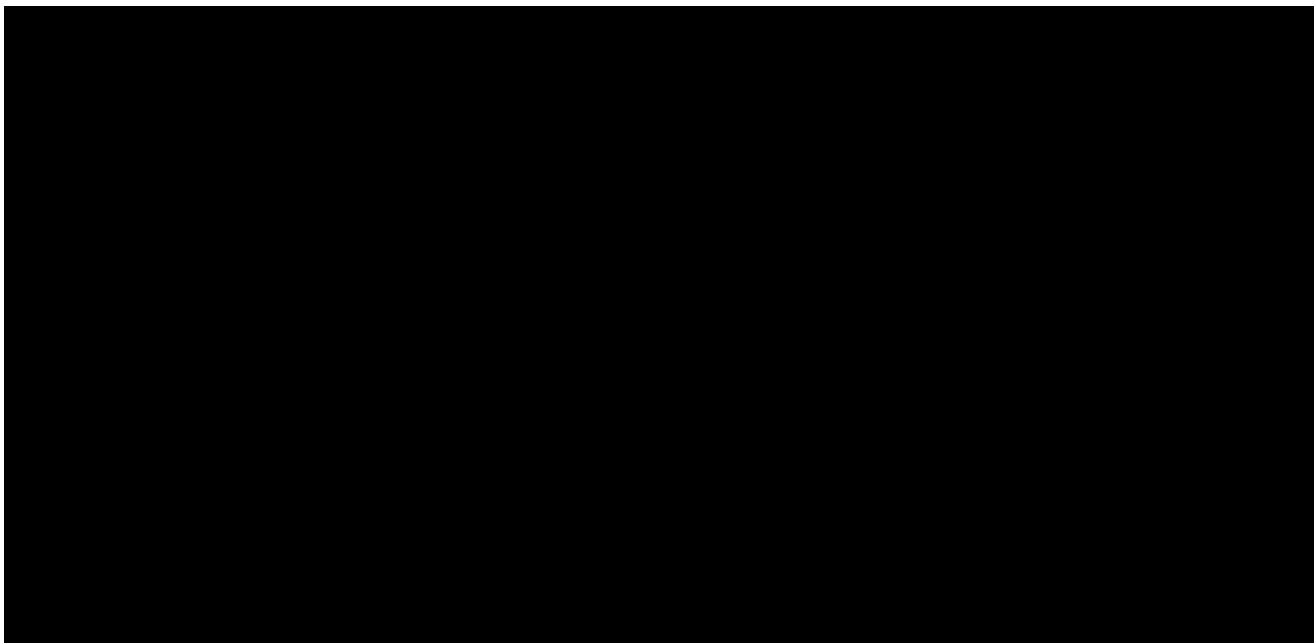


Table 2. Most Flock Cameras are Clustered

Clusters are determined by cameras within 500 feet within city limits.

Camera Name	Account Name
039 NB CHESAPEAKE AT CROMWELL	VA - Norfolk PD
040 SB CHESAPEAKE AT CROMWELL	VA - Norfolk PD
041 SB CROMWELL AT CHESAPEAKE	VA - Norfolk PD
042 NB CROMWELL AT CHESAPEAKE	VA - Norfolk PD
043 NB CHESAPEAKE AT LAFAYETTE	VA - Norfolk PD
044 SB BALLENTINE AT CHESAPEAKE	VA - Norfolk PD
045 SB CHESAPEAKE AT BALLENTINE	VA - Norfolk PD
046 WB LAFAYETTE AT BALLENTINE	VA - Norfolk PD
054 EB NORVIEW AT CHESAPEAKE	VA - Norfolk PD
055 NB CHESAPEAKE AT NORVIEW	VA - Norfolk PD
056 NB SEWELLS POINT AT CHESAPEAKE	VA - Norfolk PD
057 SB CHESAPEAKE AT NORVIEW	VA - Norfolk PD
058 SB SEWELLS POINT AT CHESAPEAKE	VA - Norfolk PD
059 WB NORVIEW AT CHESAPEAKE	VA - Norfolk PD
133 NB St Pauls at Waterside	VA - Norfolk PD
134 SB Waters St at Waterside	VA - Norfolk PD
135 WB Waterside at St Pauls	VA - Norfolk PD
136 EB Waterside at E Water St	VA - Norfolk PD
140 SB St Pauls at E Main St	VA - Norfolk PD
148 NB Granby at Little Creek	VA - Norfolk PD
149 EB Little Creek at Granby	VA - Norfolk PD
150 WB Little Creek at Granby	VA - Norfolk PD
151 SB Granby at Little Creek	VA - Norfolk PD
063 NB ALEXANDER AT STRAND	VA - Norfolk PD
064 SB ALEXANDER AT STRAND	VA - Norfolk PD
065 WB STRAND AT ALEXANDER	VA - Norfolk PD
106 EB STRAND AT ALEXANDER	VA - Norfolk PD
01 NB Cypress at Greenleaf	VA - Norfolk Redevelopment and Housing Authority
02 EB Greenlead at Campostella	VA - Norfolk Redevelopment and Housing Authority
03 EB Cottonwood Ct at Campostella	VA - Norfolk Redevelopment and Housing Authority
05 WB Vernon @ Campostella	VA - Norfolk Redevelopment and Housing Authority
022 NB LIBERTY AT CULPEPPER	VA - Norfolk PD
023 SB LIBERTY AT CULPEPPER	VA - Norfolk PD
#01 Sykes Apartments	VA - Norfolk Redevelopment and Housing Authority
#03 Sykes Apartments Camera 2	VA - Norfolk Redevelopment and Housing Authority
066 NB SEWELLS POINT AT JOHNSTON	VA - Norfolk PD
067 EB JOHNSTON AT SEWELLS POINT	VA - Norfolk PD
068 SB SEWELLS POINT AT JOHNSTON	VA - Norfolk PD
107 WB JOHNSTON AT SEWELLS POINT	VA - Norfolk PD
074 SB COLLEY AT 34TH	VA - Norfolk PD
075 NB COLLEY AT 35TH	VA - Norfolk PD
076 WB COLLEY AT 35TH	VA - Norfolk PD
077 EB COLLEY AT 35TH	VA - Norfolk PD
085 AZALEA GARDEN AT SEWLLS POINT	VA - Norfolk PD
086 SB AZALEA GARDEN AT SEWELLS POINT	VA - Norfolk PD
087 NB SEWELLS POINT AT AZALEA GARDEN	VA - Norfolk PD
088 EB SEWELLS POINT AT AZALEA GARDEN	VA - Norfolk PD
#03 Majestic Ave @ Corprew Ave SB	VA - Norfolk State University Campus PD
#04 Presidential Pkwy @ Middletown Crescent WB	VA - Norfolk State University Campus PD
#16 New Residential Parking @ Corprew Ave SB	VA - Norfolk State University Campus PD
#17 Echols Hall @ Middle Towne Crescent SB	VA - Norfolk State University Campus PD
013 SB S MAIN AT LIBERTY	VA - Norfolk PD
014 WB LIBERTY AT MAIN	VA - Norfolk PD
015 WB LIBERTY AT MAIN	VA - Norfolk PD
016 NB MAIN AT LIBERTY	VA - Norfolk PD

