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TRAFFIC STOP DATA ANALYSIS AND FINDINGS, 2022

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PREAMBLE

This preamble was written by an ad hoc committee of the Connecticut Racial Profiling Prohibition Project advisory board and unanimously endorsed by the board on December 6, 2018.

1. Racial Profiling has historically occurred and continues to occur throughout America.
2. The Alvin W. Penn Racial Profiling Law enacted by the Connecticut General Assembly in 1999 required state and local police to collect traffic stop data and report the data to the state.
3. The 2011 federal investigation into the East Haven Police Department brought this issue to the forefront in Connecticut again and led to the Connecticut General Assembly updating the Profiling Legislation in 2012.
4. Disparities across racial and ethnic groups occur in traffic stops in Connecticut.
5. Enforcing the law's data reporting requirement and collecting and analyzing racial disparities in traffic stop records in the primary charge of the advisory board.
    a. A broader analysis utilizing multiple methodologies in the preferred method for measuring the presence of racial disparities in traffic enforcement;
    b. Although no measure is 100% accurate in measuring disparities, the analysis utilized in Connecticut is sufficient in determining the presence of disparities;
    c. We will continue to modify and refine our methodologies based on the best available research and accepted practices in the field.
6. We will take a proactive approach to understanding, explaining, and addressing disparities found in the analysis by:
    a. Utilizing input from all stakeholders to understand the underlying causes for such disparities;
    b. Clearly explaining to the public and stakeholders if there are justifiable reasons for such disparities;
    c. Reporting to the Office of Policy and Management instances where the Connecticut Racial Profiling Prohibition Project Advisory Board believes that a police department is in violation of the Alvin W. Penn law.

EXECUTIVE SUMMARY OF FINDINGS

The Alvin W. Penn Racial Profiling Prohibition Act (Public Act 99-198) was first enacted in 1999 in Connecticut. The law prohibits any law enforcement agency in the state from stopping, detaining, or searching motorists when the stop is motivated solely by considerations of the race, color, ethnicity, age, gender, or sexual orientation of that individual (Connecticut General Statutes Sections 54-1l and 54-1m). In 2012 and 2013, the Connecticut General Assembly made several major revisions to the law in an effort to ensure its effective implementation. In accordance with these changes, police agencies began collecting data pertaining to all traffic stops on October 1, 2013.

In 2012, the Racial Profiling Prohibition Project Advisory Board was established to advise the Office of Policy and Management (OPM) in adopting the law's standardized methods and guidelines. The Institute for Municipal and Regional Policy (IMRP) at Central Connecticut State University was tasked to help oversee the design, evaluation, and management of the racial profiling study mandated by Public Act No. 12-74 and Public Act No. 13-75, "An Act Concerning Traffic Stop Information." The project staff worked with the state's Criminal Justice Information System (CJIS) to develop a system to collect consistent and universal traffic stop information and submit it to CJIS electronically on a monthly basis.

In Connecticut, there are 94 municipal police departments: 29 departments employing more than 50 officers, 50 employing between 20 and 50 officers, and 15 with fewer than 20 officers. State police are comprised of 11 distinct troops. Although there are an additional 80 jurisdictions that do not have organized police departments and are provided police services by the state police, either directly or through the provision of resident troopers, these stops were categorized with their overarching state police troops. Additionally, 13 special agencies have the authority to conduct traffic stops.

As per section 54-1m of the Connecticut General Statutes, the IMRP is required to submit an annual report analyzing traffic stop records for all police departments in Connecticut. This is the ninth annual report published by the IMRP and presents the results from an analysis of approximately 313,000 traffic stops conducted during the 12-month study period from January 1, 2022, through December 31, 2022. It also presents a three-year aggregate analysis of the approximately 829,000 traffic stops conducted between January 1, 2020, and December 31, 2022. This report serves as a screening tool, essentially highlighting areas where disparities between races and ethnicities are greatest in traffic enforcement throughout the state.

All departments and communities would benefit from carefully reviewing the findings in this report. Addressing statewide racial and ethnic disparities will require a collective effort of all law enforcement and community stakeholders. An atmosphere of open-mindedness, empathy, and honesty from all stakeholders remains necessary to create sustained police legitimacy and a safer, more just society. The authors of this report are hopeful that the information contained herein will be valuable to the citizens of Connecticut as they seek to fulfill the promise of the Alvin W. Penn Act. We are both humbled and grateful for the opportunity to be part of this important effort.

E.1: 2022 AND 2020-22 STATEWIDE TRAFFIC STOP ANALYSIS AND FINDINGS

Assessing racial disparities in policing data has been used for the last two decades as a policy tool to evaluate whether there exists the possibility that racial and ethnic bias is occurring within a given jurisdiction. The statistical evaluation of policing data in Connecticut is an important step toward developing a transparent dialogue between law enforcement and the public at large. As such, this report aims to present the results of that evaluation in the most transparent and unbiased manner possible. The report is organized to lead the reader through seven distinct analytical tests that vary in their assumptions and level of scrutiny. This approach intends to apply multiple tests as a screening filter for the possibility that any one test (1) produces false positive results or (2) reports a false negative.

The research strategy underlying the statistical analysis presented in chapters three through seven of this report was developed with three guiding principles in mind. Each principle was considered throughout the research process and when selecting the appropriate results to display publicly. A better understanding of these principles helps to frame the results presented in the technical portions of the analysis. In addition, by presenting these principles at the onset of the report, readers have a better context to understand the overall framework of the approach.

> *Principle 1: Acknowledge that statistical evaluation is limited to finding racial and ethnic disparities that are indicative of racial and ethnic bias but that, in the absence of a formal procedural investigation, cannot be considered comprehensive evidence.*
>
> *Principle 2: Apply a holistic approach for assessing racial and ethnic disparities in Connecticut policing data by using a variety of approaches that rely on well-respected techniques from existing literature.*
>
> *Principle 3: Outline the assumptions and limitations of each approach transparently so that the public and policymakers can use their judgment in drawing conclusions from the analysis.*

We emphasize the message that any statistical test is only truly capable of identifying racial and ethnic disparities. Such findings provide a mechanism to indicate possible racial profiling, but they cannot, without further investigation, provide sufficient evidence that racial profiling exists.

E.1 (A): Findings from the Statewide Analysis

Municipal and State Police departments in Connecticut made 313,347 traffic stops in 2022 (829,000 in 2020-22), of which 59% were of White motorists, 19% were Black, and 18% were of Hispanic motorists. Recorded traffic stops increased by 14% in 2022 compared to 2021 but remained 39% lower than 2019. State police traffic stops increased by 39.5% in 2022 compared to 2021 but remained 35% lower than 2019. Municipal police increased traffic stops by 5% in 2022 compared to 2021 but remain 40% lower than 2019.

At the aggregate level, we present estimates by applying the solar visibility analysis, a search hit-rate analysis, and a post-stop disposition analysis. The solar visibility analysis exploits quasi-random variation in the timing of sunset to identify potential discrimination in the decision to stop a motorist. According to the results from applying this test, the estimated change from daylight to darkness in

the likelihood that a stopped motorist was Black or Hispanic was 0.3 and 0.0 percentage points, statistically indistinguishable from zero in 2022. The key identifying assumption of this test is that police officers who are inclined to racially profile motorists are better able to do so during daylight when the motorist race is more easily observed before making a traffic stop. According to this logic and the application of the test to the traffic stop data, Connecticut police were not any more likely to stop Black or Hispanic motorists on average in 2022.

In 2022, Municipal and State Police departments in Connecticut also conducted a total of only 2,580 discretionary motor vehicle searches, of which 36% were White motorists, 31% were Black, and 34% were Hispanic motorists. At the aggregate level, we present estimates comparing the likelihood a search resulted in contraband being found for White motorists relative to non-White motorists. In addition, we compare the disposition of traffic stops across these groups after conditioning on the motivating reason for the traffic stop. The rate at which discretionary searches of White motorists yielded contraband was 41% in 2022, while the rate at which searches of Black and Hispanic motorists yielded contraband was 33% and 36%, respectively, in 2022. The key identifying assumption of this test is that, if police are unbiased, they will only search non-White motorists more often than Whites relative to their expected likelihood of carrying contraband. The lower hit rate for non-White motorists is suggestive of potential bias on the part of police. The stop disposition analysis did not reveal any discernible pattern in terms of how non-White motorists are treated following a traffic stop but did indicate that they faced statistically different outcomes.

Solar Visibility Analysis Findings, 2022 and 2020-22

To better identify the source of these racial and ethnic disparities, each analysis was repeated at the department level for both the 2022 calendar year and the 2020 to 2022 aggregate sample. The threshold for identifying individual departments was the presence of a statistically significant disparity at the 95 percent level in the Black or Hispanic alone categories.[1] Here, the unit of analysis is a municipal department or State Police Troop, where disparities could be a function of several factors, including institutional culture, departmental policy, or individual officers.[2]

We identify four State Police Troops in the three-year aggregate sample. State Police Headquarters and Troop D were also identified in our 2020 and 2021 analysis. We also identified two municipal police departments in the three-year aggregate sample[3]. For all departments identified in this report with disparities across all robustness tests, we conclude that there is strong evidence that a disparity exists in the rate of non-White traffic stops made during daylight conditions. These departments include:

[1] Put simply, there must have been at least a 95 percent chance that the motorists were more likely to be stopped at a higher rate relative to white non-Hispanic motorists.

[2] Since department or state police barrack estimates represent an average effect of stops made by individual officers weighted by the number of stops that they made in 2022, it is possible that officer-level disparities exist in departments that were not identified.

[3] Glastonbury was identified with statistically significant disparities in the 2022 sample for Hispanic motorists. There was not sufficient data available to estimate robustness checks using a subsample of moving violations. Wethersfield was also identified with statistically significant disparities in the 2022 sample for Hispanic motorists, but only in the robustness checks.

State Police Headquarters

State Police Troop Headquarters was identified on the solar visibility analysis in the 2020-22 sample for Black and Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood that a stopped motorist was Black and Hispanic totaled 16.9% and 17.4% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 7.2 percentage points or 43.7% relative to the dependent mean. The likelihood of a stopped motorist being Hispanic grew by 5.4 percentage points or 31.0% relative to the dependent mean.

State Police Troop D

State Police Troop D was identified on the solar visibility analysis in the 2020-22 sample for Black and Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood that a stopped motorist was Black and Hispanic totaled 7.7% and 8.6% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 2.9 percentage points or 37.5% relative to the dependent mean. The likelihood of a stopped motorist being Hispanic grew by 2 percentage points or 23.2% relative to the dependent mean.

State Police Troop E

State Police Troop E was identified on the solar visibility analysis in the 2020-22 sample for Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood of a stopped motorist being Hispanic totaled 11.4% overall. Conditioning on the day of the week and time of day, the likelihood of a stopped motorist being Hispanic grew by 2.2 percentage points or 19.6% relative to the dependent mean.

State Police Troop H

State Police Troop H was identified on the solar visibility analysis in the 2020-22 sample for Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood of a stopped motorist being Hispanic totaled 22.5% overall. Conditioning on the day of the week and time of day, the likelihood of a stopped motorist being Hispanic grew by 5.2 percentage points or 23.1% relative to the dependent mean.

Berlin:

Berlin was identified on the solar visibility analysis in the 2020-22 sample for Black and Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood that a stopped motorist was Black and Hispanic totaled 12% and 14.7% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 7.2 percentage points or 60% relative

to the dependent mean. The likelihood of a stopped motorist being Hispanic grew by 7.1 percentage points or 48.4% relative to the dependent mean.

Guilford:

Guilford was identified on the solar visibility analysis in the 2020-22 sample for Black motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood that a stopped motorist was Black totaled 3.4% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 1.7 percentage points or 50.3% relative to the dependent mean.

Other Statistical and Descriptive Measure Analysis Findings, 2022 and 2020-22

In addition to the four State Police troops and two municipal police departments identified to exhibit statistically significant racial or ethnic disparities in the solar visibility analysis, a number of other departments were identified using either the descriptive tests, stop disposition test, or KPT hit-rate analysis. These additional tests are designed as a screening tool to identify the jurisdictions where consistent disparities exceed certain thresholds in the data. Although it is understood that certain assumptions have been made in the design of each of these measures, it is reasonable to believe that departments with consistent data disparities that separate them from the majority of other departments should be subject to further review and analysis with respect to the factors that may be causing these differences.

The results from estimating whether individual departments stopped more non-White motorists relative to their requisite synthetic control found 25 municipal police departments and 7 State Police troops to have a disparity that was statistically significant at the 95 percent level in the Black or Hispanic alone categories. *Troop I, East Haven, Farmington, Hamden, New Haven, Newington, North Haven, Orange, Plymouth, South Windsor, Wallingford, Waterford, Wethersfield,* and *Wolcott* were identified in the 2022 sample and the aggregate 2020 to 2022 sample. *Troop HQ, Troop A, Troop L, Naugatuck, Newtown, Plainville, Vernon, West Haven,* and *Windsor* were identified only in the 2022 sample. *Branford, Troop E, Troop G, Troop H, Easton, Granby, Middlebury, New London, Trumbull, Willimantic,* and *Woodbridge* were identified only in the three-year aggregate analysis.

The descriptive tests are designed as an additional tool to identify disparities that exceed certain thresholds that appear in a series of census-based benchmarks. The two descriptive benchmarks used are (1) statewide average and (2) resident-only stops. Although 60 municipal police departments were identified with racial and ethnic disparities when compared to one or more of the descriptive measures, only *Derby, Naugatuck, New Britain, Newington,* and *Stratford* exceeded the disparity threshold in both measures with a score of at least four out of six.

Similar to 2021, we find no discernible pattern of non-White motorists being treated differently in any uniform way relative to their White counterparts in the stop disposition test. No departments were found to have a statistically significant disparity in post-stop outcomes in 2022.

The KPT Hit Rate test results, applied to the aggregate search data for all departments in Connecticut, show that departments are less successful in motorist searches across all non-White groups, which is a potential indicator of disparate treatment. There were no municipal police departments, or State Police Troops found to have a disparity in the hit rate of non-White motorists relative to White motorists for the 2022 sample. In the combined 2020-22 aggregate sample, there was one municipal

police department (Hartford), and one state police troop barracks (HQ) found to have a disparity in the hit rate of non-White motorists relative to White motorists. However, neither department can withstand the robustness test.

E.1 (B): Conclusions from the Statewide Analysis

The analysis presented in chapters III through VII of this report should be utilized as a screening tool by which researchers, law enforcement administrators, community members, and other appropriate stakeholders focus resources on those departments displaying the greatest level of disparities in their respective stop data. As noted previously, racial and ethnic disparities in any traffic stop analysis do not, by themselves, provide conclusive evidence of racial profiling. Statistical disparities do, however, provide evidence of the presence of data trends that warrant further analysis.

In order to determine if a department's racial and ethnic disparities warrant additional in-depth analysis, researchers review the results from some of the analytical sections of the report. The threshold for identifying significant racial and ethnic disparities for departments is described in each section of the report (ex. departments with a statistically significant disparity at the 95 percent level in the Black or Hispanic alone categories in the Solar Visibility analysis were identified as statistically significant). A department is identified for a follow-up analysis if it meets any one of the following criteria:

1. A statistically significant disparity in the one-year or three-year Solar Visibility analysis
2. A statistically significant disparity in the one-year or three-year KPT hit rate and Stop Disposition analyses

In general, we continue to identify far fewer departments in this report relative to the previous year's studies, with two municipal departments (**Berlin** and **Guilford**) and four State Police troops (**State Police Headquarters**, **Troop D**, **Troop E**, and **Troop H**. The municipal departments and State Police Troops were only identified in the three-year aggregate solar visibility sample. Based on the above-listed criteria and past research considerations, it was recommended that an in-depth follow-up analysis be conducted for the **Guilford** police department. Unlike other agencies in this report, an in-depth follow-up analysis of the Guilford traffic stop data has never been conducted.

In addition to being identified with racial and ethnic disparities in this study, the **Berlin** police department was identified with racial and ethnic disparities in the 2015-16 Traffic Stop Data Analysis and Findings report. An in-depth analysis, with recommendations, was completed and published as part of the 2015-16 Traffic Stop Data Analysis and Findings Supplemental report released in October 2018. The follow-up analysis and subsequent departmental interventions were not completed until the end of 2018. Therefore, it is reasonable that any changes made by the department would not be reflected in their data until late 2018 or early 2019. We reviewed the data covered in this analysis period and did not believe the agency's disparity was a significant enough deviation to warrant additional analysis. We will continue monitoring the department's data to determine if additional analysis is warranted in the future.

Although this year we formally identified **Troop D**, **Troop E, Troop H,** and **Headquarters** with statistically significant racial and ethnic disparities, a comprehensive five-year analysis of traffic stop disparities for the entire State Police was published in May 2020 as part of the 2018 Traffic Stop Data Analysis and Findings report. Many challenges are associated with assessing the racial and ethnic disparities identified within the State Police compared to municipal police departments. We will

continue to monitor State Police aggregate and Troop level trends for significant variations and to determine if additional comprehensive analysis is warranted.

It is also worth noting that the Connecticut Racial Profiling Prohibition Project advisory board authorized a comprehensive audit of racial profiling records submitted by the Connecticut State Police between January 1, 2014, and December 31, 2021. The audit identified inaccurate infraction records submitted to the racial profiling database by troopers and constables during all years of the audit. The inaccurate records most likely had a small but statistically significant impact on any analysis, including Connecticut State Police data between 2014 and 2021. This report covered the 2020 through 2022 calendar years. The full audit can be found on our website at www.ctrp3.org.

E.2: 2022 FOLLOW-UP ANALYSIS AND FINDINGS

A total of two municipal police departments and four state police troops were identified as having a statistically significant disparity in the probability of a non-White motorist being stopped in each respective jurisdiction. Part I of the report noted that these two municipal departments were identified across multiple statistical and descriptive tests. Although making any direct inference about racial bias is impossible, the findings present statistical evidence that warrants further investigation. In Part II of this report, researchers conducted an in-depth follow-up analysis for the Guilford Police Department. A follow-up analysis, with recommendations, was previously completed for the Berlin Police Department in October 2018. Based on the results of the previously published follow-up analyses and our further understanding of traffic stop enforcement in Berlin, we do not believe another follow-up analysis would significantly add to the knowledge of factors that may have influenced these disparities already documented in the previous follow-up reports. We would refer readers to the follow-up analysis for Berlin published in the *2015-16 Supplemental Traffic Stop Analysis and Findings report* for more specific information on the department.

Although Troop D, Troop E, Troop H, and the CSP Headquarters Troop were identified with statistically significant racial and ethnic disparities, a comprehensive 5-year review of state police activity was published in May 2020. Based on the results of the previously published analyses, we do not believe another follow-up analysis would significantly add to the knowledge of factors that may have influenced these disparities already documented in the previous report. We would refer readers to the follow-up analysis for Connecticut State Police published in *Traffic Stop Data Analysis and Findings, 2018* report for more specific information on the agency.

By conducting additional in-depth analysis of the Guilford Police Department, the public can better understand why and how disparities exist. This transparency is intended to assist in achieving the goal of increasing trust between the public and law enforcement. The follow-up analysis was designed to be a collaborative effort between research staff and the police department. The analysis was tailored based on the department and community's unique characteristics. Traffic stop disparities can be influenced by many factors, such as the location of crashes, high call-for-service volume areas, high crime rate areas, and areas with major traffic generators, such as shopping and entertainment districts, to name a few.

The follow-up analysis outlines additional descriptive measures that were applied to department-level data for Guilford. In order to understand the factors that might be contributing to traffic enforcement decisions, researchers sought to understand where their respective traffic enforcement patterns occurred and why. Mapping the traffic stops was the best means to begin this part of the

analysis. We were able to map a significant percentage of location coordinates in the census tract and also conducted a descriptive analysis of traffic stops by major corridors. The follow-up analysis also included a much more in-depth post-stop data review to examine differences in citation rates, contraband found as a result of a search, and stop reasons.

Traffic stop studies in other states have primarily focused on statewide or department-level trends. Aside from formal investigations, there is little precedence for a state to gain a more nuanced understanding of department-level enforcement patterns with an eye toward racial and ethnic disparities contained therein. Yet researchers believe it imperative to the success of this project that the conversation does not end at the identification of departments with significant racial and ethnic disparities. Indeed, the individual department follow-up proved enlightening for researchers and the department. However, there is always more to build upon to achieve the stated goals of the Alvin W. Penn Act. The follow-up analysis should be viewed as a part of an ongoing process for the public, law enforcement, and the law's implementing agency to gain an increasingly enhanced understanding of the factors contributing to racial and ethnic disparities in traffic stops.

BACKGROUND

First enacted in 1999, Connecticut's anti-racial profiling law entitled the Alvin W. Penn Racial Profiling Prohibition Act (Public Act 99-198), prohibits any law enforcement agency from stopping, detaining, or searching any motorist when the stop is motivated solely by considerations of the race, color, ethnicity, age, gender or sexual orientation of that individual (Connecticut General Statutes Sections 54-1l and 54-1m). In 2012 and 2013, the Connecticut General Assembly made several changes to this law to create a system to address racial profiling concerns in Connecticut.

In 2012, the Racial Profiling Prohibition Project Advisory Board was established to advise OPM on adopting the law's standardized methods and guidelines. The Institute for Municipal and Regional Policy (IMRP) at UConn was tasked with helping oversee the design, evaluation, and management of the racial profiling study mandated by PA 12-74 and PA 13-75, "An Act Concerning Traffic Stop Information." The IMRP worked with the advisory board and all appropriate parties to enhance the collection and analysis of traffic stop data in Connecticut.

Through September 30, 2013, police agencies collected traffic stop information based on requirements outlined in the original 1999 Alvin W. Penn law. Beginning October 1, 2013, police agencies had to submit traffic stop data for analysis under the new methods outlined by the Office of Policy and Management (OPM), as required by the amended racial profiling prohibition law. The law also authorized the OPM secretary to order appropriate penalties (i.e., the withholding of state funds) when municipal police departments, the Department of Emergency Services and Public Protection (DESPP), and other police departments fail to comply.

The National Highway Traffic and Safety Administration (NHTSA) provided resources for this project through a grant administered by the Connecticut Department of Transportation. The Racial Profiling Prohibition Project Advisory Board and the project staff have been meeting since May 2012 to outline a plan to successfully implement the requirements of the 2012 and 2013 legislation. The focus of the project's early phase was to understand traffic stop data collection in other states. After an extensive review of best practices, working groups were formed and met monthly to discuss the different aspects of the project. These working groups included Data and Systems, Public Awareness, and Training work groups. The full advisory board held more than 25 meetings, and the working groups met approximately 60 times.

The advisory board and IMRP also worked with law enforcement officials to create a data collection system that is efficient, not burdensome to the police collecting it and provides information that is easy to work with when it is submitted. Police agencies in Connecticut vary in their sophistication and technological capacity with respect to how they collect and report data. The project staff worked with the state's Criminal Justice Information System (CJIS) to develop a system to collect consistent and universal traffic stop information and submit it to CJIS electronically on a monthly basis.

The IMRP developed and maintains a project website (www.ctrp3.org) that informs the public of the advisory board's activities, statewide informational forums, and related news items on racial profiling. The website includes meeting agendas and minutes, press releases, and links to register for events. The website is updated weekly. In addition to the project website, the IMRP partnered with the Connecticut Data Collaborative to publish all traffic stop data on a quarterly basis. The public can

download the information in its original form or view summary tables easily. A full set of analytical tools will be available for more advanced users who are interested in data analysis.

Although much of the initial focus of this project was to develop a standardized method for data collection and analysis, there are other important components. The initiatives include a public awareness and education campaign, effective training for officers and departments, and a rigorous complaint process. Information about all of these initiatives is provided on the project website. These initiatives collectively represent different tools available for education and the prevention of racial profiling in policing. These tools were implemented to build and enhance trust between communities and law enforcement in Connecticut.

In February 2014, the U.S. Department of Justice Community Oriented Policing Services Division sponsored a train-the-trainer program in Connecticut on "Fair and Impartial Policing (FIP)." The FIP program was established to train police officers and supervisors on fair and impartial policing by understanding both conscious and unconscious bias. Over the next year, this program was offered to police agencies throughout the state.

Lastly, a major component of addressing concerns about the possibility of racial profiling in Connecticut is bringing law enforcement officials and community members together to discuss police-community relationships. The project staff has conducted several public forums throughout the state to unite these groups and will continue these dialogues in the foreseeable future. They serve as an important tool to inform the public of their rights and the role of law enforcement in serving their communities.

I: METHODOLOGICAL APPROACH UNDERLYING THE ANALYSIS

Assessing racial disparities in policing data has been used for the last two decades as a policy tool to evaluate whether racial bias exists within a given jurisdiction. Although there has always been widespread public support for the equitable treatment of individuals of all races, recent national headlines have brought this issue to the forefront of American consciousness and prompted a contentious national debate about policing policy. The statistical evaluation of policing data in Connecticut is an important step toward developing a transparent dialogue between law enforcement and the public. As such, this report's goal is to present the results of that evaluation in a transparent and unbiased manner.

The research strategy underlying this statistical analysis was developed with consideration to three guiding principles. Each principle served as an important foundation for the research process, particularly when selecting the appropriate results to disseminate to the public. A better understanding of these principles helps to frame the results in the technical portions of the analysis. Further, presenting these principles at the outset of the report provides readers with the appropriate context to understand our overall approach.

> *Principle 1: Acknowledge that statistical evaluation is limited to finding racial and ethnic disparities that are indicative of racial and ethnic bias but that, in the absence of a formal procedural investigation, cannot be considered comprehensive evidence.*
>
> *Principle 2: Apply a holistic approach for assessing racial and ethnic disparities in Connecticut policing data by using a variety of approaches that rely on well-respected techniques from existing literature.*
>
> *Principle 3: Outline the assumptions and limitations of each approach transparently so that the public and policy-makers can use their judgment in drawing conclusions from the analysis.*

The report is organized to lead the reader through a host of descriptive and statistical tests that vary in their assumptions and level of scrutiny. The intent behind this approach is to apply multiple tests as a screening filter for the possibility that any one test (1) produces false positive results or (2) reports a false negative. Seven distinct analytical tools were used to evaluate whether racial and ethnic disparities are present in the Connecticut policing data. In the analysis, the demography of motorists was grouped into four overlapping categories to ensure a large enough sample size for the statistical analysis. Although much of the analysis focuses on stops made of black (Hispanic or non-Hispanic) and Hispanic motorists (any race), the analysis was also conducted for aggregated groupings of all non-white motorists (Hispanic or non-Hispanic) as well as a combined sample of black and Hispanic motorists. In terms of identifying departments or state police barracks in individual tests, the estimated disparity (i.e. the higher likelihood of stopping a minority motorist) must have been estimated with at least a 95 percent level of statistical significance for either black or Hispanic motorists alone. Put simply, under the rigorous conditions set by each test, there must have

been at least a 95 percent chance that either black or Hispanic motorists were more likely to be stopped (or searched) at a higher rate relative to Caucasian non-Hispanic motorists.

The analysis begins by presenting a method referred to as the Solar Visibility analysis, also known in academic literature as the Veil of Darkness method, which was used to assess the existence of racial and ethnic disparities in stop data. The test is a statistical technique developed by Jeffery Grogger and Greg Ridgeway (2006) and published in the *Journal of the American Statistical Association*. The Solar Visibility analysis examines a restricted sample of stops occurring during the "inter-twilight window." It assesses relative differences in the ratio of non-White to White stops that occur in daylight compared to darkness. The inter-twilight window restricts stops to a fixed window throughout the year when visibility varies due to seasonality and the discrete daylight savings time shift. This technique relies on the idea that if police officers are profiling motorists, they are better able to do so during daylight hours when race and ethnicity are more easily observed. After restricting the sample of stops to the inter-twilight window and controlling for things like the time of day and day of the week, any remaining difference in the likelihood that a non-White motorist is stopped during daylight is attributed to disparate treatment. This analytical approach is considered the most rigorous and broadly applicable of all the tests presented in this report.

The second analytical tool used in the analysis is the synthetic control, where the number of non-White traffic stops in a given department is evaluated against a benchmark constructed using stops made by all other departments in Connecticut. Since departments differ in enforcement activity (i.e., time of stops, reason for stops, etc.) and the underlying demographics of the population on the roadway, this analysis relies on the rich statistical literature on propensity scores. Here, a propensity score measures how similar a stop made outside a given department is to a stop made by the analyzed department. These similarity measures are used to weight stops when constructing a benchmark for each department. For example, if the department being analyzed has a high non-White population and makes most of their stops on Friday nights at 7 PM for speeding violations, then stops made for speeding violations by departments with a similar residential population at this time and day will be given more weight when constructing the benchmark. This methodology ensures an apples-to-apples comparison between the number of non-White motorists stopped in a given town relative to their benchmark and allows for the interpretation of any remaining differences attributed to possible disparate treatment.

The two techniques contained in Chapter 5 are descriptive in nature and compare department-level data to two benchmarks (statewide average and resident population). These methods are called population benchmarks and are commonly used to evaluate racial disparities in police data nationwide. The statewide average comparison provides a simple and effective way to establish a baseline for all departments from which the relative differences between department stop numbers and the average for the state are compared. A comparison to the statewide average is presented alongside the context necessary to understand differences between local jurisdictions. The other population benchmark comparison limits the analysis to stops involving only community residents. It compares them to the community demographics based on the most recent decennial census for residents aged 16 and over. Although none of these benchmarks can provide a rigorous enough analysis to conclude racial disparities, they serve as useful tools if taken together with more rigorous statistical methods.

The sixth analytical tool used in the analysis tests for disparities in the outcomes of traffic stops using a model that examines the distribution of dispositions conditional on race and the reason for the stop. Specifically, we test whether traffic stops made of non-White motorists result in different outcomes relative to their White peers. We provide one important cautionary note about interpreting this test as causal evidence of discrimination. Ideally, this test would be performed on data containing *all* violations observed by the police officer before making a traffic stop and where we would include a control for the number of violations. In practice, data on traffic stops typically only contain the most severe reason that motivated the stop. In the absence of data on the full set of violations observed by police officers, we suggest that the reader interpret results from this test as providing descriptive evidence to be viewed in concert with other such empirical measures.

Lastly, an analysis of post-stop outcomes using a hit-rate approach following a technique published in the *Journal of Political Economy* by Knowles, Persico, and Todd (2001). The hit-rate approach relies on the idea that motorists rationally adjust their propensity to carry contraband in response to their likelihood of being searched by police. Similarly, police officers rationally decide whether to search a motorist based on visible indicators of guilt and an expectation of the likelihood that a given motorist might have contraband. According to the model, a demographic group of motorists would be searched by police more often if they were more likely to carry contraband. However, the higher level of searches should be proportional to this group's higher propensity to carry contraband. Thus, without racial animus, we should expect the rate of successful searches (i.e., the hit rate) to be equal across different demographic groups regardless of differences in their propensity to carry contraband. [4] In this test, discrimination is interpreted as a preference for searching non-White motorists that shows up statistically as a lower hit rate relative to White motorists. Note that this test inherently says nothing about disparate treatment in the decision to stop motorists as it is limited in scope to vehicular searches.

In short, we move forward with the overall goal of identifying the statistically significant racial and ethnic disparities in Connecticut policing data. Various statistical tests are applied to the data to provide a comprehensive approach based on the lessons learned from academic and policy applications. Our explanations of the mechanisms and assumptions underlying each test are intended to provide policymakers and the public with enough information to assess the data and draw their own conclusions from the findings.

Finally, we emphasize that any statistical test can only truly identify racial and ethnic disparities. Such findings provide a mechanism to indicate possible racial profiling, but they cannot, without further investigation, provide sufficient evidence that racial profiling exists.

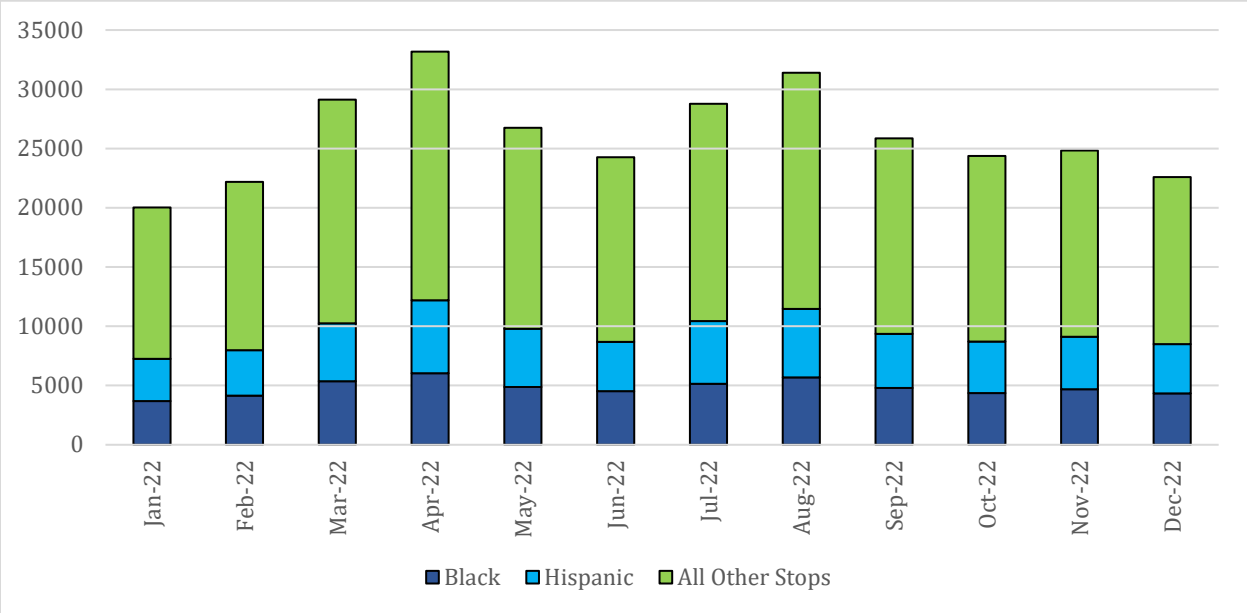
[4] Although some criticism has risen concerning the technique and extensions have suggested that more disaggregated groupings of searches be used in the test, the ability to implement such improvements is limited by the small overall sample of searches in a single year of traffic stops. Despite these limitations, the hit-rate analysis is still widely applied in practice and contributes to the overall understanding of post-stop police behavior in Connecticut.

II: CHARACTERISTICS OF TRAFFIC STOP DATA

This section examines general patterns of traffic enforcement activities in Connecticut for the study period of January 1, 2022, to December 31, 2022. Statewide and agency activity information can be used to identify variations in traffic stop patterns to help law enforcement and local communities understand more about traffic enforcement. Although some comparisons can be made between similar communities, we caution against comparing agencies' data in this report section. Please note that the tables in this report present information from only a few departments. Complete tables for all agencies are included in the technical appendix.

In Connecticut, more than 313,000 traffic stops were conducted during the 12-month study period. Traffic enforcement increased by approximately 14% in 2022 compared to the previous year. The State of Connecticut saw a significant reduction in traffic enforcement during the COVID-19 pandemic. Although there was a continued increase in traffic enforcement in 2022 compared to 2020 and 2021, enforcement remains approximately 37% lower than pre-pandemic levels. The most traffic stops occur in April, with a total of 33,000. This is still significantly below the pre-pandemic average for April, which was closer to 60,000 stops. Almost 67% of the total stops were conducted by the 94 municipal police departments, and 33% of the total stops were conducted by state police. Figure 2.1 shows the aggregate number of monthly traffic stops and each demographic category.