152 NB Chesapeake at Little Creek	VA - Norfolk PD
153 EB Little Creek at Chesapeake	VA - Norfolk PD
154 WB Little Creek at Chesapeake	VA - Norfolk PD
155 SB Chesapeake at Little Creek	VA - Norfolk PD
163 NB Colley at Brambleton	VA - Norfolk PD
164 WB Brambleton at Colley	VA - Norfolk PD
165 SB Colley at Brambleton	VA - Norfolk PD
166 EB Brambleton at Colley	VA - Norfolk PD
#025 SB CHESAPEAKE AT FARRELL ST SB	VA - Norfolk PD
024 NB CHESAPEAKE AT MARINERS WAY	VA - Norfolk PD
026 WB MARINERS WAY AT CHESAPEAKE	VA - Norfolk PD
027 EB CHESTER AT CHESAPEAKE	VA - Norfolk PD
159 NB St Pauls at Brambleton	VA - Norfolk PD
160 EB Brambleton at St Pauls	VA - Norfolk PD
161 SB St Pauls at Brambleton	VA - Norfolk PD
162 WB Brambleton at St Pauls	VA - Norfolk PD
167 NB Hampton at Redgate	VA - Norfolk PD
168 EB Redgate at Hampton	VA - Norfolk PD
169 SB Hampton at Redgate	VA - Norfolk PD
170 WB Redgate at Hampton	VA - Norfolk PD
035 NB TIDEWATER AT CROMWELL	VA - Norfolk PD
036 SB TIDEWATER AT CROMWELL	VA - Norfolk PD
037 EB CROMWELL AT TIDEWATER	VA - Norfolk PD
038 WB CROMWELL AT TIDEWATER	VA - Norfolk PD
001 NB CHURCH AT PRINCESS ANNE	VA - Norfolk PD
002 WB PRINCESS ANNE AT CHURCH	VA - Norfolk PD
003 SB CHURCH AT PRINCESS ANNE	VA - Norfolk PD
004 EB PRINCESS ANNE AT CHURCH	VA - Norfolk PD
011 WB GOFF AT TIDEWATER	VA - Norfolk PD
#02 Huntersquare Apartments	VA - Norfolk Redevelopment and Housing Authority
#04 Huntersquare Apartments	VA - Norfolk Redevelopment and Housing Authority
#13 Theater Co Parking @ Corprew Ave SB	VA - Norfolk State University Campus PD
#14 Gym Rd @ Corprew Ave NB	VA - Norfolk State University Campus PD
#15 NSUPD @ Corprew Ave SB	VA - Norfolk State University Campus PD
047 NB INGLESIDE AT CAPE HENRY	VA - Norfolk PD
048 SB INGLESIDE AT CAPE HENRY	VA - Norfolk PD
049 EB CAPE HENRY	VA - Norfolk PD
156 NB Shore at Little Creek	VA - Norfolk PD
157 SB Shore at Little Creek	VA - Norfolk PD
158 WB Little Creek at Shore	VA - Norfolk PD
081 NB AZALEA GARDEN AT PRINCESS ANNE	VA - Norfolk PD
082 WB PRINCESS ANNE AT AZALEA GARDEN	VA - Norfolk PD
084 SB AZALEA GARDEN AT PRINCESS ANNE	VA - Norfolk PD
071 WB JOHNSTON AT CHESAPEAKE	VA - Norfolk PD
072 SB CHESAPEAKE AT JOHNSTON	VA - Norfolk PD
073 EB JOHNSTON AT CHESAPEAKE	VA - Norfolk PD
031 NB TIDEWATER AT LAFAYETTE	VA - Norfolk PD
032 SB TIDEWATER AT LAFAYETTE	VA - Norfolk PD
034 EB LAFAYETTE AT TIDEWATER	VA - Norfolk PD
060 WB NORVIEW AT ALEXANDER	VA - Norfolk PD
061 EB NORVIEW AT ALEXANDER	VA - Norfolk PD
062 NB ALEXANDER AT PALL MALL	VA - Norfolk PD
12 SB St Paul at Virginia Beach Blvd	VA - Norfolk Redevelopment and Housing Authority
13 EB Virginia Beach Blvd at St Paul	VA - Norfolk Redevelopment and Housing Authority
14 SB Salter at Virginia Beach	VA - Norfolk Redevelopment and Housing Authority
145 NB Hampton rd at Little Creek	VA - Norfolk PD
146 EB Little Creek at Hampton Rd	VA - Norfolk PD
147 SB Hampton at Little Creek	VA - Norfolk PD
028 NB TIDEWATER AT SHOOP	VA - Norfolk PD
029 SB TIDEWATER AT SHOOP	VA - Norfolk PD
030 EB SHOOP AT TIDEWATER	VA - Norfolk PD

117 SB Entrance Ramp to 64 from E. Little Creek Rd	VA - Norfolk PD
118 SB E Little Creek at Hwy 64 - original	VA - Norfolk PD
119 NB E Little Creek at Hwy 64	VA - Norfolk PD
099 NB PREMIUM OUTLETS AT NORTHAMPTON	VA - Norfolk PD
100 EB NORTHAMPTON AT PREMIUM OUTLETS	VA - Norfolk PD
102 WB NORTHAMPTON AT PREMIUM OUTLETS	VA - Norfolk PD
103 NB TIDEWATER AT GUY AVE	VA - Norfolk PD
104 SB TIDEWATER AT GUY	VA - Norfolk PD
105 EB GUY AVE TIDEWATER	VA - Norfolk PD
114 NB 460 at WB 564 entrance ramp	VA - Norfolk PD
115 SB Granby St at E Taussig	VA - Norfolk PD
116 EB E Taussig Blvd at Granby	VA - Norfolk PD
#02 Corprew Ave @ Park Ave EB	VA - Norfolk State University Campus PD
#11 Joseph St @ Corprew Ave SB	VA - Norfolk State University Campus PD
#12 John Jordan Dr @ Corprew Ave SB	VA - Norfolk State University Campus PD
141 NB Maryland at Admiral Taussig Blvd	VA - Norfolk PD
143 SB Hampton at Admiral Taussig	VA - Norfolk PD
144 Admiral Taussig at Maryland	VA - Norfolk PD
017 WB BERKLEY AT FAUQUIER St	VA - Norfolk PD
018 EB BERKLEY AT BERKLEY AVE EXT	VA - Norfolk PD
019 SB BERKELY AVE EXT AT BERKLEY	VA - Norfolk PD
091 NB NEWTOWN AT VIRGINIA BEACH	VA - Norfolk PD
092 WB VIRGINIA BEACH BLVD AT NEWTOWN RD	VA - Norfolk PD
094 EB VIRGINIA BEACH AT NEWTOWN	VA - Norfolk PD
#01 Park Ave @ Bond St WB	VA - Norfolk State University Campus PD
#08 Park Ave @ Bond St EB	VA - Norfolk State University Campus PD
#10 Maude B Davis St @ Park Ave EB	VA - Norfolk State University Campus PD
005 EB C AVE AT CHURCH	VA - Norfolk PD
006 SB CHURCH AT C AVE	VA - Norfolk PD
007 NB OKEEFE AT FREMONT	VA - Norfolk PD
008 SB OKEEFE AT FREMONT	VA - Norfolk PD
10 SB School Service Rd at E Olney	VA - Norfolk Redevelopment and Housing Authority
11 EB E Olney at St Paul	VA - Norfolk Redevelopment and Housing Authority
123 NB Chesapeake at Hwy 64	VA - Norfolk PD
124 SB Chesapeake at Dundale	VA - Norfolk PD
108 Entrance to Hwy 64 from W Ocean View Ave	VA - Norfolk PD
109 EB W Ocean View from Hwy 64 exit ramp	VA - Norfolk PD
097 NB MILITARY HWY AT POPLAR	VA - Norfolk PD
098 SB MILITARY HWY AT POPLAR	VA - Norfolk PD
171 NB Pritchard at Miller Store Rd	VA - Norfolk PD
172 Sb Pritchard at Miller Store Rd	VA - Norfolk PD
110 SB 4th View St at Staten	VA - Norfolk PD
111 NB 4th View at Staten	VA - Norfolk PD
18 NB Wide St at E Olney	VA - Norfolk Redevelopment and Housing Authority
19 WB E Olney at Wide	VA - Norfolk Redevelopment and Housing Authority
009 NB TIDEWATER AT ST JULIAN	VA - Norfolk PD
010 SB TIDEWATER AT ST JULIAN	VA - Norfolk PD
020 WB BERKLEY AVE EXT AT OBENDORFER	VA - Norfolk PD
021 EB BERKLEY AVE EXT AT OBENDORFER	VA - Norfolk PD
130 NB Ballentine at Middle Town Crescent	VA - Norfolk PD
#06 Ballentine Blvd SB	VA - Norfolk State University Campus PD
050 WB CAPE HENRY	VA - Norfolk PD
051 EB CAPE HENRY	VA - Norfolk PD
052 NB BALLENTINE AT CAPE HENRY	VA - Norfolk PD
053 SB BALLENTI NE AT CAPE HENRY	VA - Norfolk PD
079 EB 26TH AT MONTICELLO	VA - Norfolk PD
080 WB 27TH AT MONTICELLO	VA - Norfolk PD
125 EB Norview at Johns	VA - Norfolk PD
126 EB Norview at Johns	VA - Norfolk PD
120 SB Tidewater at Widgeon	VA - Norfolk PD
121 NB Tidewater at Widgeon	VA - Norfolk PD

127 NB N Military Hwy at Hwy 64	VA - Norfolk PD
128 SB N Military Hwy at Academy Dr	VA - Norfolk PD
089 NB TIDEWATER AT LITTLE CREEK	VA - Norfolk PD
090 SB TIDEWATER AT LITTLE CREEK	VA - Norfolk PD
#07 Park Ave @ E Bramnleton Ave SB	VA - Norfolk State University Campus PD
04 WB Melon at Campostella	VA - Norfolk Redevelopment and Housing Authority
06 WB Berkely at Campostella	VA - Norfolk Redevelopment and Housing Authority
F#118 SB E Little Creek at Hwy 64 EB	VA - Norfolk PD
112 EB W Ocean Ave at Hwy 64	VA - Norfolk PD
083 EB PRINCESS ANNE AT AZALEA GARDEN	VA - Norfolk PD
131 Sb Campostella at Kimball Terrace	VA - Norfolk PD
176 Military Hwy @ Springmeadow Blvd SB	VA - Norfolk PD
20 WB Bagnall at Tidewater	VA - Norfolk Redevelopment and Housing Authority
070 NB CHESAPEAKE AT JOHNSTON	VA - Norfolk PD
069 SB SEWELLS POINT AT AVE F	VA - Norfolk PD
174 Ocean View Avenue @ Cape View Ave WB	VA - Norfolk PD
101 SB WESLEYAN AT NORTHAMPTON	VA - Norfolk PD
VA #1065 - 1 Garden Center	Lowe's Home Improvement
132 WB E Brableton Ave at Hwy 264	VA - Norfolk PD
173 Ocean View Ave @ 4th View St WB	VA - Norfolk PD
093 SB NEWTOWN AT VIRGINA BEACH BLVD	VA - Norfolk PD
08 EB Kimball Terrace at at Ballentine	VA - Norfolk Redevelopment and Housing Authority
096 SB MILITARY HWY AT CORPORATE	VA - Norfolk PD
113 EB W Bay Ave at 1st View St	VA - Norfolk PD
137 NB St Pauls at Market St	VA - Norfolk PD
#05 E1 @ Middletown Crescent SB	VA - Norfolk State University Campus PD
138 WB City Hall Ave at St Pauls	VA - Norfolk PD
175 Military Hwy @ Norview Ave NB	VA - Norfolk PD
09 WB Kimball Terrace at East End Ave	VA - Norfolk Redevelopment and Housing Authority
129 SB Ballentine at Westminster	VA - Norfolk PD
07 NB Melon at Berkley	VA - Norfolk Redevelopment and Housing Authority
033 EB E Chester St @ Old Ocean View Rd	VA - Norfolk PD
#09 Presidential Pkwy @ Park Ave EB	VA - Norfolk State University Campus PD
078 NB COLLEY AT 38TH	VA - Norfolk PD
095 NB MILITARY HWY AT CORPORATE	VA - Norfolk PD
17 EB Virginia Beach at St Paul St	VA - Norfolk Redevelopment and Housing Authority
16 SB Lincoln at Virginia Beach	VA - Norfolk Redevelopment and Housing Authority
012 EB GOFF AT TIDEWATER	VA - Norfolk PD
139 EB City Hall Ave at St Pauls	VA - Norfolk PD
15 WB E Olney at Lincoln	VA - Norfolk Redevelopment and Housing Authority
142 WB Taussig and Mall Dr	VA - Norfolk PD
122 SB Chesapeake Blvd at Joyner	VA - Norfolk PD