Figure 2.1: Aggregate Traffic Stops by Month of the Year



The number of reported traffic stops decreased each year between 2014 and 2018. There was a small increase in traffic stops in 2019 until a sharp decrease in 2020. There was a 16% decrease between 2014 and 2018; in 2020, the number of stops sharply decreased by 54% from 2019 and 61% from 2014. In 2021, this number increased a moderate 17% from 2020. In 2022, it increased 15% from 2021, but still below pre-pandemic levels. This suggests that the effects of the Covid-19 pandemic

were still present in 2022. Figure 2.2 shows the total number of traffic stops by year since the start of the project.

Figure 2. 2: Connecticut, number of traffic stops, 2014-2022

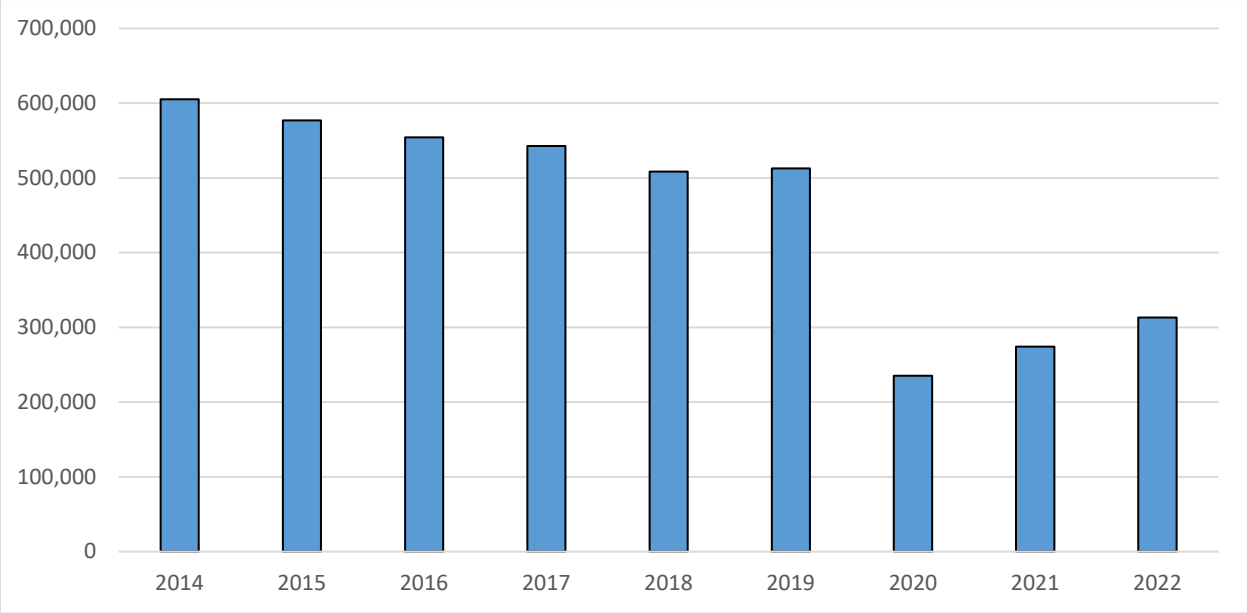


Figure 2.3 shows the aggregate number of traffic stops by month of the year between 2019 and 2022. Traffic stops have increased each month of each year since April 2020, but no single month has matched pre-pandemic stop stops. Although the monthly trends remain similar, April and August contributed the largest number of traffic stops, and December had the lowest number of traffic stops in the calendar year. February 2022 saw the largest single-month increase compared to the previous year.

Figure 2. 3: Aggregate Traffic Stops by Month of the Year 2019 to 2022

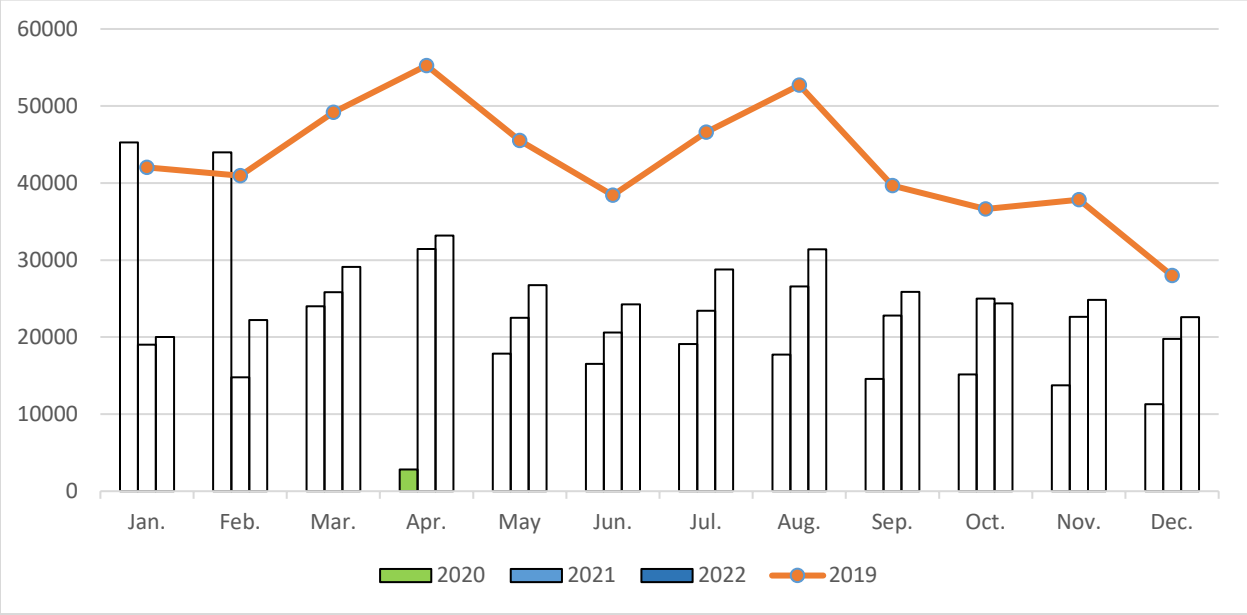


Figure 2.4 displays traffic stops by time of day for the analysis period. As can be seen from the figure, the total volume of traffic stops fluctuates significantly across different times of the day. The sample's highest hourly volume of traffic stops occurred from five to six in the evening and accounted for 7.3% of all stops. It is not surprising that traffic stops increase between these hours as this is a peak commuting time in Connecticut. The lowest volume of traffic stops occurred between four and five in the morning and continued at a suppressed level during the morning commute. The low level of traffic stops during the morning commute is likely due to an interest in maintaining a smooth traffic flow during these hours. Discretionary traffic stops might be less likely to be made during these hours than others in the sample.

The evening commute represents a period when significant traffic stops are made. The surge between four and seven at night represents the most significant traffic enforcement period. In aggregate, stops occurring between these hours represented 20% of total stops. Interestingly, there seems to be a significant correlation between the proportion of non-White stops and the overall volume of stops. In particular, the share of Hispanic and Black stops increases when the total volume of stops decreases.

Figure 2.4: Aggregate Traffic Stops by Time of Day

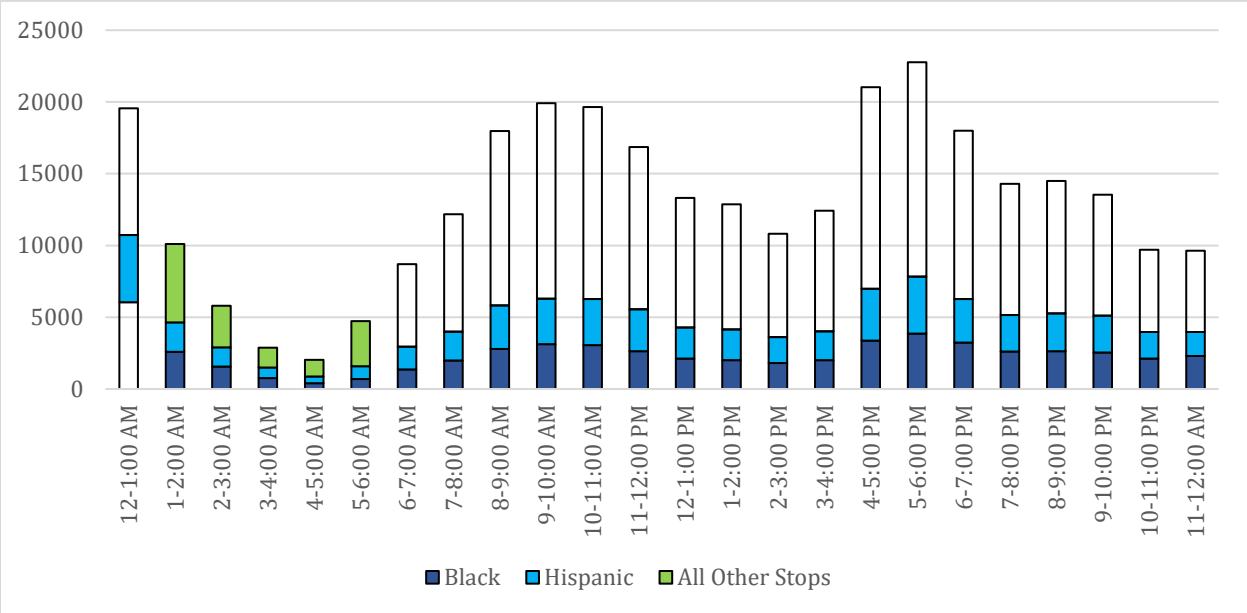
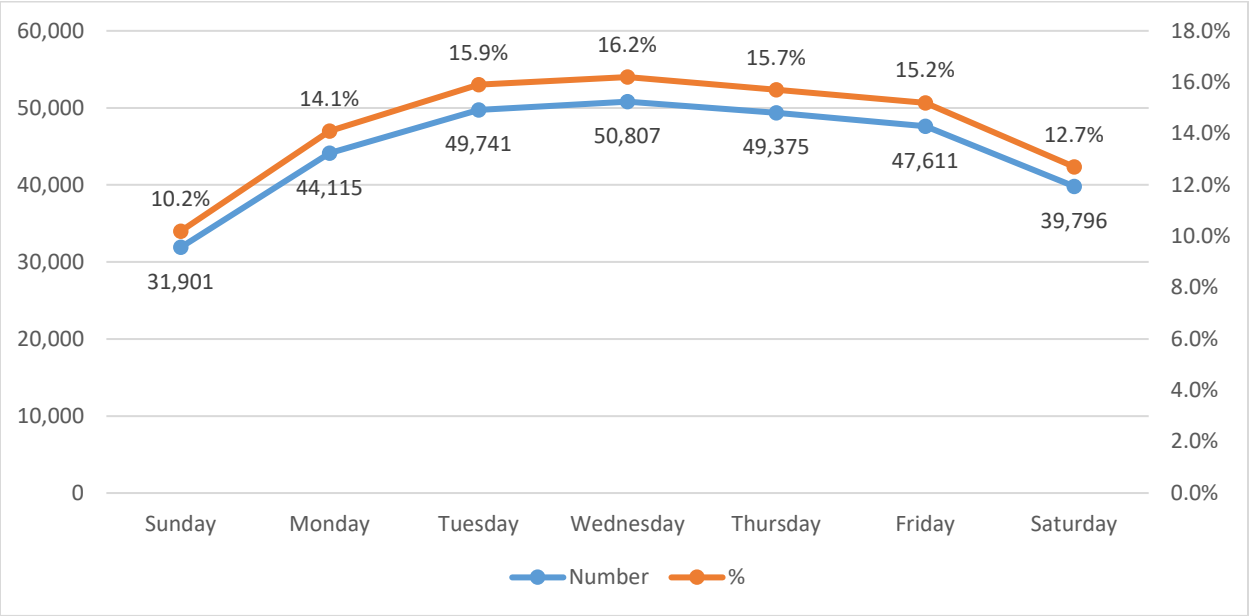


Figure 2.5 displays traffic stops by day of the week for the entire analysis period. This figure shows that the number of traffic stops increases throughout the week and peaks on Wednesdays. Traffic stops decline substantially on the weekends, with the smallest number occurring on Sundays.

Figure 2. 5: Traffic Stops by Day of Week



The level of and reason for traffic stop enforcement varies greatly across agencies throughout the state for a number of reasons. For example, some enforcement is targeted to prevent traffic crashes in dangerous areas, combat increased criminal activity, or respond to complaints from citizens. Those agencies with active traffic units tend to produce more traffic stops. The traffic stop rate per 1,000 residents in the population helps to compare the stop activity between agencies. The five municipal police agencies with the highest stop rate per 1,000 residents are Orange, Wilton, Waterford, Rocky Hill, and Ledyard. Conversely, Wolcott, Shelton, Granby, Waterbury, and Newtown have the lowest rate of stops per 1,000 residents. Table 2.1 shows the distribution of stops for the highest and lowest level of enforcement per 1,000 residents for police agencies. All department results are contained in Table B.1 of Appendix B.

Table 2. 1: Municipal Police, Highest and Lowest Rates of Traffic Stops

Town Name	16+ Population*	Traffic Stops	Stops per 1,000 Residents
Connecticut	2,825,946	313,346	111
Municipal Departments with the Highest Rate of Traffic Stops			
Orange	11,017	3,623	329
Wilton	12,973	4,068	314
Waterford	15,760	4,579	291
Rocky Hill	16,224	4,635	286
Ledyard	11,527	2,986	259
Municipal Departments with the Lowest Rate of Traffic Stops			
Wolcott	13,175	111	8

Town Name	16+ Population*	Traffic Stops	Stops per 1,000 Residents
Shelton	32,010	287	9
Granby	8,716	86	10
Waterbury	83,964	943	11
Newtown	20,171	367	18

* The population 16 years of age and older was obtained from the United States Census Bureau 2010 Decennial Census.

Table 2.2 presents some basic demographic data on persons stopped in Connecticut between January 1, 2022, and December 31, 2022. Nearly two-thirds (63%) of drivers stopped were male, and most (88%) were Connecticut residents. Of the stops conducted by police departments other than state police, 92% were Connecticut residents. Of the stops made by state police, 81% were Connecticut residents. About one-third (36%) of drivers stopped were under 30, compared to 25% over 50. The vast majority of stops in Connecticut were White Non-Hispanic drivers (60%); 18% were Black Non-Hispanic drivers; 18% were Hispanic drivers; and 3% were Asian/Pacific Islander Non-Hispanic and American Indian/Alaskan Native Non-Hispanic drivers.

Table 2. 2: Statewide Driver Characteristics

Race and Ethnicity		Gender		Residency		Age	
White	60.3%	Male	62.8%	CT Resident	88.3%	16 to 20	9.1%
						21 to 30	27.0%
Black	18.4%					31 to 40	22.6%
						41 to 50	16.0%
Hispanic	17.9%	Female	37.2%	Non-Resident	11.7%	51 to 60	13.8%
						Older than 61	11.4%
Other	3.4%						

Table 2.3 presents data on the characteristics of the traffic stops in the state. Most traffic stops were made for a violation of the motor vehicle laws (90%) instead of a stop made for an investigatory purpose or equipment violation. The most common violation drivers were stopped for was speeding (35%). After a driver was stopped, 30% were given a ticket, while most of the remaining drivers received a warning (62%). Statewide, about 1 percent of traffic stops resulted in the arrest of a driver, and less than 2 percent of stops resulted in a search being conducted. Stops that result in a search continued to decline in 2022.

Table 2. 3: Statewide Stop Characteristics

Classification of Stop		Basis for Stop	
Motor Vehicle Violation	90.0%	Speeding	34.7%
Equipment Violation	7.2%	Defective Lights	6.5%
Investigatory	2.8%	Misc. Moving Violation	8.3%
Outcome of Stop		Stop Sign	10.4%
Uniform Arrest Report	1.1%	Registration	8.7%
Misdemeanor Summons	5.7%	Traffic Control Signal	7.4%
Infraction Ticket	29.9%	Cell Phone	6.7%
Written Warning	22.4%	STC Violation	4.1%
Verbal Warning	39.4%	Display of Plates	2.7%
No Disposition	1.5%	Seatbelt	1.7%
Vehicles Searched	1.7%	All Other	8.8%

In addition to the difference in the volume of traffic stops across communities, agencies stopped drivers for a number of different reasons. Police record the statutory reason for stopping a motor vehicle for every stop. Those statutes are then sorted into 15 categories, from speeding to registration and stop sign violations. For example, all statutory violations that are speed-related are categorized as speeding. Although speeding is the most often cited reason for stopping a motor vehicle statewide, the results vary by jurisdiction.

The average number of municipal police department stops for speeding violations was 34%, compared to the average number of state police stops, which was 40%. Due to the nature of state police highway operations, it is reasonable that its average for speeding is higher. In 22 departments and two state police barracks, more than 50% of the traffic stops were for speeding violations. On the other hand, four departments stopped drivers for speeding less than 5% of the time. These four departments were all special police agencies with limited jurisdiction. It is reasonable that they are not stopping many drivers from speeding violations. Table 2.4 shows the top 10 departments where speeding (as a percentage of all stops) was the most common reason for the traffic stop. All department results are contained in Table B.2 of Appendix B.

Table 2. 4: Highest Speeding Stop Rates across All Departments

Department Name	Total Stops	Speeding Violations
Simsbury	3,275	70.2%
Suffield	958	69.8%
Easton	223	68.6%
CSP Headquarters	13,353	68.5%
Avon	481	67.6%
Thomaston	252	65.9%
Canton	1,158	65.5%
Ledyard	2,986	63.7%
Groton Long Point	8	62.5%
Weston	281	61.9%

Registration violations have been cited as a low-discretionary reason for stopping a motor vehicle, particularly due to the increased use of license plate readers to detect registration violations. Statewide, 9% of all traffic stops are for registration violations. Table 2.5 presents the top 10

departments with the highest percentage of stops for registration violations. All department results are contained in Table B.2 of Appendix B.

Table 2. 5: Highest Registration Violation Rates across All Departments

Department Name	Total Stops	Registration Violations
Branford	1,514	30.7%
Troop B	3,282	28.1%
North Branford	574	27.2%
East Haven	2,126	25.7%
North Haven	1,489	20.3%
Waterbury	943	20.0%
Troop A	11,537	20.0%
West Hartford	4,726	19.0%
Willimantic	1,018	19.0%
Farmington	3,560	18.8%

The Connecticut Department of Transportation and the National Highway Safety Administration work together yearly to fund various driver safety campaigns. Some of the campaigns that we are most familiar with include: "Click it or Ticket," "Drive Sober or Get Pulled Over," and "Move Over." Law enforcement agencies receive federal grants each year to fund targeted traffic safety campaigns. This past year, Connecticut continued to see many traffic stops for distracted driving. Statewide, 7% of all stops resulted from a cell phone violation, and this rate varies across departments. Table 2.6 presents the top 10 departments with the highest percentage of stops for cell phone violations. All department results are contained in Table B.2 of Appendix B.

Table 2. 6: Highest Cell Phone Violation Rates across All Departments

Department Name	Total Stops	Cell Phone Violations
Putnam	530	27.4%
Bridgeport	2,847	26.4%
Hamden	1,136	25.4%
Waterbury	943	24.8%
Stamford	3,022	24.6%
Norwalk	2,748	23.2%
Danbury	2,478	22.3%
Wethersfield	2,811	20.9%
Plymouth	1,147	19.1%
Glastonbury	2,514	18.4%

Some Connecticut residents have expressed concern about the stops made for violations perceived as more discretionary, potentially making the driver more susceptible to possible police bias. Those stops are typically referred to as pretext stops and might include stops for defective lights, excessive window tint, or a display of plate violation, each of which, though a possible violation of state law, leaves the police officer with considerable discretion with respect to actually making the stop. A statewide combined average for stopping drivers for these violations is 11%. Forty-five municipal police departments, two special police agencies, and one state police troop barracks exceeded that statewide average. Table 2.7 presents the top 10 departments with the highest percentage of stops for equipment-related violations. All department results are contained in Table B.2 of Appendix B.

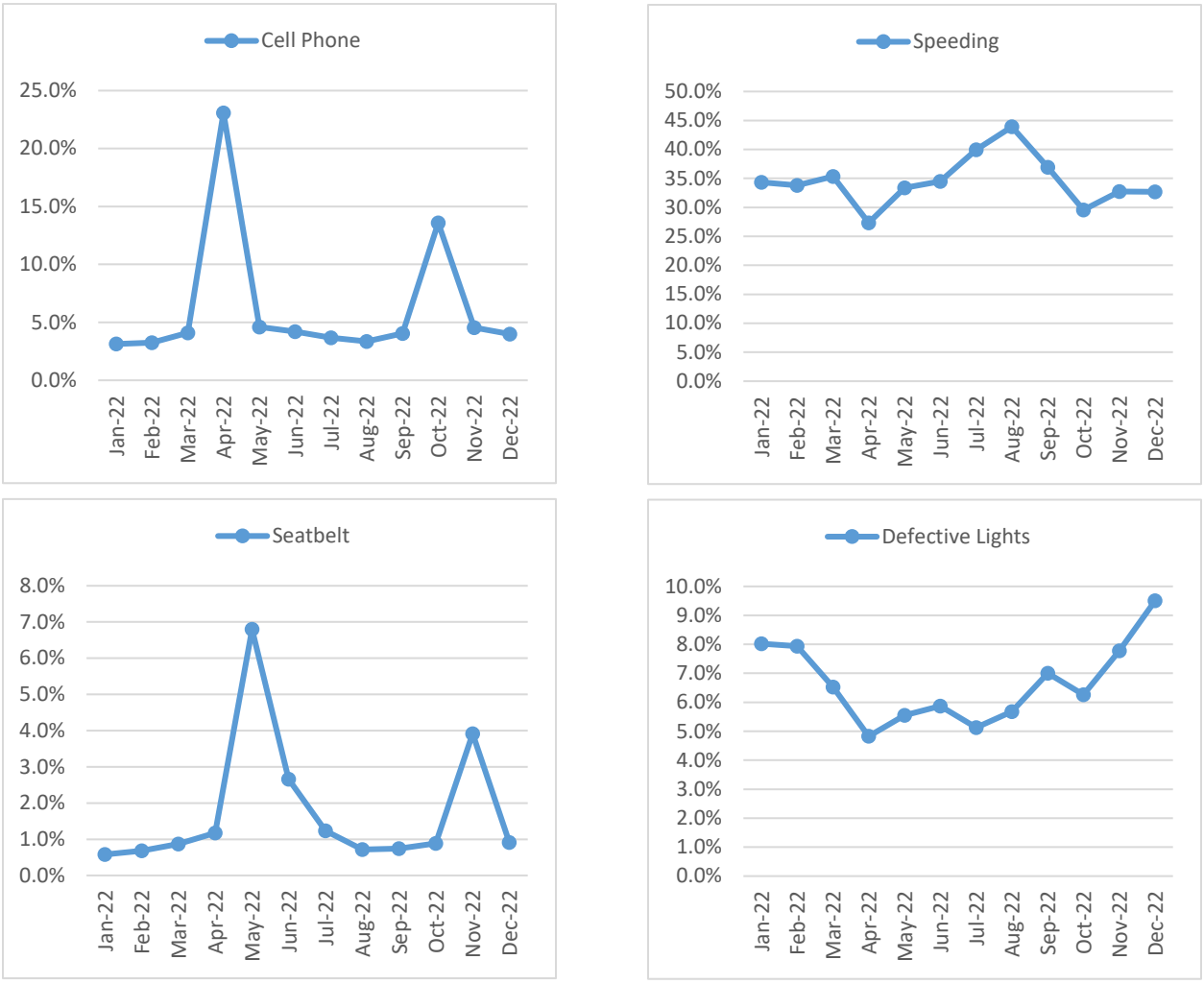
In communities with a higher proportion of stops due to these violations, it is recommended that the departments be proactive in discussing the reasons for these stops with community members and examine for themselves whether or not such stops produce disparate enforcement patterns.

Table 2. 7: Highest Equipment-Related Violation Rates across All Departments

Department Name	Total Stops	Equipment-Related Violations
Plainfield	1,658	40.7%
Putnam	530	27.0%
Torrington	6,641	26.2%
Groton City	1,739	26.2%
Shelton	287	26.1%
Cromwell	1,038	24.9%
Willimantic	1,018	24.2%
Groton Town	2,212	23.3%
East Windsor	1,269	23.3%
New Britain	3,348	23.1%

Police tend to stop the same percentage of drivers each month for most of the violation categories. For example, approximately 3% of all drivers are stopped for an administrative offense each month. Four violation categories change more substantially based on the month or season. Less than 5% of all monthly stops are for a cell phone-related violation, except in April and October. Almost a quarter of all stops in April were for a cell phone-related offense, and just under 15% of stops in October. These are likely months with increased federal funding to local police departments for distracted driving enforcement campaigns. Speed enforcement decreased in April when there was an increase in cell phone enforcement. This likely means that the enforcement campaign doesn't substantially increase overall enforcement efforts but does change what law enforcement focuses on as violations. For example, speed enforcement peaks in August, and seatbelt enforcement follows a similar trend to cell phone enforcement, with minimal enforcement throughout the year, except in May and November. There appears to be a seasonal increase in defective lighting stops during the winter months, which is logical given that there are more hours of darkness. Lighting violations peak between November and February. Figure 2.6 shows the percentage of monthly stops for cell phone, speeding, seatbelt, and defective lighting violations.

Figure 2. 6: Percent of Stops by Month for Select Violations



Some argue that it is difficult for police to determine the defining characteristics of a driver before stopping and approaching the vehicle. Similar to variations found across departments for the reason for the traffic stop, some variations occur with the outcome of the stop. These variations illustrate the influence that local police departments have on enforcing state traffic laws. Some communities may view infraction tickets as the best method to increase traffic safety, while others may consider warnings more effective. This analysis should help police departments and local communities understand their level and type of traffic enforcement compared to other communities.

Approximately one-third (30%) of drivers stopped in Connecticut received an infraction ticket, while 62% received a written or verbal warning. Individual jurisdictions varied in their post-stop enforcement actions. Stamford issued infraction tickets at 66% of all traffic stops, one of the highest in the state. Portland only issued infraction tickets at 1% of all traffic stops, the lowest rate in the state. For state police, officers not assigned to a troop issued the highest infractions (90%), and Troop B issued the lowest number of infractions (23%). Table 2.8 presents the highest infraction rates across municipal departments and state police barracks. All department results are contained in Table B.3 of Appendix B.

Table 2. 8: Highest Infraction Rates across All Departments

Department Name	Total Stops	Infraction Ticket
Highest Municipal Departments		
Stamford	3,022	65.7%
Danbury	2,478	59.9%
Meriden	1,883	51.5%
East Hartford	7,343	51.1%
Hartford	11,916	50.4%
Highest State Police Troops		
CSP Headquarters	13,353	90.0%
Troop I	6,981	49.6%
Troop H	3,330	47.2%
Troop G	13,416	46.3%
Troop D	4,216	42.6%

On the other hand, Portland issued warnings 97% of the time (the highest rate), and Waterbury issued warnings 26% of the time (the lowest rate). For state police, Troop C issued the highest percentage of warnings (67%), and the group of officers not assigned to a troop issued the lowest percentage of warnings (8%). Table 2.9 presents the highest warning rates across municipal departments and state police barracks. All department results are contained in Table B.3 of Appendix B.

Table 2. 9: Highest Warning Rates across All Departments

Department Name	Total Stops	Resulted in Warning
Highest Municipal Departments		
Portland	265	97.0%
Middlebury	305	94.1%
Windsor	4,467	93.7%
Thomaston	252	92.1%
Cheshire	3,007	91.3%
Highest State Police Troops		
Troop C	9,766	67.2%
Troop B	3,282	65.6%
Troop F	10,456	63.7%
Troop L	6,199	60.3%
Troop K	9,639	53.6%

Statewide, only 1% of all traffic stops resulted in the driver being arrested. As with infraction tickets and warnings, departments varied in the percentage of arrests associated with traffic stops. Troop H issued the most uniform arrest reports from a traffic stop, with 6.9% of all stops resulting in an arrest. Only five municipal police departments, two special police agencies, and one state police troop arrested more than 3% of all drivers stopped. Table 2.10 presents the highest arrest rates across all departments. All department results are contained in Table B.3 of Appendix B.

Table 2. 10: Highest Arrest Rates across All Departments

Department Name	Total Stops	Arrests
Troop H	3,330	6.9%

Department Name	Total Stops	Arrests
New London	1,651	6.0%
Bridgeport	2,847	5.7%
State Capitol Police	23	4.3%
Willimantic	1,018	4.0%
Yale University	50	4.0%
Winsted	461	3.5%
Naugatuck	2,036	3.1%
Groton City	1,739	2.8%
New Britain	3,348	2.6%

Rarely do traffic stops in Connecticut result in a vehicle being searched. During the study period, only 1.7% of all traffic stops resulted in a search. Although searches are rare in Connecticut, they vary across jurisdictions, and the data provides information about enforcement activity throughout the state. When they search a vehicle, officers must report their supporting legal authority and whether contraband was found. Thirty-six municipal departments, three special police agencies, and one state police barracks exceeded the statewide average for searches. Still, the largest search rate was found in Waterbury (20%), State Capitol Police (17%), Bridgeport (10%), West Haven (8.5%), and Naugatuck (8%). Table 2.11 presents the highest search rates across all municipal departments. All department results are contained in Table B.4 of Appendix B.

Table 2.11: Highest Search Rates across All Departments

Department Name	Total Stops	Resulted in Search
Waterbury	943	19.8%
State Capitol Police	23	17.4%
Bridgeport	2,847	10.2%
West Haven	1,597	8.5%
Naugatuck	2,036	8.2%
New Britain	3,348	6.8%
Winsted	461	6.5%
Groton City	1,739	6.4%
Norwich	1,473	6.0%
Hartford	11,916	5.4%

III: ANALYSIS OF TRAFFIC STOPS, SOLAR VISIBILITY

The solar visibility analysis relies on seasonal variation in sunset timing to test for evidence of racial and ethnic disparities in police traffic stops. The test operates under the key assumption that police officers are marginally better able to observe motorists' race and ethnicity during daylight relative to darkness (Grogger and Ridgeway 2006; Ridgeway 2009; Horace and Rohlin 2018; Kalinowski et al. 2017, 2019a, 2019b).[5] The test relies on seasonal variation in the timing of sunset and the discrete daylight savings time shift to compare stops made at the same time in darkness versus daylight. This methodology's advantage relative to population-based benchmarks is that it does not require any assumptions about the underlying risk set of motorists on the roadway. Rather, the test presumes that the composition of motorists does not vary in response to changes in visibility.[6] Within a fixed window when sunset timing varies throughout the year, the racial composition of stops in darkness is used as a counterfactual for stops in daylight, when officers can better observe the race of the motorist.

More specifically, the solar visibility test evaluates whether statistically significant disparities exist in the likelihood that a stopped motorist is a non-White motorist during daylight relative to darkness. As detailed explicitly in Appendix A.2, Grogger and Ridgeway (2006) illustrate that under certain conditions, the odds-ratio of a stopped motorist being a non-White in daylight vs. darkness is equivalent to the odds-ratio that a non-White motorist is stopped during daylight vs. darkness. In a practical context, these assumptions are that variations in travel and enforcement patterns (abject of discrimination) do not change differentially by race in response to daylight. The estimated conditions are on time and on the day of the week to ensure these conditions are met. We also control for inherent differences in daylight and darkness; the sample is restricted to the inter-twilight window, a period of time during the day when solar visibility varies throughout the year (i.e., between the earliest eastern sunset and the latest western end to civil twilight). Conveniently, this time window falls within the evening commute, where we might expect the risk-set of motorists to be less susceptible to seasonal variation.

III.A: AGGREGATE ANALYSIS WITH SOLAR VISIBILITY, 2022 AND 2020-22

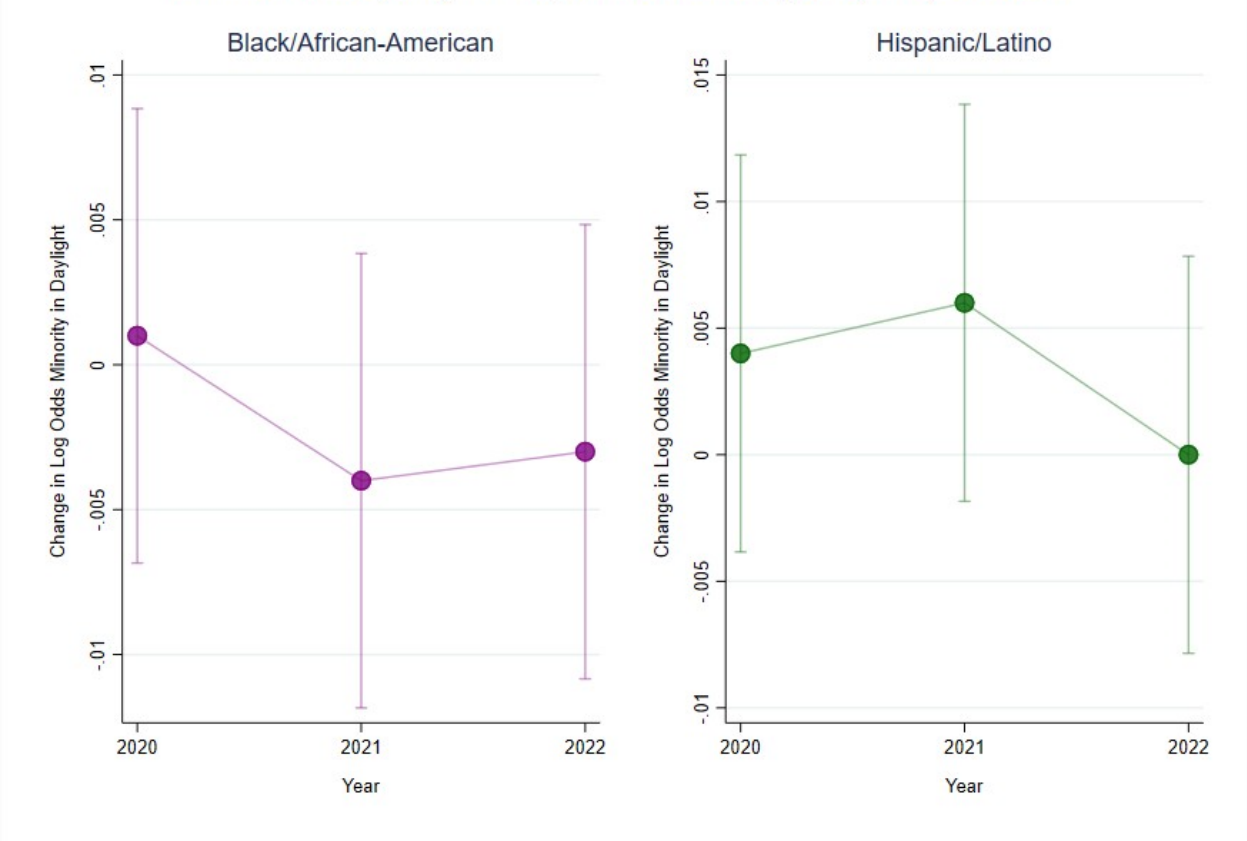
Figure 3.1 presents the results of applying the solar visibility test to the aggregate sample of traffic stops made within the inter-twilight sample in Connecticut in 2020, 2021, and 2022. The vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a linear probability model of motorist race/ethnicity on daylight. It includes controls for the time of day, day of the week, and department. The figure plots the estimated change in the likelihood that a Black (left panel) or Hispanic (right panel) motorist is stopped in daylight relative to darkness. Under the assumptions of

[5] Applications of the so-called "Veil of Darkness" method include: Grogger and Ridgeway (2006) in Oakland, CA; Ridgeway (2009) in Cincinnati, OH; Ritter and Bael (2009) and Ritter (2017) in Minneapolis, MN; Worden et al. (2010; 2012) in Syracuse, NY while Horace and Rohlin (2016) in Syracuse, NY; Renauer et al. (2009) in Portland, OR; Taniguchi et al. (2016a, 2016b, 2016c, 2016d) in Durham, Greensboro, Raleigh, and Fayetteville; Masher (2016) in New Orleans, LA; Chanin et al. (2016) in San Diego, CA; Ross et al. (2015; 2016; 2017a; 2017b) in Connecticut and Connecticut; Criminal Justice Policy Research Institute (2017) in Corvallis PD, OR; Milyo (2017) in Columbia, MO; Smith et al. (2017) in San Jose, CA; and Wallace et al. (2017) in Maricopa, AZ.