Table 3. A Few Camera Clusters Account for a Large Number of Captures

Camera Name
099 NB PREMIUM OUTLETS AT NORTHAMPTON
100 EB NORTHAMPTON AT PREMIUM OUTLETS
102 WB NORTHAMPTON AT PREMIUM OUTLETS
039 NB CHESAPEAKE AT CROMWELL
040 SB CHESAPEAKE AT CROMWELL
041 SB CROMWELL AT CHESAPEAKE
042 NB CROMWELL AT CHESAPEAKE
043 NB CHESAPEAKE AT LAFAYETTE
044 SB BALLENTINE AT CHESAPEAKE
045 SB CHESAPEAKE AT BALLENTINE
046 WB LAFAYETTE AT BALLENTINE
152 NB CHESAPEAKE AT LITTLE CREEK
153 EB LITTLE CREEK AT CHESAPEAKE
154 WB LITTLE CREEK AT CHESAPEAKE
155 SB CHESAPEAKE AT LITTLE CREEK
148 NB GRANBY AT LITTLE CREEK
149 EB LITTLE CREEK AT GRANBY
150 WB LITTLE CREEK AT GRANBY
151 SB GRANBY AT LITTLE CREEK
035 NB TIDEWATER AT CROMWELL
036 SB TIDEWATER AT CROMWELL
037 EB CROMWELL AT TIDEWATER
038 WB CROMWELL AT TIDEWATER
159 NB ST PAULS AT BRAMBLETON
160 EB BRAMBLETON AT ST PAULS
161 SB ST PAULS AT BRAMBLETON
162 WB BRAMBLETON AT ST PAULS
156 NB SHORE AT LITTLE CREEK
157 SB SHORE AT LITTLE CREEK
158 WB LITTLE CREEK AT SHORE
091 NB NEWTOWN AT VIRGINIA BEACH
092 WB VIRGINIA BEACH BLVD AT NEWTOWN RD
094 EB VIRGINIA BEACH AT NEWTOWN
167 NB HAMPTON AT REDGATE
168 EB REDGATE AT HAMPTON
169 SB HAMPTON AT REDGATE
170 WB REDGATE AT HAMPTON
054 EB NORVIEW AT CHESAPEAKE
055 NB CHESAPEAKE AT NORVIEW
056 NB SEWELLS POINT AT CHESAPEAKE
057 SB CHESAPEAKE AT NORVIEW
058 SB SEWELLS POINT AT CHESAPEAKE
059 WB NORVIEW AT CHESAPEAKE

097 NB MILITARY HWY AT POPLAR
098 SB MILITARY HWY AT POPLAR
127 NB N MILITARY HWY AT HWY 64
128 SB N MILITARY HWY AT ACADEMY DR
031 NB TIDEWATER AT LAFAYETTE
032 SB TIDEWATER AT LAFAYETTE
034 EB LAFAYETTE AT TIDEWATER
145 NB HAMPTON RD AT LITTLE CREEK
146 EB LITTLE CREEK AT HAMPTON RD
147 SB HAMPTON AT LITTLE CREEK
163 NB COLLEY AT BRAMBLETON
164 WB BRAMBLETON AT COLLEY
165 SB COLLEY AT BRAMBLETON
166 EB BRAMBLETON AT COLLEY
028 NB TIDEWATER AT SHOOP
029 SB TIDEWATER AT SHOOP
030 EB SHOOP AT TIDEWATER
114 NB 460 AT WB 564 ENTRANCE RAMP
115 SB GRANBY ST AT E TAUSSIG
116 EB E TAUSSIG BLVD AT GRANBY
001 NB CHURCH AT PRINCESS ANNE
002 WB PRINCESS ANNE AT CHURCH
003 SB CHURCH AT PRINCESS ANNE
004 EB PRINCESS ANNE AT CHURCH
103 NB TIDEWATER AT GUY AVE
104 SB TIDEWATER AT GUY
105 EB GUY AVE TIDEWATER
125 EB NORVIEW AT JOHNS
126 EB NORVIEW AT JOHNS
074 SB COLLEY AT 34TH
075 NB COLLEY AT 35TH
076 WB COLLEY AT 35TH
077 EB COLLEY AT 35TH
071 WB JOHNSTON AT CHESAPEAKE
072 SB CHESAPEAKE AT JOHNSTON
073 EB JOHNSTON AT CHESAPEAKE
120 SB TIDEWATER AT WIDGEON
121 NB TIDEWATER AT WIDGEON
133 NB ST PAULS AT WATERSIDE
134 SB WATERS ST AT WATERSIDE
135 WB WATERSIDE AT ST PAULS
136 EB WATERSIDE AT E WATER ST
140 SB ST PAULS AT E MAIN ST
132 WB E BRABLETON AVE AT HWY 264
#06 BALLENTINE BLVD SB
130 NB BALLENTINE AT MIDDLE TOWN CRESCENT
060 WB NORVIEW AT ALEXANDER
061 EB NORVIEW AT ALEXANDER
062 NB ALEXANDER AT PALL MALL
081 NB AZALEA GARDEN AT PRINCESS ANNE
082 WB PRINCESS ANNE AT AZALEA GARDEN
084 SB AZALEA GARDEN AT PRINCESS ANNE