[6] Note that this assumption allows for differential rates of traffic stops to exist across races and the potential for differences in guilt and driving behavior.

this test, an increase in the likelihood that a non-White motorist is represented in the traffic stop data during daylight is suggestive of potential adverse treatment on the part of police. Across the period 2020-22, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 19.34% and 17.75%, respectively, as compared to 59.61% non-Hispanic White. We find that the annual estimated change in the likelihood a Black or Hispanic motorist is stopped in daylight relative to darkness ranged from -0.4 to 0.1 and 0 to 0.6 percentage points, respectively. According to this test, neither Black or Hispanic motorists, on average, were any more likely to be stopped by Connecticut police during daylight relative to darkness.

Figure 3.1: Aggregate Solar Visibility Analysis by Year, All Traffic Stops, 2020-22



Notes: Coefficient estimates are obtained from Table 3.1 of the 2020 and 2021 annual reports and the 2022 estimates from the table below.

Table 3.1 presents the comprehensive results from the 2022 solar visibility test applied to the aggregate sample of traffic stops made by all Connecticut police departments within the inter-twilight window. The results were obtained by estimating Equation 4 of Appendix A.2 with the standard errors clustered by department. The estimates include controls for the hour, day of week, and department. The estimates rely on four non-White definitions that are not mutually exclusive; for example, the first specification includes all non-White motorists (regardless of ethnicity), while the third includes all Hispanic motorists (regardless of race). The second specification is restricted to only Black motorists (regardless of ethnicity, i.e., a subset of the first specification), and the fourth specification includes both Black and Hispanic motorists (i.e., combines the second and third specifications). The omitted control group across all specifications includes only stops of motorists

who were observed to be White and non-Hispanic. The results for the Black and Hispanic alone categories are also depicted graphically in Figure 3.1.

The coefficient estimates across all categories in Table 3.1 are inconsistent regarding signs and statistically insignificant across specifications. Under the identifying assumptions of this test, see Appendix A.2, we should expect that there will be a direct correspondence between changes in the likelihood of stopped motorists and that of motorists at risk of being stopped. Thus, a positive change in the likelihood that a non-White motorist is stopped during daylight is indicative of discrimination under the premise that all else is held fixed, and the only thing changing is the officer's ability to perceive race. In the aggregate, the results suggest that Black and Hispanic motorists were not any more likely to be stopped by police during daylight when their race is more easily observed.

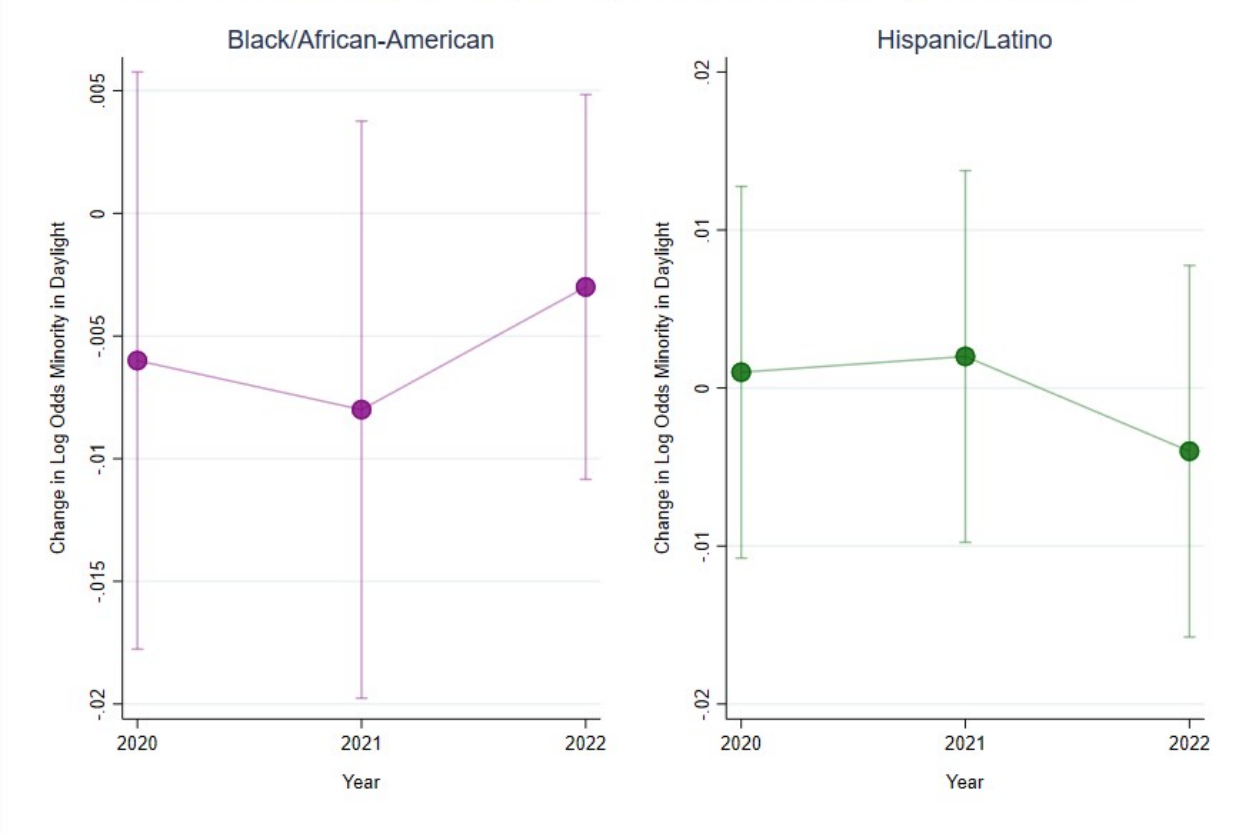
Table 3.1: Linear Probability Model of Race/Ethnicity on Daylight with Department Fixed-Effects, All Traffic Stops 2022

LHS: Minority Status		Non-White	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.003	-0.003	0.000	-0.002
	Standard Error	(0.004)	(0.004)	(0.004)	(0.004)
N =		62,225	59,467	58,945	72,072

Notes: The coefficients are presented as percentage point changes and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance rate greater than 10%. All specifications include controls for an hour of the day, day of the week, and department-fixed effects. The sample includes all traffic stops made during the inter-twilight window in 2022.

Figure 3.2 presents the results from the solar visibility test applied to the combined sample of municipal departments from 2020, 2021, and 2022. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a linear probability model of motorist race/ethnicity on daylight and controls for time of day, day of week, and department. A positive coefficient represents an increase in the likelihood a non-White motorist was represented in the traffic stop data during daylight, which suggests potential adverse treatment on the part of the police. Across the period 2020-22, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 21.48% and 18.95%, respectively, compared to 56.39% non-Hispanic White. We find that the annual estimated change in the likelihood of a Black and Hispanic motorist being stopped in daylight ranged from -0.8 to -0.3 and -0.4 to 0.1 percentage points, respectively. In the aggregate, the results suggest that Black and Hispanic motorists were not any more likely to be stopped by police during daylight when their race is more easily observed.

Figure 3.2: Aggregate Solar Visibility Analysis by Year, Municipal Traffic Stops, 2020-22



Notes: Coefficient estimates are obtained from Table 3.2 of the 2020 and 2021 annual reports and the 2022 estimates from the table below.

Table 3.2 presents the full set of results estimated from the sample of all municipal police departments during the inter-twilight window in 2022. As discussed above with respect to Figure 2, we find very little evidence of a statistically significant disparity for non-White motorists in the combined sample of municipal police departments. Under the identifying assumptions of this test, see Appendix A.2, we should expect that there will be a direct correspondence between changes in the likelihood of stopped motorists and that of motorists at risk of being stopped. Thus, a positive change in the likelihood that a non-White motorist is stopped during daylight is typically indicative of discrimination. In the aggregate, the results below do not consistently show any disparity in the likelihood that non-White motorists are stopped by Connecticut municipal police during daylight relative to darkness.

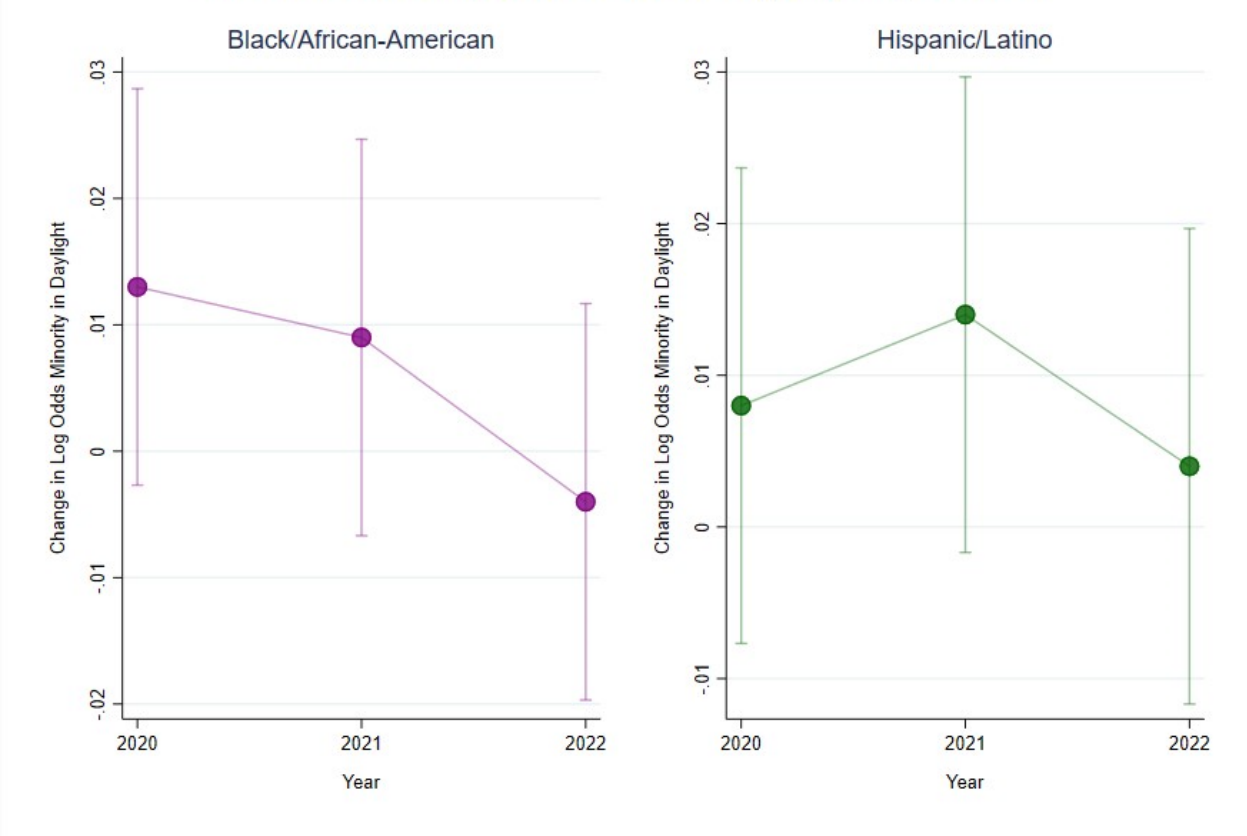
Table 3.2: Linear Probability Model of Race/Ethnicity on Daylight, Municipal Traffic Stops 2022

LHS: Minority Status		Non-White	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.003	-0.003	-0.004	-0.004
	Standard Error	(0.004)	(0.004)	(0.006)	(0.004)
N =		42,366	40,618	39,753	49,787

Notes: The coefficients are presented as percentage point changes and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance rate greater than 10%. All specifications include controls for an hour, day of the week, and department-fixed effects. The sample includes all traffic stops made during the inter-twilight window in 2022.

Figure 3.3 presents the results from the solar visibility test applied to the combined sample of State Police troops from 2020, 2021, and 2022. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a linear probability model of motorist race/ethnicity on daylight and controls for time of day, day of week, and department. A positive coefficient represents an increase in the likelihood a non-White motorist was represented in the traffic stop data during daylight, which suggests potential adverse treatment on the part of the police. Across the period 2020-22, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 13.87% and 18.95%, respectively, compared to 68.01% non-Hispanic White. We find that the annual estimated change in the likelihood of a Black and Hispanic motorist being stopped in daylight ranged from -0.4 to 1.3 and 0.4 to 1.4 percentage points, respectively. In the aggregate, the results suggest that Black and Hispanic motorists were not any more likely to be stopped by police during daylight when their race is more easily observed.

Figure 3.3: Aggregate Solar Visibility Analysis by Year, State Police Traffic Stops, 2020-22



Notes: Coefficient estimates are obtained from Table 3.3 of the 2020 and 2021 annual reports and the 2022 estimates from the table below.

Table 3.3 presents the full set of results estimated from the sample of all State Police troops during the inter-twilight window in 2022. Under the identifying assumptions of this test, see Appendix A.2, we should expect that there will be a direct correspondence between changes in the likelihood of stopped motorists and that of motorists at risk of being stopped. Thus, a positive change in the likelihood that a non-White motorist is stopped during daylight indicates discrimination. In the aggregate, the results below do not show a disparity in the likelihood that a Hispanic or Black motorist is stopped by Connecticut State Police.

Table 3.3: Linear Probability Model of Race/Ethnicity on Daylight, State Police Traffic Stops 2022

LHS: Minority Status		Non-White	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.002	-0.004	0.004	0.002
	Standard Error	(0.008)	(0.008)	(0.008)	(0.008)
N =		19,440	18,462	18,828	21,817

Notes: The coefficients are presented as percentage point changes and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01, which is significant at the end of every table. Is it supposed to be capitalized and have punctuation? Is this an error? All specifications include controls for an hour, day of the week, and department-fixed effects. The sample includes all traffic stops made during the inter-twilight window in 2022.

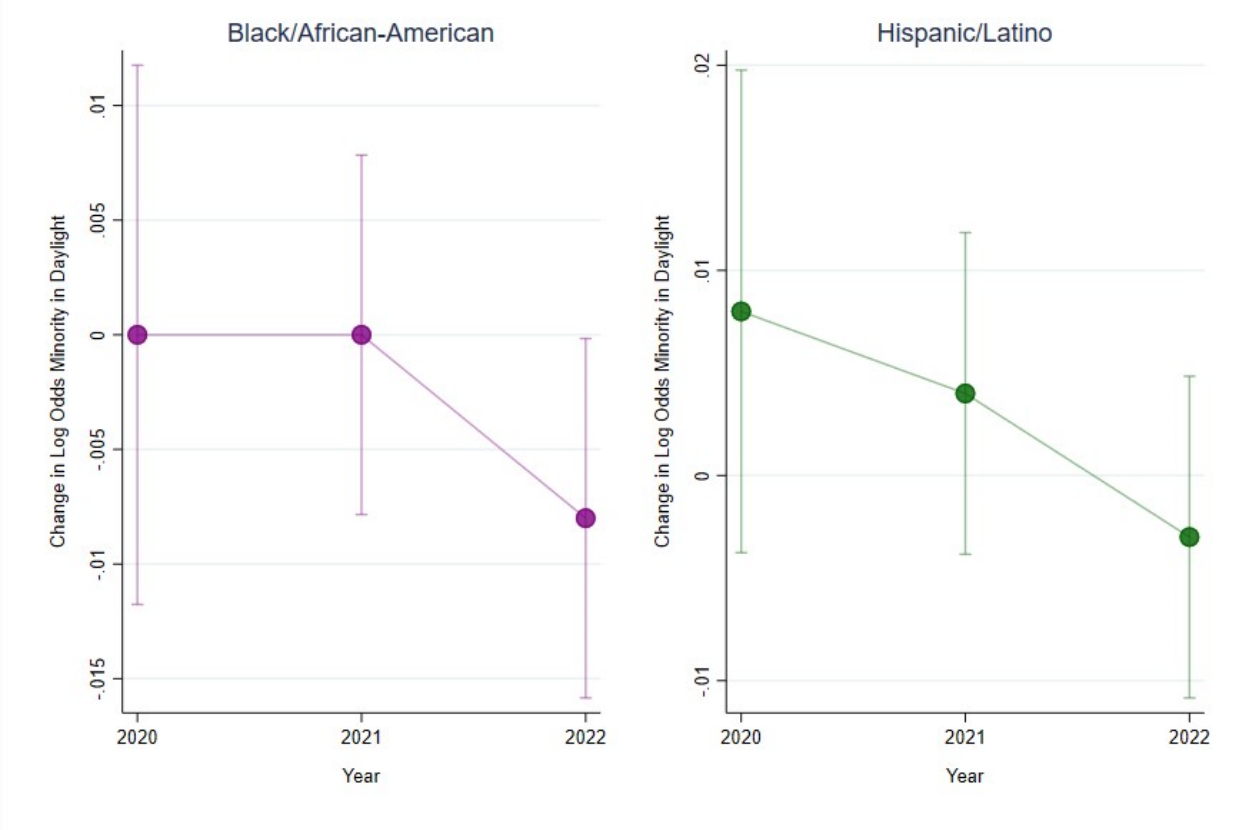
The prior set of results aggregates all traffic stops across multiple departments. It should be considered an average treatment effect estimated from quasi-random variation in sunset timing. Although the results from this section indicated that there was not an overarching disparity in the rate of non-White traffic stops, that does not necessarily indicate that all individual police departments are uniformly engaged in bias-free policing. Note also that the findings of this test pertain exclusively to the inter-twilight window and cannot be generalized to other times of the day when different officers might be on duty, or different enforcement activities are taking place. We analyze individual departments in a subsequent subsection to address the former while addressing the latter, which requires additional analytical tests.

III.B: AGGREGATE ROBUSTNESS CHECKS WITH SOLAR VISIBILITY, 2022 AND 2020-22

This section presents a robustness check on the initial specification using a more restrictive subsample of only moving violations. As mentioned, an analysis using all violations is potentially biased against finding discrimination because specific violations are likely to correlate with daylight/darkness and race/ethnicity. For example, imagine that non-White motorists are more likely to have a broken headlight and that these violations are only observable and enforced by police during darkness. In that instance, comingling equipment violations with moving violations might make it likely that more non-White drivers are stopped at night relative to a sample of only moving violations. Thus, these violations might have a large enough effect to bias the test statistic towards zero, even in the presence of discrimination. In contrast, one might also imagine that cellphone and seatbelt violations have the potential to bias the results upward if they are only observable to police in daylight and are also correlated with race/ethnicity. Since both scenarios seem reasonable and the net effect of the two sources of bias is impossible to quantify, a natural robustness checks on our initial findings is simply to limit the estimation sample to only moving violations.

Figure 3.4 presents the results from the solar visibility test applied to the subsample of moving violations made by all policing agencies within the inter-twilight window from the last three annual reports in 2020, 2021, and 2022. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a linear probability model of motorist race/ethnicity on daylight as well as controls for time of day, day of week, and department. A positive coefficient indicates an increase in the likelihood a non-White motorist was represented in the traffic stop data during daylight, which suggests potential adverse treatment on the part of the police. Across the period 2020-22, the probability of a stopped motorist being Black or Hispanic within the inter-twilight window averaged 17.27% and 15.30%, respectively, compared to 63.60% non-Hispanic Caucasian. We find that the annual estimated change in the likelihood a Black or Hispanic motorist is stopped in daylight relative to darkness ranged from -0.8 to 0 and -0.3 to 0.8 percentage points, respectively. According to this test, neither Black nor Hispanic motorists, on average, were any more likely to be stopped by Connecticut police during daylight relative to darkness.

Figure 3.4: Aggregate Solar Visibility Analysis by Year, All Moving Violations, 2020-22



Notes: Coefficient estimates are obtained from Table 3.4 of the 2020 and 2021 annual reports and the 2022 estimates from the table below.

Table 3.4 presents the aggregate results estimated from the subsample of moving violations made by all departments during the inter-twilight window in 2022. These results were estimated with the standard errors clustered by the department and included controls for the hour, day of the week, and department. These results suggest that our prior set of results using the full sample was not driven by a correlation between race, visibility, and specific enforcement types. In the aggregate, the results below do not show a disparity in the likelihood that a non-White motorist is stopped by Connecticut police in daylight relative to darkness.

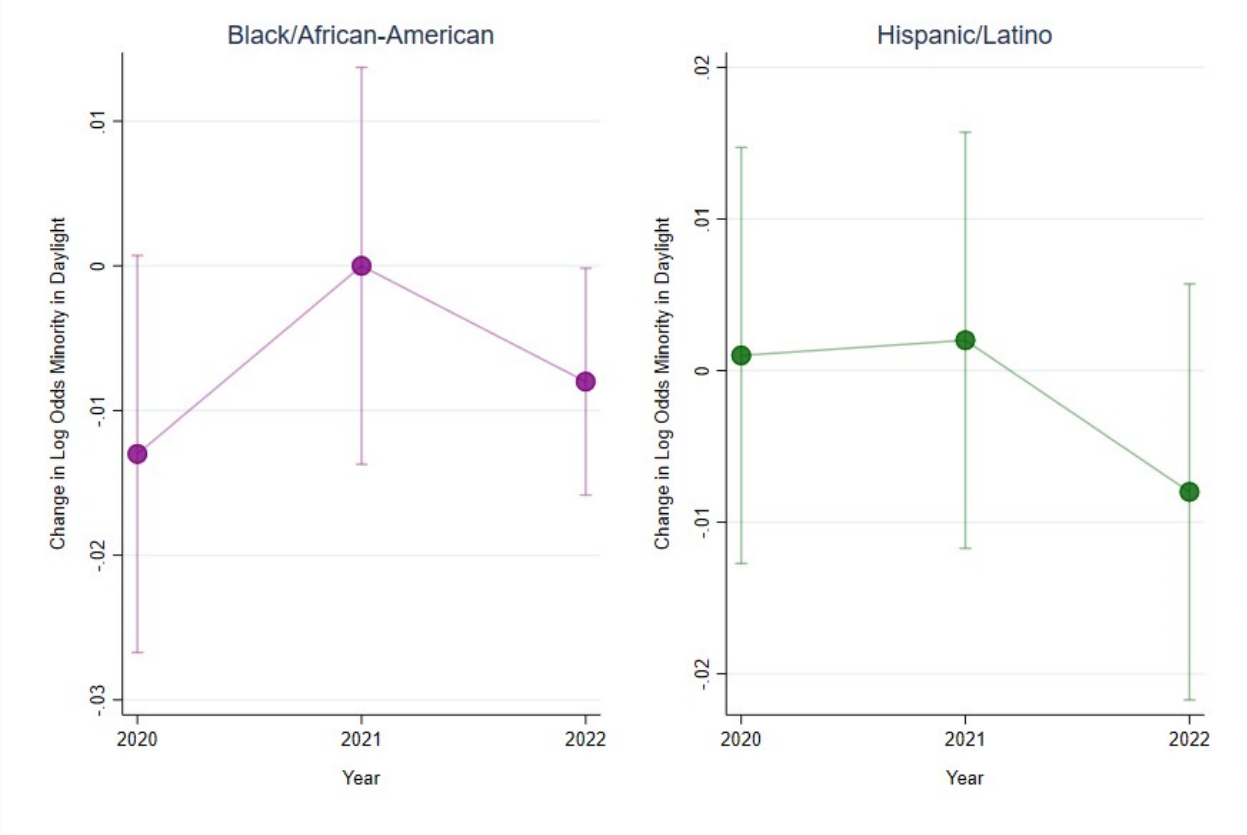
Table 3.4: Linear Probability Model of Race/Ethnicity on Daylight with Department Fixed-Effects, All Moving Violations 2022

LHS: Minority Status		Non-White	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.007	-0.008*	-0.003	-0.007
	Standard Error	(0.004)	(0.004)	(0.004)	(0.004)
N =		39,813	37,883	37,434	44,798

Notes: The coefficients are presented as percentage point changes and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. All specifications include controls for an hour, day of the week, and department-fixed effects. The sample includes all moving violations made during the inter-twilight window in 2022.

Figure 3.5 presents the results from the solar visibility test applied to the subsample of moving violations made by municipal police departments within the inter-twilight window in 2020, 2021, and 2022. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a linear probability model of motorist race/ethnicity on daylight as well as controls for time of day, day of week, and department. A positive coefficient represents an increase in the likelihood a non-White motorist was represented in the traffic stop data during daylight, which suggests potential adverse treatment on the part of the police. Across the period 2020-22, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 18.79% and 16.09%, respectively, compared to 61.43% non-Hispanic White. We find that the annual estimated change in the likelihood a Black and Hispanic motorist is stopped in daylight ranged from -1.3 to 0 and -0.8 to 0.2 percentage points, respectively. In the aggregate, the results suggest that Black and Hispanic motorists were not any more likely to be stopped by police during daylight when their race is more easily observed.

Figure 3.5: Aggregate Solar Visibility Analysis by Year, Municipal Moving Violations, 2020-22



Notes: Coefficient estimates are obtained from Table 3.5 of the 2020 and 2021 annual reports and the 2022 estimates from the table below.

Table 3.5 presents the aggregate results estimated from the subsample of moving violations made by municipal police departments during the inter-twilight window in 2022. These results were estimated with the standard errors clustered by the department and included controls for the hour, day of the week, and department. These results suggest that our prior set of results using the full sample was not driven by a correlation between race, visibility, and specific enforcement types. In

the aggregate, the results below do not show a disparity in the likelihood that a non-White motorist is stopped by Connecticut police in daylight relative to darkness.

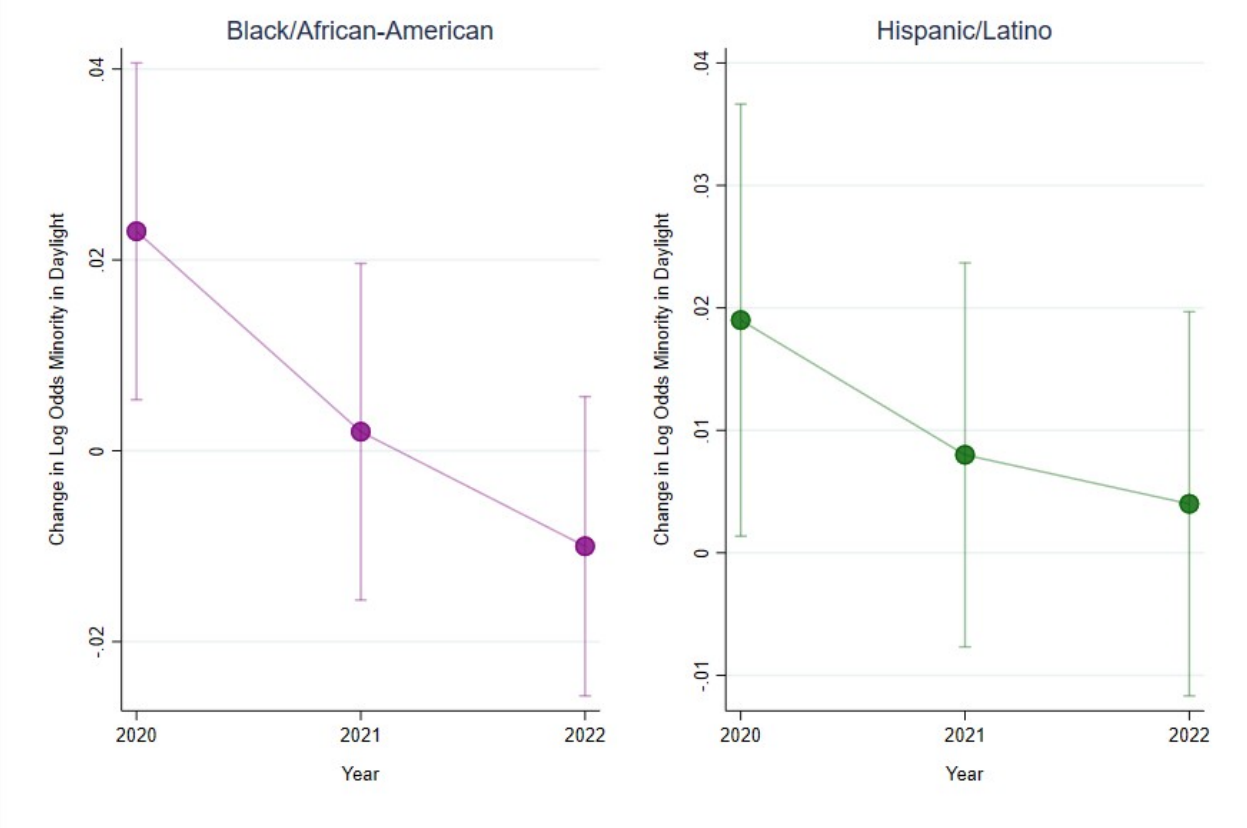
Table 3.5: Linear Probability Model of Race/Ethnicity on Daylight, Municipal Moving Violations 2022

LHS: Minority Status		Non-White	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.006	-0.008	-0.008	-0.008
	Standard Error	(0.006)	(0.004)	(0.007)	(0.006)
N =		26,796	25,627	25,045	30,491

Notes: The coefficients are presented as percentage point changes and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. All specifications include controls for an hour, day of the week, and department-fixed effects. The sample includes all moving violations made during the inter-twilight window in 2022.

Figure 3.6 presents the results from the solar visibility test applied to the moving violation subsample of all State Police troops in 2020, 2021, and 2022. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a linear probability model of motorist race/ethnicity on daylight as well as controls for time of day, day of week, and department. A positive coefficient indicates an increase in the likelihood a non-White motorist was represented in the traffic stop data during daylight which is suggestive of potential adverse treatment on the part of police. Across the period 2020-22, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 13.72% and 13.51%, respectively, compared to 68.79% non-Hispanic White. We find that the annual estimated change in the likelihood a Black motorist is stopped in daylight ranged from -1 to 2.3 percentage points. The change in the likelihood of a Hispanic motorist being stopped in daylight relative to darkness ranged from 0.4 to 1.9 percentage points. In the aggregate, the results below do not consistently show any disparity in the likelihood that non-White motorists are stopped by Connecticut State Police during daylight relative to darkness.

Figure 3.6: Aggregate Solar Visibility Analysis by Year, State Police Moving Violations, 2020-22



Notes: Coefficient estimates are obtained from Table 3.6 of the 2020 and 2021 annual reports and the 2022 estimates from the table below.

Table 3.6 presents the aggregate results estimated from the subsample of moving violations made by state police troops during the inter-twilight window in 2022. These results were estimated with the standard errors clustered by the department and included controls for the hour, day of the week, and department. These results suggest that our prior set of results using the full sample was not driven by a correlation between race, visibility, and specific enforcement types. In the aggregate, the results below do not show a disparity in the likelihood that a non-White motorist is stopped by Connecticut police in daylight relative to darkness.

Table 3.6: Linear Probability Model of Race/Ethnicity on Daylight, State Police Moving Violations 2022

LHS: Minority Status		Non-White	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.008	-0.010	0.004	-0.003
	Standard Error	(0.009)	(0.008)	(0.008)	(0.009)
N =		12,741	12,006	12,161	14,010

Notes: The coefficients are presented as percentage point changes and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance rate greater than 10% All specifications include controls for hour, day of the week, and department fixed effects. The sample includes all moving violations made during the inter-twilight window in 2022.

The results presented in this robustness analysis provide additional evidence that there are not any overarching disparities in the rate at which police stopped Black and Hispanic motorists in 2022. Although restricting the sample to moving violations slightly attenuated the point estimates and further reduced statistical power across most of the models, we found that the results were consistent with those in the full sample, i.e., no evidence of disparity. As mentioned previously, these aggregate results do not necessarily represent all individual policing agencies or officers within the state and should only be interpreted as an average effect. In the preceding section, the test will be applied to both individual municipal departments and State Police troops.

III.C: DEPARTMENT ANALYSIS WITH SOLAR VISIBILITY, 2022 AND 2020-22

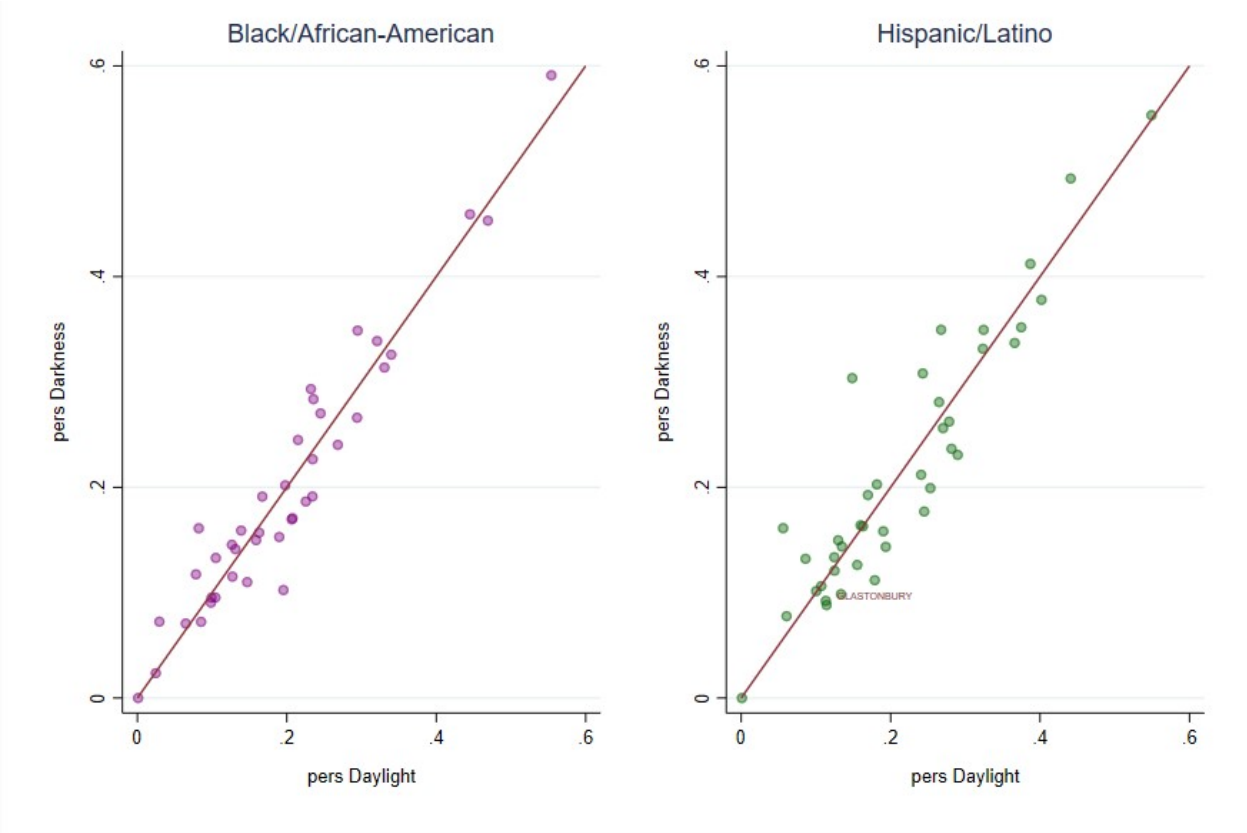
The analysis presented at the state level shows that the likelihood a stopped motorist is non-White does not increase in daylight relative to darkness. As noted in the introduction and detailed in Appendix A.2, we can directly attribute any disparity to a change in the likelihood that a non-White motorist is stopped in daylight relative to darkness under reasonable assumptions about the counterfactual. By construction, the aggregate analysis from Section III.A and III.B does not investigate the source of any disparities regarding specific municipal police departments or State Police troops. The analysis presented in this section seeks to identify better if any disparity exists regarding specific departments and troops by running separate tests for each jurisdiction.