141 NB MARYLAND AT ADMIRAL TAUSSIG BLVD
143 SB HAMPTON AT ADMIRAL TAUSSIG
144 ADMIRAL TAUSSIG AT MARYLAND
079 EB 26TH AT MONTICELLO
080 WB 27TH AT MONTICELLO
085 AZALEA GARDEN AT SEWELLS POINT
086 SB AZALEA GARDEN AT SEWELLS POINT
087 NB SEWELLS POINT AT AZALEA GARDEN
088 EB SEWELLS POINT AT AZALEA GARDEN
009 NB TIDEWATER AT ST JULIAN
010 SB TIDEWATER AT ST JULIAN
123 NB CHESAPEAKE AT HWY 64
124 SB CHESAPEAKE AT DUNDALE
066 NB SEWELLS POINT AT JOHNSTON
067 EB JOHNSTON AT SEWELLS POINT
068 SB SEWELLS POINT AT JOHNSTON
107 WB JOHNSTON AT SEWELLS POINT
093 SB NEWTOWN AT VIRGINA BEACH BLVD
137 NB ST PAULS AT MARKET ST
047 NB INGLESIDE AT CAPE HENRY
048 SB INGLESIDE AT CAPE HENRY
049 EB CAPE HENRY
052 NB BALLENTINE AT CAPE HENRY
053 SB BALLENTINE AT CAPE HENRY
096 SB MILITARY HWY AT CORPORATE
12 SB ST PAUL AT VIRGINIA BEACH BLVD
13 EB VIRGINIA BEACH BLVD AT ST PAUL
14 SB SALTER AT VIRGINIA BEACH
131 SB CAMPOSTELLA AT KIMBALL TERRACE
175 MILITARY HWY @ NORVIEW AVE NB
122 SB CHESAPEAKE BLVD AT JOYNER
#01 PARK AVE @ BOND ST WB
#08 PARK AVE @ BOND ST EB
#10 MAUDE B DAVIS ST @ PARK AVE EB
110 SB 4TH VIEW ST AT STATEN
111 NB 4TH VIEW AT STATEN
#025 SB CHESAPEAKE AT FARRELL ST SB
024 NB CHESAPEAKE AT MARINERS WAY
026 WB MARINERS WAY AT CHESAPEAKE
027 EB CHESTER AT CHESAPEAKE
117 SB ENTRANCE RAMP TO 64 FROM E. LITTLE CREEK RD
118 SB E LITTLE CREEK AT HWY 64 - ORIGINAL
119 NB E LITTLE CREEK AT HWY 64
070 NB CHESAPEAKE AT JOHNSTON
005 EB C AVE AT CHURCH
006 SB CHURCH AT C AVE
101 SB WESLEYAN AT NORTHAMPTON
095 NB MILITARY HWY AT CORPORATE
142 WB TAUSSIG AND MALL DR
017 WB BERKLEY AT FAUQUIER ST
018 EB BERKLEY AT BERKLEY AVE EXT
019 SB BERKELY AVE EXT AT BERKLEY

078 NB COLLEY AT 38TH
013 SB S MAIN AT LIBERTY
014 WB LIBERTY AT MAIN
015 WB LIBERTY AT MAIN
016 NB MAIN AT LIBERTY
083 EB PRINCESS ANNE AT AZALEA GARDEN
089 NB TIDEWATER AT LITTLE CREEK
090 SB TIDEWATER AT LITTLE CREEK
069 SB SEWELLS POINT AT AVE F
112 EB W OCEAN AVE AT HWY 64
#01 SYKES APARTMENTS
#03 SYKES APARTMENTS CAMERA 2
022 NB LIBERTY AT CULPEPPER
023 SB LIBERTY AT CULPEPPER
17 EB VIRGINIA BEACH AT ST PAUL ST
139 EB CITY HALL AVE AT ST PAULS
171 NB PRITCHARD AT MILLER STORE RD
172 SB PRITCHARD AT MILLER STORE RD
113 EB W BAY AVE AT 1ST VIEW ST
#02 CORPREW AVE @ PARK AVE EB
#11 JOSEPH ST @ CORPREW AVE SB
#12 JOHN JORDAN DR @ CORPREW AVE SB
#03 MAJESTIC AVE @ CORPREW AVE SB
#04 PRESIDENTIAL PKWY @ MIDDLETOWN CRESCENT WB
#16 NEW RESIDENTIAL PARKING @ CORPREW AVE SB
#17 ECHOLS HALL @ MIDDLE TOWNE CRESCENT SB
138 WB CITY HALL AVE AT ST PAULS
020 WB BERKLEY AVE EXT AT OBENDORFER
021 EB BERKLEY AVE EXT AT OBENDORFER
129 SB BALLENTINE AT WESTMINSTER
063 NB ALEXANDER AT STRAND
064 SB ALEXANDER AT STRAND
065 WB STRAND AT ALEXANDER
106 EB STRAND AT ALEXANDER
01 NB CYPRESS AT GREENLEAF
02 EB GREENLEAD AT CAMPOSTELLA
03 EB COTTONWOOD CT AT CAMPOSTELLA
05 WB VERNON @ CAMPOSTELLA
108 ENTRANCE TO HWY 64 FROM W OCEAN VIEW AVE
109 EB W OCEAN VIEW FROM HWY 64 EXIT RAMP
#09 PRESIDENTIAL PKWY @ PARK AVE EB
18 NB WIDE ST AT E OLNEY
19 WB E OLNEY AT WIDE
#07 PARK AVE @ E BRAMNLETON AVE SB
#02 HUNTERSQUARE APARTMENTS
#04 HUNTERSQUARE APARTMENTS
011 WB GOFF AT TIDEWATER
050 WB CAPE HENRY
051 EB CAPE HENRY