In this section, we graphically present an estimate of the solar visibility test (i.e., Equation 4 of Appendix A.2) separately for each municipal department and State Police troop. We first provide results for the 2022 sample of the data as we have done in the prior three reports. However, we also leverage the full three-year sample from 2020-22 and graphically present estimates of the effect of daylight for smaller departments, which previously had an insufficiently small sample to run the test annually. Although restricting the sample of stops to the inter-twilight window is necessary to mitigate the risk of violating the identifying assumptions of the solar visibility test, it is a relatively onerous sample restriction. It significantly reduces the estimation power in small samples. The figures and discussion below highlight only the departments with a statistically significant disparity in the Black or Hispanic alone categories for either the 2022 or combined 2020-22 samples. The full results are in Table C.7 and C.9 of Appendix C. We calculate robust standard errors for both sets of estimates and include a vector of controls for each hour and day of the week. Identification requires that departments and State Police troops have a disparity that is statistically significant at or above the 95% level in either the Hispanic or Black alone groups. Further, we only highlight departments that withstand the scrutiny of restricting the sample to only moving violations and that have a false discovery rate below 10% in both specifications. We provide the full set of results in Tables C.1 and C.3 and the moving violation robustness tests in C.2 and C.4 of Appendix C.

Figure 3.7 plots the likelihood that a Black (left panel) or Hispanic (right panel) motorist was stopped relative to a non-Hispanic White motorist in daylight versus darkness by the department in 2022. Individual points on the figure represent specific municipal departments and State Police troops. The vertical axis plots the likelihood a stopped motorist is non-White in darkness, and the horizontal axis plots the same likelihood in daylight. For ease of presentation in the figure, we approximate the regression results by imposing the coefficient estimate of daylight from Table C.8 of Appendix C on the unadjusted likelihood that a non-White motorist is stopped in darkness during the inter-twilight

window.[7] The red 45-degree line represents parity (equal treatment) between daylight and darkness amongst non-White and non-Hispanic White motorists. Thus, only departments falling below this line (bottom right quadrant) are likelier to stop non-White motorists during daylight when their race is more easily observed. The results indicate that Glastonbury had a statistically significant disparity of 6.7 percentage points for Hispanic motorists in 2022. However, there was not sufficient data available to estimate robustness checks using a subsample of moving violations. The results for the subsample of traffic stops involving a moving violation (but not the overall sample of stops) indicate that Wethersfield had a statistically significant disparity of 7.5 percentage points for Black motorists in 2022.

Figure 3.7: Solar Visibility Analysis, All Departments 2022



Notes: Coefficient estimates are obtained from Table C.7 of Appendix C imposed on the raw likelihood that a non-White motorist is stopped in darkness for each department. The change in the likelihood that a non-White motorist was represented in the traffic stop data is estimated with controls for hour and day of the week. Annotated departments include only those with a statistically significant disparity estimated with a confidence level at or exceeding 95% in the combined sample of all traffic stops within the inter-twilight window as well as in a robustness check focusing on moving violations (Table C.8 of Appendix C). Identified departments also had a false discovery rate below 10%, as estimated by Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

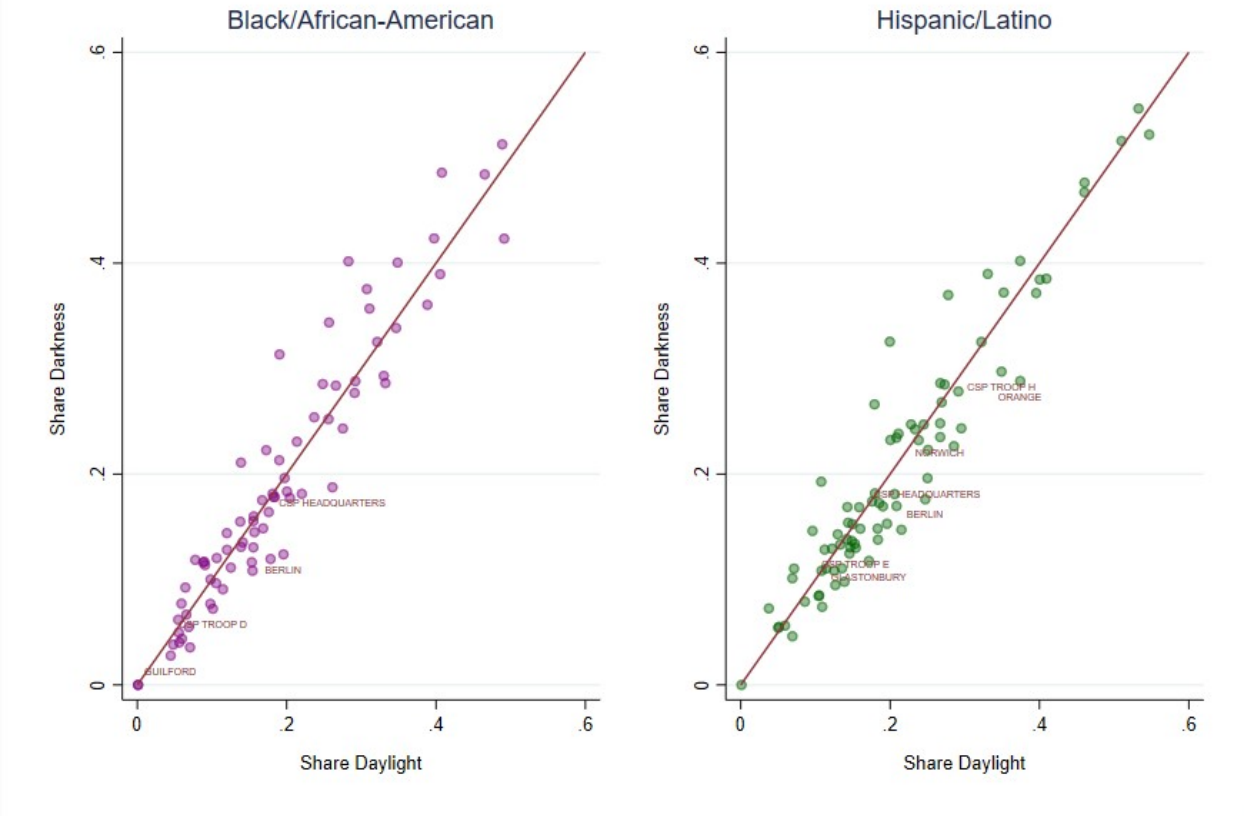
In order to test for disparities in smaller departments where we cannot precisely estimate the effect of daylight in the annual report due to an insufficiently small sample within the inter-twilight window, we leverage data from 2020-22. As with the previous figure, Figure 3.8 plots the likelihood a Black (left panel) or Hispanic (right panel) motorist is stopped relative to a non-Hispanic White

[7] More specifically, the share of minority stops in darkness is the uncontrolled raw level rather than the regression adjusted level. We do this for simplicity and ease of exposition.

motorist in daylight versus darkness by the department in the 2020-22 sample. Individual points on the figure represent specific municipal departments and State Police troops. The vertical axis plots the likelihood a stopped motorist is non-White in darkness, and the horizontal axis plots the same likelihood in daylight. For ease of presentation in the figure, we approximate the regression results by imposing the coefficient estimate of daylight from Table C.9 of Appendix C on the unadjusted likelihood that a non-White motorist is stopped in darkness during the inter-twilight window.[8] The red 45-degree line represents parity (equal treatment) between daylight and darkness amongst non-White and non-Hispanic White motorists. Thus, only departments falling below this line (bottom right quadrant) are likelier to stop non-White motorists during daylight when their race is more easily visible. We annotate only those departments where the difference is statistically significant at or above the 95% confidence level in the overall sample of traffic stops and the robustness test using only moving violations. Applying the test to the combined 2020-22 data, we find evidence of a statistically significant disparity in State Police Troop Headquarters (Black & Hispanic), State Police Troop D (Black & Hispanic), State Police Troop E (Hispanic), State Police Troop H (Hispanic), Berlin (Black & Hispanic), and Guilford (Black). Using the more restrictive subsample of moving violations, we also identify Clinton (Hispanic), Farmington (Black), and Norwich (Black). We also note that Glastonbury (Hispanic), Orange (Hispanic), Norwich (Hispanic), and Wethersfield (Black & Hispanic) appeared but did not survive robustness tests.

[8] More specifically, the likelihood of a non-White stop in darkness is the uncontrolled raw level rather than the regression adjusted level. We do this for simplicity and ease of exposition.

Figure 3.8: Solar Visibility Analysis, All Departments 2020-22



Notes: Coefficient estimates are obtained from Table C.7 of Appendix C imposed on the raw likelihood that a minority is stopped in darkness for each department. The change in the likelihood that a minority motorist was represented in the traffic stop data is estimated with controls for hour and day of the week. Annotated departments include only those with a statistically significant disparity estimated with a confidence level at or exceeding 95% in the combined sample of all traffic stops within the inter-twilight window as well as in a robustness check focusing on moving violations (Table C.8 of Appendix C). Identified departments also had a false discovery rate below 10%, as estimated by Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

We identify two departments in the 2022 sample and nine departments in the 2020-22 sample. For these departments, we conclude that there is strong evidence of a disparity in the rate of non-White traffic stops made during daylight. All disparities identified in this section are limited to those occurring within a window during the evening commute when sunset varies throughout the year. Although it is impossible to link these observed disparities to racial profiling, as the differences could be driven by policing policy or individual officer patterns, these results provide strong evidence that police in these areas are treating non-White motorists differently during daylight.

IV: ANALYSIS OF TRAFFIC STOPS, SYNTHETIC CONTROL

Traditional approaches that rely on population-based benchmarks to evaluate policing data must make various assumptions about the underlying risk set of motorists. Despite their flaws, these approaches are intuitively appealing because they offer tangible, easily interpreted measures of potential discrimination. This section presents the results of a synthetic control analysis with the same intuition as traditional population-based benchmarks or relative rate/disparity indices but remains grounded in rigorous statistical theory. A synthetic control is a unique benchmark constructed for each department using various stop-specific and town-level demographic characteristics captured through inverse propensity score weighting. The synthetic control is then used to assess the effect of treatment on an outcome variable(s), in this case, the probability that a non-White motorist is involved in a police traffic stop.[9]

Put simply, departments differ in enforcement activity (i.e., the timing of stops and types of violations, etc.) and the underlying demographics of the population on the roadway. This analysis accounts for these differences by estimating a measure of similarity called a propensity score. Here, a propensity score measures how similar a stop made outside a given department is to a stop made by the analyzed department. These similarity measures are used to weigh stops when constructing a benchmark for each department. For example, suppose the department being analyzed has a high non-White population and makes most of their stops on Friday nights at 7 PM for speeding violations. In that case, stops made for speeding by departments with a similar residential population at this time and day will be given more weight when constructing the benchmark. This methodology ensures an apples-to-apples comparison between the number of minorities stopped in a given town relative to their benchmark and allows for the interpretation of any remaining differences attributed to possible disparate treatment.

Weighting the observations by the propensity score inverse ensures that the distribution of observable characteristics is consistent between the department of interest and the so-called "synthetic control". As long as these observed variables fully capture selection into treatment, inverse propensity score weighting allows for an unbiased estimate of the effect of treatment on the outcome of interest. In the present context, constructing a synthetic control using inverse propensity score weights allow for assessing whether specific departments disproportionately stop non-White motorists. A detailed description of the mechanics underlining this methodology and the current application can be found in Appendix A.3. Generally speaking, the synthetic control approach follows a rich and extensive literature spanning the fields of statistics, economics, and public policy. The application of similar methodologies to policing data has recently entered the criminal justice literature through notable applications by McCaffrey et al. (2004), Ridgeway (2006), and Ridgeway and MacDonald (2009).

[9] In the methodological discussion here and in the appendix, the details of the estimation procedure are presented as if a single treatment effect were estimated using a single outcome variable. However, the estimates were constructed for each municipal department using four different outcome variables for the minority groupings used throughout the report

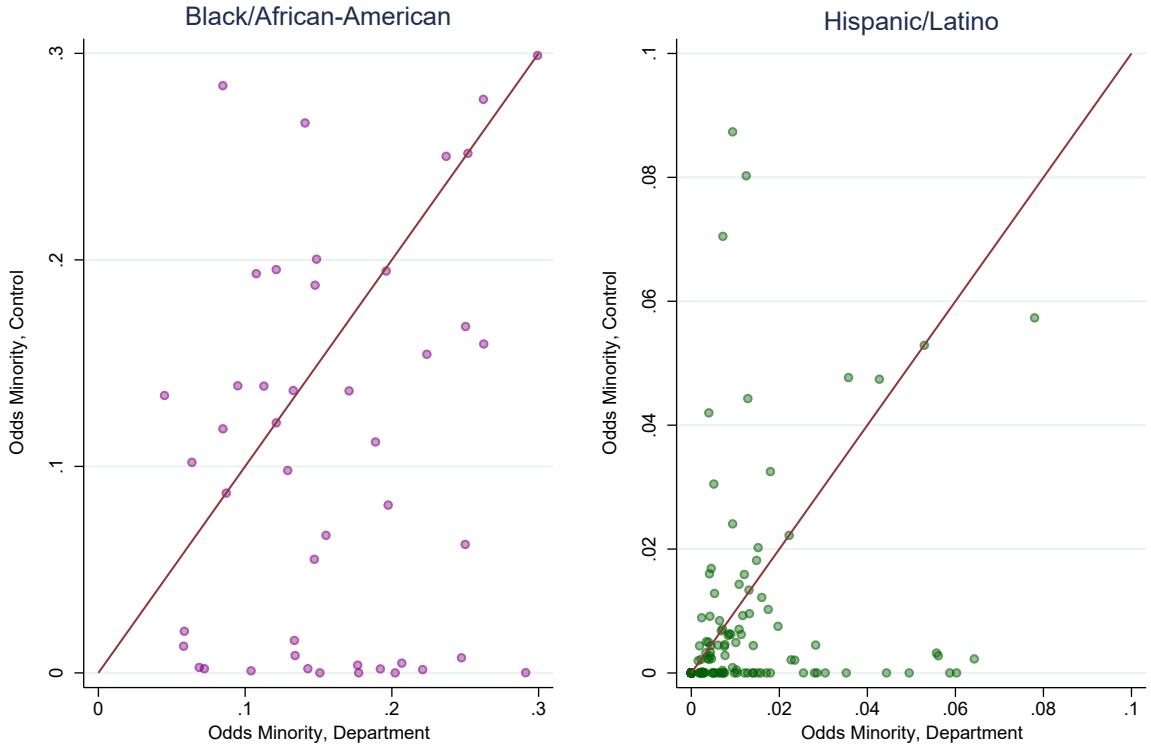
IV.A: AGGREGATE ANALYSIS WITH SYNTHETIC CONTROL, 2022 AND 2020-2022

Each municipal police department was examined independently by weighting observations with inverse propensity scores estimated using Equation 7 of Appendix A.3. The variables used to estimate the propensity scores are detailed in Table A.2 (1) of Appendix A.3. Treatment effects were estimated using Equation 8 of Appendix A.3 for individual departments and State Police troops across four demographic subgroups relative to non-Hispanic Caucasians. As before, we identified all departments with a statistically significant disparity at the 95% level in either the Hispanic or Black alone group. In this section, we graphically present the results from the synthetic control analysis and annotate towns with a statistically significant disparity in the rate of Black or Hispanic stops. We first provide results for the 2022 sample of the data as we have done in the prior three reports. However, we also leverage the full three-year sample from 2020-22 and graphically present estimates for smaller departments that previously had an insufficiently small sample to run the test on an annual basis. The figures and discussion below highlight only the departments with a statistically significant disparity in the Black or Hispanic alone categories for either the 2022 or combined 2020-22 samples. Identification requires that departments and State Police troops have a disparity that is statistically significant at or above the 95% level in either the Hispanic or Black alone groups. Further, we only highlight departments that withstand more rigorous doubly-robust estimation and have a false discovery rate below 10% in both specifications. We provide the full set of results in Tables D.1 and D.3 and doubly-robust estimation in D.2 and D.4 of Appendix D.

Figure 4.1 plots the odds a Black (left panel) or Hispanic (right panel) motorist is stopped relative to a non-Hispanic Caucasian motorist in the focal town versus a synthetic control in 2022. Individual points on the figure represent specific municipal departments and State Police troops. The vertical axis plots the odds a stopped motorist is a non-White motorist in the synthetic control, and the horizontal axis plots the same odds for the focal department. For ease of presentation in the figure, we approximate the regression results by imposing the estimated difference from Table D.1 of Appendix D on the unadjusted odds of a non-White motorist stopped in the focal department such that we obtain an estimate of the odds for the control. The red 45-degree line represents parity (equal treatment) between the focal department and control amongst minorities and non-Hispanic Caucasians. Thus, only departments falling below this line (bottom right quadrant) are more likely to stop non-White motorists relative to their synthetic control. We omit annotation of individual departments for the sake of parsimony and instead note those departments in the preceding paragraph where the difference is statistically significant at or above the 95% confidence level in the main specification and with doubly-robust estimation.

Applying this test to the 2022 data, we identify the following departments: 2022: Connecticut State Police Headquarters (Black), Connecticut State Police Troop A (Hispanic), Connecticut State Police Troop I (Black & Hispanic), Connecticut State Police Troop L (Black & Hispanic), East Haven (Hispanic), Farmington (Hispanic), Hamden (Black), Naugatuck (Hispanic), New Haven (Black), Newington (Hispanic), Newtown (Black), North Haven (Black), Orange (Black & Hispanic), Plainville (Hispanic), Plymouth (Black & Hispanic), South Windsor (Black), Vernon (Black), Wallingford (Black & Hispanic), Waterford (Black), West Haven (Black), Wethersfield (Hispanic), Windsor (Hispanic), and Wolcott (Black). All of these departments had a disparity in the Black or Hispanic alone category, which was significant at a level exceeding 95% confidence, withstood doubly-robust estimation, and had a false discovery rate below 10%. For the full results, see Table D.2 for the baseline specification and Table D.1 of Appendix D for the double-robust estimates.