10 SB SCHOOL SERVICE RD AT E OLNEY
11 EB E OLNEY AT ST PAUL
08 EB KIMBALL TERRACE AT AT BALLENTINE
007 NB OKEEFE AT FREMONT
008 SB OKEEFE AT FREMONT
#13 THEATER CO PARKING @ CORPREW AVE SB
#14 GYM RD @ CORPREW AVE NB
#15 NSUPD @ CORPREW AVE SB
012 EB GOFF AT TIDEWATER
15 WB E OLNEY AT LINCOLN
033 EB E CHESTER ST @ OLD OCEAN VIEW RD
07 NB MELON AT BERKLEY
04 WB MELON AT CAMPOSTELLA
176 MILITARY HWY @ SPRINGMEADOW BLVD SB
09 WB KIMBALL TERRACE AT EAST END AVE
F#118 SB E LITTLE CREEK AT HWY 64 EB
174 OCEAN VIEW AVENUE @ CAPE VIEW AVE WB
20 WB BAGNALL AT TIDEWATER
16 SB LINCOLN AT VIRGINIA BEACH
173 OCEAN VIEW AVE @ 4TH VIEW ST WB
#05 E1 @ MIDDLETOWN CRESCENT SB

Table 4. Across 21-Day Windows, Camera Captures are Sporadic

Camera Grouping		Of Days with Captures				Average Captures per Day	Average Percent of Days With Captures
		Avg. Percent of All Days with No Captures	Avg. Percent of All Days with 1 Capture	Avg. Percent of All Days with 1 or 2 Captures	Avg. Percent of Capture Days with 1 Capture	Avg. Percent of Capture Days with 1 or 2 Captures	
Norfolk PD		65.35%	5.12%	11.72%	11.30%	27.26%	34.65%
Norfolk PD		28.45%	8.76%	18.17%	12.02%	25.45%	71.55%
Norfolk PD		86.36%	6.35%	8.56%	74.54%	85.38%	13.64%
All Norfolk Cameras		65.35%	5.12%	11.72%	11.30%	27.26%	34.65%
All Norfolk Cameras		28.45%	8.76%	18.17%	12.02%	25.45%	71.55%
All Norfolk Cameras		86.42%	6.28%	8.44%	74.53%	85.19%	13.58%
All Cameras		33.29%	7.80%	18.33%	12.21%	28.86%	66.71%
All Cameras		27.61%	7.08%	17.33%	9.78%	24.09%	72.39%
All Cameras		85.38%	6.56%	8.73%	75.66%	85.20%	14.62%

Notes:

[1] Excluding subsequent captures for the same camera under one minute.

[2] Non-Plaintiff calculations limited to non-null OCR license plates with 4 or more characters

Table 5. Ignoring 21-Day Windows, There are Few Average Captures Per Day

					Of Days with Captures		Average Captures per Day	Average Percent of Days With Captures
Camera Grouping		Percent of All Days with No Captures	Percent of All Days with 1 Capture	Percent of All Days with 1 or 2 Captures	Percent of Capture Days with 1 Capture	Percent of Capture Days with 1 or 2 Captures		
Norfolk PD		60.14%	7.25%	15.22%	18.18%	38.18%	2.23	39.86%
Norfolk PD		27.54%	7.97%	18.12%	11.00%	25.00%	3.24	72.46%
Norfolk PD		95.75%	1.99%	2.68%	84.31%	91.66%	0.15	4.25%
All Norfolk Cameras		60.14%	7.25%	15.22%	18.18%	38.18%	2.28	39.86%
All Norfolk Cameras		27.54%	7.97%	18.12%	11.00%	25.00%	3.25	72.46%
All Norfolk Cameras		95.77%	1.96%	2.64%	84.32%	91.56%	0.15	4.23%
All Cameras		41.25%	7.15%	15.26%	13.64%	28.94%	3.56	58.75%
All Cameras		53.77%	5.16%	13.76%	11.38%	36.03%	1.92	46.23%
All Cameras		93.65%	2.90%	3.92%	83.65%	91.04%	0.21	6.35%

Notes:

[1] Non-Plaintiff calculations limited to non-null OCR license plates with 4 or more characters

Table 6. Most Vehicles in the Flock Camera Data Were Captured Fewer than Five Times Total

Camera Grouping	Number of License Plates	Number of Plates with 1 Capture	Percent of Plates with 1 Capture	Number of Plates with 2 Captures	Percent of Plates with 2 Captures	Number of Plates with 3 Captures	Percent of Plates with 3 Captures	Number of Plates 5 or fewer Captures	Percent of Plates 5 or fewer Captures
Norfolk PD	8,154,653	4,700,956	57.65%	1,058,411	12.98%	459,820	5.64%	6,682,471	81.95%
All Norfolk Cameras	8,372,846	4,825,112	57.63%	1,087,660	12.99%	473,980	5.66%	6,863,551	81.97%
All Cameras	16,046,832	9,124,278	56.86%	2,070,751	12.90%	940,706	5.86%	13,062,262	81.40%

Notes:

- [1] Excluding subsequent captures for the same camera under one minute.
- [2] Non-Plaintiff calculations limited to non-null OCR license plates with 4 or more characters

Table 7. On Days with Captures, Most Vehicles Have 2 or Fewer Captures in a Day.

Camera Grouping	Of Capture Days, Avg. Percent of Days with 1 Capture	Of Capture Days, Avg. Percent of Days with 2 or Fewer Captures
Norfolk PD	84.31%	91.66%
All Norfolk Cameras	84.32%	91.56%
All Cameras	85.18%	91.50%

Notes:

- [1] Excluding subsequent captures for the same camera under one minute.
- [2] Non-Plaintiff calculations limited to non-null OCR license plates with 4 or more characters

Table 8. Across 21-Day Windows, The Overwhelming Majority of the Time 7:00 am and 9:00 pm Vehicles Do Not Have Consecutive Captures Within 30 Minutes

Camera Grouping		Avg. Percent of Time Within 30 Mins
Norfolk PD		0.84%
Norfolk PD		1.15%
Norfolk PD		0.75%
Norfolk PD		0.50%
All Norfolk Cameras		0.85%
All Norfolk Cameras		1.15%
All Norfolk Cameras		0.77%
All Norfolk Cameras		0.51%
All Cameras		2.72%
All Cameras		1.47%
All Cameras		1.24%
All Cameras		0.68%

[1] Excluding subsequent captures for the same camera under one minute.

[2] Non-Plaintiff calculations limited to non-null OCR license plates with 4 or more characters

Table 9. There are Numerous Establishments Arounds Plaintiffs' Cameras with the Most Captures

	Bank		Commercial	
	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras
	0	0	2	8
	0	1	9	23
	1	3	10	50
	1	4	7	26
	5	5	25	34
	1	1	6	8
	1	5	14	31
	0	1	10	67
	0	1	4	9
	0	0	0	0
	0	0	2	8

Culture		Education		Food/Bar		Gas Station	
Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras
0	1	4	9	4	13	1	1
0	1	5	11	13	33	1	2
0	1	1	5	11	48	2	6
0	0	2	9	15	38	1	3
0	0	4	12	37	43	3	4
1	1	0	0	16	27	3	4
0	1	4	13	20	43	1	5
0	0	2	4	4	21	1	3
0	1	3	9	14	13	2	3
0	0	0	0	0	5	0	0
0	1	4	9	4	14	1	1

Government		Grocery Store		Medical		Non-Profit	
Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras
0	0	0	1	0	0	0	0
1	1	0	2	0	0	0	0
0	2	0	3	0	0	0	0
1	4	1	4	0	0	0	0
4	4	4	5	1	2	0	0
1	1	2	4	1	1	0	0
4	9	1	3	0	0	0	2
2	4	0	0	0	1	0	0
1	1	0	2	0	0	1	2
0	0	1	3	0	0	0	0
0	0	0	1	0	0	0	0

Place of Worship		Recreation		Transportation	
Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras	Number of Establishments within 0.5 Mile of Nearest Cameras	Number of Establishments within 1 Mile of Nearest Cameras
5	15	0	0	0	0
8	18	0	1	0	0
1	7	1	1	0	0
3	12	0	1	1	1
4	16	0	1	1	1
1	1	1	1	0	0
7	16	2	4	1	1
0	4	0	0	0	0
15	21	0	2	0	1
0	0	0	0	0	0
5	15	0	0	0	0

Table 10. Plaintiffs’ Flock Camera Data Near Plaintiffs’ Disclosed Locations

		Within 0.25 Mile		
		% of Possible Cameras		
		Total Number of Cameras	Captured	% of All Plaintiff Captures
		0	0%	0%
		1	100%	0%
		3	100%	4%
		2	50%	0%
		0	0%	0%
		0	0%	0%
		0	0%	0%
		0	0%	0%
		4	100%	18%
		0	0%	0%
		1	0%	0%
		0	0%	0%
		0	0%	0%
		0	0%	0%
		0	0%	0%

Within 0.5 Mile			Within 0.75 Mile		
% of Possible Cameras			% of Possible Cameras		
Total Number of Cameras	Captured	% of All Plaintiff Captures	Total Number of Cameras	Captured	% of All Plaintiff Captures
0	0%	0%	0	0%	0%
8	75%	3%	19	79%	10%
6	100%	6%	12	100%	9%
2	50%	0%	2	50%	0%
1	0%	0%	3	0%	0%
0	0%	0%	1	100%	0%
0	0%	0%	2	100%	4%
0	0%	0%	4	100%	18%
10	80%	42%	10	80%	42%
0	0%	0%	1	0%	0%
5	60%	1%	5	60%	1%
1	100%	0%	1	100%	0%
0	0%	0%	3	0%	0%

Within 1 Mile		
% of Possible Cameras		
Total Number of Cameras	Captured	% of All Plaintiff Captures
0	0%	0%
21	71%	10%
26	73%	15%
2	50%	0%
3	0%	0%
5	40%	1%
5	40%	4%
10	80%	42%
15	73%	57%
10	20%	1%
5	60%	1%
7	100%	26%
5	40%	10%

Table 11. Number of Cameras and corresponding area

Account Name	Number of Cameras	Area (Square Miles)	Area (Square Feet)	Optimal Field of Vision Coverage Area Percentage (40 ft - 70 ft)	Field of Vision Coverage Area Percentage (90 ft)
Norfolk VA PD	175	66	1,839,974,400	0.0068479%	0.0205438%
Newport News VA PD	86	69	1,923,609,600	0.0032189%	0.0096568%
Suffolk VA PD	74	400	11,151,360,000	0.0004778%	0.0014334%
Chesapeake VA PD	76	353	9,841,075,200	0.0005560%	0.0016681%
Portsmouth VA PD	71	33.65	938,108,160	0.0054493%	0.0163478%
Hampton VA PD	55	54.7	1,524,948,480	0.0025968%	0.0077904%
VA - Norfolk Redevelopment and Housing Authority	24	66	1,839,974,400	0.0009391%	0.0028174%
Virginia Beach VA PD	23	310	8,642,304,000	0.0001916%	0.0005748%
VA - Norfolk State University Campus PD	17	0.21	5,854,464	0.2090712%	0.6272137%
VA - City of Franklin	10	8.75	243,936,000	0.0029516%	0.0088548%
Smithfield VA PD	11	10.1	281,571,840	0.0028128%	0.0084383%
Isle Of Wight County VA SO	7	320	8,921,088,000	0.0000565%	0.0001695%
VA - Franklin County SO	4	690.43	19,248,083,712	0.0000150%	0.0000449%

Notes:
[1] The assumed average lane width in both Norfolk and Richmond is 12 feet.

Sources:

[1] <https://www.norfolk.gov/DocumentCenter/View/97172/2024-Annual-Comprehensive-Financial-Report-PDF>

[2] <https://www.norfolk.gov/4715/About-Norfolk>

[3] <https://www.nnva.gov/DocumentCenter/View/37373/Fiscal-Year-2024-Annual-Comprehensive-Financial-Report-PDF>

[4] <https://www.suffolkva.us/ArchiveCenter/ViewFile/Item/14503>

[5] <https://www.cityofchesapeake.net/ArchiveCenter/ViewFile/Item/885>

[6] <https://portsmouthva.gov/DocumentCenter/View/16714/FY-2024-Portsmouth-VA-ACFR>

[7] <https://www.hampton.gov/ArchiveCenter/ViewFile/Item/4410>

[8] <https://s3.us-east-1.amazonaws.com/virginia-beach-departments-docs/finance/Financials/AnnualReports/Fiscal-Year-2024-Annual-Report.pdf>

[9] <https://s3.us-east-1.amazonaws.com/virginia-beach-departments-docs/finance/Financials/AnnualReports/Fiscal-Year-2024-Annual-Report.pdf>

[10] <https://www.nsu.edu/Admissions-Aid/Learn-About-NSU/University-at-a-Glance>

[11] <https://cms2.revize.com/revize/franklinva/Documents/Government/Departments%20A%20to%20G/Finance/Forms%20and%20Documents/annual-comprehensive-financial-repor>

[12] <https://www.smithfieldva.gov/288/About-Our-Town>

[13] <https://cms9files.revize.com/wightcountyva/FY24%20ACFR%20eFile%20-%2012.18.24.pdf>

[14] <https://www.franklincountyva.gov/ArchiveCenter/ViewFile/Item/213>

Table 12. Time and Distance Between Captures on Days with Multiple Captures.

	Average Time (min) Between Captures	Average Driving Distance (mi) Between Captures
	49.46	2.50
	47.45	3.45
	89.66	3.79
	108.78	5.94

Notes:

- [1] Excluding subsequent captures for the same camera under one minute.
- [2] Non-Plaintiff calculations limited to non-null OCR license plates with 4 or more characters

Appendix D

Documents and Data Relied Upon

Complaint for Declaratory and Injunctive Relief, October 21, 2024.

Defendants' Memorandum in Support of Their Motion to Dismiss the Complaint, November 25, 2024.

Plaintiffs' Opposition to Defendants' Motion to Dismiss, December 16, 2024.

Defendants' Reply Memorandum in Support of Their Motion to Dismiss the Complaint, December 22, 2024.

Opinion and Order – Motion to Dismiss Order, February 5, 2025.

Plaintiffs' Reply in Support of Their Motion to Compel, April 10, 2025.

Expert Report of Andrew P. Wheeler on Behalf of Plaintiffs, Schmidt v City of Norfolk, No. 2:24-cv-621 (E.D. Va.), July 7, 2025.

Expert Witness Report of Chad Higdon-Topaz, PhD., July 8, 2025.

Plaintiff Lee Schmidt's Responses to Defendants' First Set of Interrogatories, May 23, 2025.

Plaintiff Crystal Arrington's Responses to Defendants' First Set of Interrogatories, May 23, 2025.

Plaintiff Crystal Arrington's Responses to Defendants' First Set of Requests for Production of Documents, May 23, 2025.

Uncertified Rough Draft Transcript of the Deposition of Davis Lukens (7/29/2025)

Minutes of City of Norfolk Council Meeting, May 23, 2023.

Footnotes

- <https://www.flocksafety.com/media-kit>
- <https://www.flocksafety.com/devices/lpr-cameras>
- <https://www.census.gov/programs-surveys/acs>
- <https://data.census.gov/table/ACSDT1Y2023.B08541?q=mode+of+transportation+norfolk+va>
- <https://www.norfolk.gov/5092/Data-How-are-we-doing>
- <https://www.norfolk.gov/5967/Cameras>
- <https://www.wtkr.com/news/hampton-roads-law-enforcement-seeing-results-from-flock-safety-cameras>
- NORF000038, 50-52, 54-55, 57-60, and 66.
- <https://www.forbes.com/sites/technology/article/what-is-ocr-technology/>
- <https://www.flocksafety.com/faq>
- NORF021152, Norfolk Police Department Memo 25-097; General order OPR-493
- U.S. v. Kumiko L. Martin, Jr., Federal Eastern District Court (Oct. 11, 2024).
- <https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/traffic-operations/traffic-counts/>
- Norfolk Open Data Portal https://norfolkgisdata-orf.opendata.arcgis.com/datasets/2559632f99f04b438f283e9e255e63fa_11/explore?location=36.894692%2C-76.260700%2C12.68.
- 2024 Annual Comprehensive Financial Report
<https://www.norfolk.gov/DocumentCenter/View/97172/2024-Annual-Comprehensive-Financial-Report-PDF>
- <https://www.norfolk.gov/430/Facts-About-Norfolk>
- <https://www.vdot.virginia.gov/news-events/news/hampton-roads-district/traffic-shift-on-granby-street-scheduled-for-express-lanes-norfolk-construction.php>
- Reference Manual on Scientific Evidence. Reference Guide on Statistics. National Academies of Sciences, Engineering, and Medicine. Third edition.

(<https://nap.nationalacademies.org/catalog/13163/reference-manual-on-scientific-evidence-third-edition>)

- <https://www.mynavyexchange.com/storelocator/storesearch.jsp?displayDetails=true&storeid=010>

Camera Data

Raw camera data was acquired via a Secure File Transfer Protocol (SFTP) connection with the following connection usernames:

- norfolk_pd_20250215_20250416
- norfolk_ext_20250409_20250509
- norfolk_pd_20250303_20250309
- norfolk_ext_20250510_20250610
- norfolk_pd_20250417_20250610

City Productions

1. NORF000191.csv
2. NORF000192.csv
3. NORF000193.csv
4. NORF000194.csv
5. NORF000195.csv
6. NORF002253.csv
7. NORF002254.csv
8. NORF002255.csv
9. NORF002256.csv
10. NORF002680.csv
11. NORF002681.csv
12. NORF015028.csv
13. NORF015133.csv
14. NORF015242.csv

- 15. NORF015400.csv
- 16. NORF021164.csv
- 17. NORF021413.csv
- 18. NORF021584.csv
- 19. NORF021738.csv
- 20. NORF021739.csv
- 21. NORF021900.csv
- 22. NORF022014.csv
- 23. NORF022153.csv