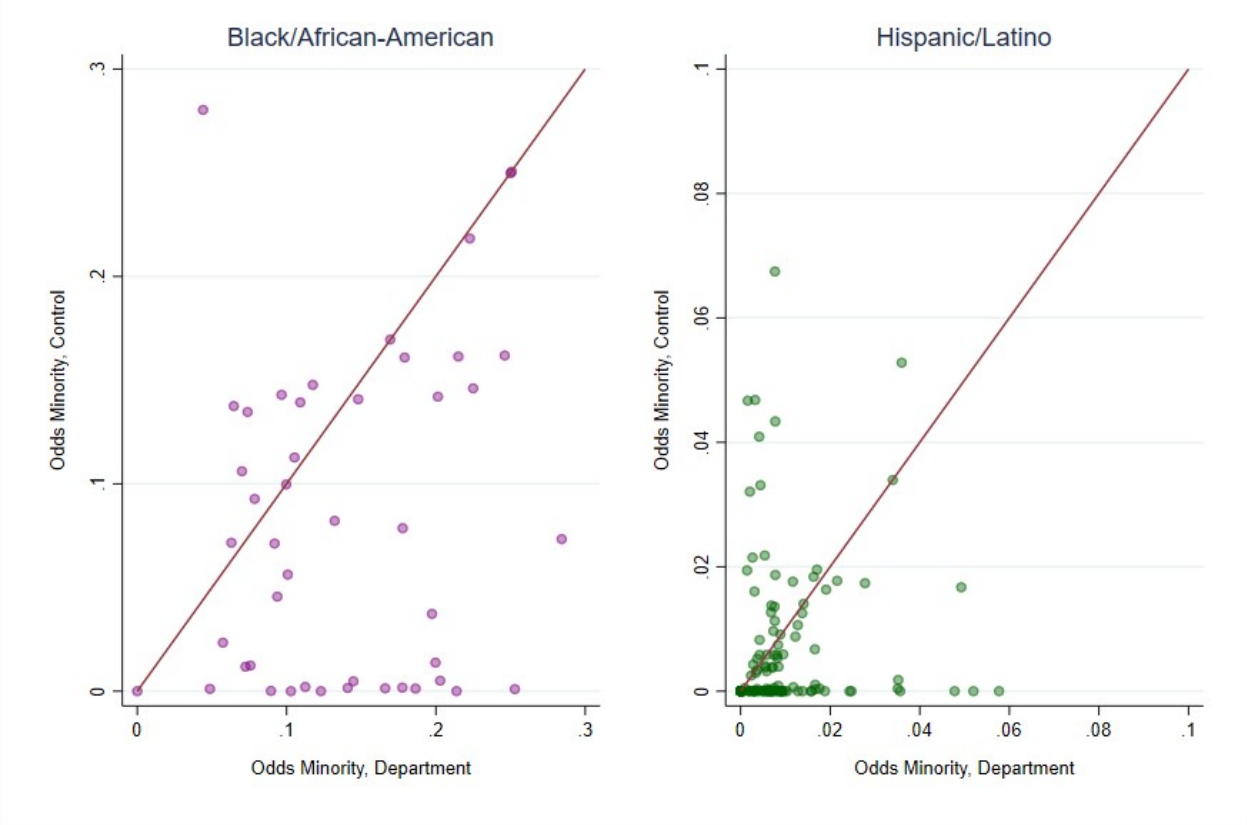
Figure 4.1: Synthetic Control Analysis, All Departments 2022



Notes: Coefficient estimates are obtained from Table D.1 of Appendix D and imposed on the raw odds that a non-White motorist is stopped in the focal department. The change in the odds a non-White motorist was represented in the traffic stop data in the focal town is estimated using Equation 7 of Appendix A.3 where the variables used to estimate the propensity scores are detailed in Table A.2 (1) of Appendix A.3. Annotated departments include only those with a statistically significant disparity estimated with a confidence level at or exceeding the 95% in the combined sample of all traffic stops as well as in a robustness check with doubly-robust estimation (Table D.2 of Appendix D). Identified departments also had a false discovery rate below 10%, as estimated by Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

Figure 4.2 contains estimates for the aggregate 2020-22 and follows the format discussed above in Figure 4.1. Applying this test to the 2020-22 data, where we gain precision by utilizing a larger sample of traffic stops, we identify the departments: Branford (Black), Connecticut State Police Troop E (Black), Connecticut State Police Troop G (Black), Connecticut State Police Troop H (Hispanic), Connecticut State Police Troop I (Black & Hispanic), East Haven (Hispanic), Easton (Hispanic), Farmington (Hispanic), Granby (Black), Hamden (Black), Middlebury (Hispanic), New Haven (Black), New London (Hispanic), Newington (Hispanic), North Haven (Black), Orange (Black & Hispanic), Plymouth (Black & Hispanic), South Windsor (Black), Trumbull (Black), Wallingford (Black & Hispanic), Waterford (Black & Hispanic), Wethersfield (Hispanic), Willimantic (Hispanic), Wolcott (Black), and Woodbridge (Black). For the full results, see Table D.4 for the baseline specification and Table D.3 of Appendix D for the double-robust estimates.

Figure 4.2: Synthetic Control Analysis, All Departments 2020-22



Notes: Coefficient estimates are obtained from Table D.3 of Appendix D and imposed on the raw odds that a non-White motorist is stopped in the focal department. The change in the odds a non-White motorist was represented in the traffic stop data in the focal town is estimated using Equation 7 of Appendix A.3 where the variables used to estimate the propensity scores are detailed in Table A.2 (1) of Appendix A.3. Annotated departments include only those with a statistically significant disparity estimated with a confidence level at or exceeding the 95% in the combined sample of all traffic stops as well as in a robustness check with doubly-robust estimation (Table D.4 of Appendix D). Identified departments also had a false discovery rate below 10%, as estimated by Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

V: ANALYSIS OF TRAFFIC STOPS, DESCRIPTIVE STATISTICS AND INTUITIVE MEASURES

The descriptive statistics and benchmarks presented in this section help to understand patterns in Connecticut policing data. Although these simple statistics are intriguing, conclusions should not be drawn from any measure alone. The two previously applied statistical tests of racial and ethnic disparities in the policing data are based solely on the policing data and rely on constructing a theoretically derived identification strategy and a natural experiment. These results have been applied by academic and policy researchers in numerous areas across the country. They are generally considered the most current and relevant approaches to assessing policing data.

In all the benchmark analyses, motorists' demographics were grouped into three overlapping categories to ensure a large enough sample size. Much of the analysis focuses on stops made by Black (Hispanic or non-Hispanic) and Hispanic motorists (any race); the analysis also was conducted for aggregated groupings of all non-White motorists (Hispanic or non-Hispanic).

V.A: STATEWIDE AVERAGE COMPARISON

Comparing town data to statewide average data is frequently the first thing the public does when trying to understand and assess how a police department may conduct traffic stops. This section presents a comparison to the statewide average alongside the context necessary to understand the information. This benchmark does provide a simple and effective way to establish a baseline for all towns from which the relative differences between town stop numbers become more apparent. A detailed explanation of the methodology can be found in Appendix A.4. The analysis presented in this report only identified the departments for which the statewide average comparison indicated the largest distances between the net stop percentage and net resident population using 10 or more points as a threshold. Tables showing the calculations for all departments, rather than just those showing distance measures of more than 10 points, can be found in Appendix E of this report. Readers should note that this section focuses entirely on departments that exceeded the statewide average for stops in these racial groups.

Comparison of Racial/Ethnic Non-White Drivers to the State Average

The racial/ethnic non-White category includes all racial classifications except White drivers. Specifically, it covers Blacks, Hispanics, Asian/Pacific Islander, American Indian/Alaskan Native, and Other Race classifications included in the census data.

For the study period from January 1, 2022, through December 31, 2022, the statewide percentage of drivers stopped by police who were identified as non-White was 39.7%. 29 departments stopped a higher percentage of non-White drivers than the state average, 9 of which exceeded the statewide average by more than 10 percentage points. The statewide average for non-White residents (16+) is 25.2%. Of the 29 towns that exceeded the statewide average for non-White drivers stopped, 21 also have non-White resident populations (16+) that exceeded the statewide average.

After the stop and resident population percentages were adjusted using the method described in Appendix A.3 (2), a total of 19 departments[10] were found to have a relative distance between their net non-White driver stop percentage and net non-White driving age population percentage of more than 10 points. Table 5.1 shows the data for these 20 departments. All department results are contained in Table E.1 of Appendix E.

Table 5. 1: Statewide Average Comparisons for Non-White Drivers for Selected Towns

Municipal Department	Non-White Stops	Difference Between Town and State Average	Non-White Residents Age 16+	Difference Between Town and State Average	Distance Between Net Differences
Newington	52.0%	12.3%	14.5%	-10.7%	23.0%
Orange	46.7%	7.0%	10.7%	-14.5%	21.5%
Darien	39.5%	-0.2%	7.2%	-18.1%	17.9%
Stratford	57.8%	18.1%	27.2%	2.0%	16.1%
South Windsor	44.6%	4.9%	14.6%	-10.6%	15.5%
East Haven	43.3%	3.6%	14.0%	-11.3%	14.9%
Wilton	36.9%	-2.8%	8.1%	-17.1%	14.3%
Wolcott	33.3%	-6.4%	5.4%	-19.8%	13.4%
Wallingford	38.9%	-0.8%	11.1%	-14.1%	13.3%
Woodbridge	40.5%	0.8%	12.8%	-12.4%	13.2%
Derby	48.2%	8.5%	20.6%	-4.7%	13.2%
Enfield	35.9%	-3.8%	8.7%	-16.6%	12.8%
New Britain	71.8%	32.1%	45.0%	19.8%	12.4%
Berlin	32.5%	-7.2%	5.8%	-19.5%	12.2%
Naugatuck	41.8%	2.1%	15.2%	-10.1%	12.2%
Shelton	37.3%	-2.4%	10.8%	-14.4%	12.0%
Wethersfield	38.6%	-1.1%	12.5%	-12.8%	11.6%
Fairfield	35.6%	-4.1%	10.0%	-15.2%	11.2%
Windsor Locks	37.3%	-2.4%	12.7%	-12.5%	10.1%
Connecticut	39.7%	0.0%	25.2%	0.0%	NA

Comparison of Black Drivers to the State Average

For the study period, the statewide percentage of motorists stopped by police who were identified as Black was 18.4%. A total of 29 departments stopped a higher percentage of Black motorists than the state average, 9 of which exceeded the statewide average by more than 10 percentage points. The statewide average for Black residents (16+) is 9.1%. Of the 29 towns that exceeded the statewide average for Black drivers stopped, 15 also have Black resident populations (16+) that exceeded the statewide average.

After the stop and resident population percentages were adjusted using the method described in Appendix A.3 (2), 2 departments were found to have a relative distance between their net Black driver stop percentage and net Black driving age population percentage of more than 10 points. Table 5.2 shows the data for these 2 towns. All department results are contained in Table E.2 of Appendix E.

[10] The Groton Long Point police department exceeded the disparity threshold by more than 10 percent but only reported 8 traffic stops in 2022. They were excluded from this summary.

Table 5. 2: Statewide Average Comparisons for Black Drivers for Selected Towns

Municipal Department	Black Stops	Difference Between Town and State Average	Black Residents Age 16+	Difference Between Town and State Average	Distance Between Net Differences
Orange	24.6%	6.2%	1.3%	-7.8%	14.0%
Woodbridge	21.3%	2.9%	1.9%	-7.2%	10.1%
Connecticut	18.4%	0.0%	9.1%	0.0%	NA

Comparison of Hispanic Drivers to the Statewide Average

For the study period, the statewide percentage of drivers stopped by police identified as Hispanic was 17.9%. A total of 31 towns stopped a higher percentage of Hispanic drivers than the state average, 12 of which exceeded the statewide average by more than 10 percentage points. The statewide Hispanic resident population (16+) is 11.9%. Of the 31 towns that exceeded the statewide average for Hispanic drivers stopped, 15 also have Hispanic resident populations (16+) that exceeded the statewide average.

After the stop and resident population percentages were adjusted using the method described in Appendix A.3 (2), a total of 5 departments[11] were found to have a relative distance between their net Hispanic driver stop percentage and net Hispanic population percentage of more than 10 points. Table 5.3 shows the data for the towns named above. All department results are contained in Table E.3 of Appendix E.

Table 5. 3: Statewide Average Comparisons for Hispanic Drivers for Selected Towns

Municipal Department	Hispanic Stops	Difference Between Town and State Average	Hispanic Residents Age 16+	Difference Between Town and State Average	Distance Between Net Differences
Newington	27.6%	9.7%	6.4%	-5.5%	15.3%
Darien	21.0%	3.1%	3.5%	-8.4%	11.5%
Bethel	23.4%	5.5%	6.7%	-5.3%	10.8%
Wilton	19.1%	1.2%	2.7%	-9.2%	10.3%
Wallingford	22.7%	4.8%	6.7%	-5.2%	10.0%
Connecticut	17.9%	0.0%	11.9%	0.0%	NA

V.B: ESTIMATED DRIVING POPULATION COMPARISON

In the previous reports, researchers conducted an analysis using an estimated driving population comparison. The EDP analysis was confined to the 94 municipal police departments in Connecticut. This methodology was designed to understand better how employment commutation can impact a community's driving population during peak commuting hours. The Covid-19 pandemic dramatically altered how and where people work. Researchers are working to determine the impact that the

[11] The Groton Long Point police department exceeded the disparity threshold by more than 10 percent but only reported 8 traffic stops in 2022. They were excluded from this summary.

Covid-19 pandemic has had on commutation patterns. Therefore, the EDP methodology is not utilized in this report.

V.C: RESIDENT ONLY STOP COMPARISON

Compared to the census, 88 departments stopped more non-White resident drivers than their non-White resident population. Again, the disparity for many of these departments was very small. In five communities, the disparity was negative, meaning that fewer non-White drivers were stopped than expected based on the population numbers. However, the negative disparities were also very small in most communities. Almost all departments (89 of 94) had a disparity for Black drivers stopped, and 74 departments had a disparity for Hispanic drivers stopped when compared to the resident driving age population.

Departments with a difference of 10 percentage points or more between the resident stop and the 16+ resident population in any of the three categories: (1) Non-White (all race/ethnicity), (2) Black non-Hispanic, and (3) Hispanic, were identified in our tier one group. Table 5.4 shows the data for the departments meeting the tier-one criteria. In addition, departments that exceeded their resident population percentage by more than five but less than 10 percentage points were identified in our tier two group for this benchmark if the ratio of the percentage of resident stops for the target group compared to the baseline measure for that group also was 1.75 or above (percentage of stopped residents divided by resident benchmark percentage equals 1.75 or more) in any of three categories: (1) Non-White (all race/ethnicity), (2) Black non-Hispanic, and (3) Hispanic. Table 5.5 shows the data for the departments meeting the tier two criteria. Results for all departments are available in Tables E.4, E.5, and E.6 of Appendix E.

Table 5. 4: Highest Ratio of Resident Population to Resident Stops (Tier I)

Department Name	Number of Residents	Residents	Resident Stops	Non-White Resident Stops	Difference	Ratio
All Non-White						
New Britain	57,164	45.0%	2,214	78.0%	33.0%	1.73
Derby	10,391	20.6%	61	52.5%	31.9%	2.55
Willimantic	20,176	34.6%	592	64.2%	29.6%	1.86
Manchester	46,667	27.9%	1,297	56.1%	28.2%	2.01
Waterbury	83,964	48.1%	474	75.7%	27.6%	1.57
Danbury	64,361	38.6%	789	64.9%	26.3%	1.68
Norwich	31,638	29.1%	858	54.5%	25.5%	1.87
Stratford	40,980	27.2%	365	51.8%	24.6%	1.90
Meriden	47,445	34.9%	1,263	59.2%	24.4%	1.70
New London	21,835	43.6%	820	67.8%	24.2%	1.56
Windsor	23,222	43.9%	1,600	68.0%	24.1%	1.55
Naugatuck	25,099	15.2%	645	39.2%	24.0%	2.58
West Haven	44,518	37.6%	728	60.7%	23.1%	1.61
Vernon	23,800	14.1%	1,095	37.0%	22.9%	2.63
East Hartford	40,229	51.6%	2,462	74.5%	22.9%	1.44
Enfield	33,218	8.7%	1,053	31.0%	22.3%	3.58
Groton City*	7,960	26.9%	500	48.8%	21.9%	1.81
South Windsor	20,162	14.6%	799	36.4%	21.8%	2.49
Hamden	50,012	30.9%	331	49.8%	18.9%	1.61

Department Name	Number of Residents	Residents	Resident Stops	Non-White Resident Stops	Difference	Ratio
East Windsor	9,164	14.6%	370	33.2%	18.7%	2.28
New Haven	100,702	62.8%	3,355	81.0%	18.1%	1.29
Bristol	48,439	12.7%	723	30.6%	17.9%	2.41
Windsor Locks	10,117	12.7%	151	29.1%	16.4%	2.29
East Haven	24,114	14.0%	661	30.0%	16.0%	2.14
Middletown	38,747	23.5%	865	39.4%	15.9%	1.68
Ansonia	14,979	25.6%	1,470	41.2%	15.6%	1.61
Newington	24,978	14.5%	805	29.9%	15.4%	2.06
Farmington	20,318	12.6%	706	27.6%	15.0%	2.19
Shelton	32,010	10.8%	151	25.8%	15.0%	2.38
West Hartford	49,650	21.8%	880	36.6%	14.8%	1.68
Wallingford	36,530	11.1%	800	25.5%	14.4%	2.29
Norwalk	68,034	40.8%	1,225	55.0%	14.2%	1.35
Bethel	14,675	13.5%	713	27.6%	14.1%	2.05
Torrington	29,251	11.0%	3,750	25.0%	14.0%	2.27
Hartford	93,669	80.8%	6,978	94.3%	13.5%	1.17
Wethersfield	21,607	12.5%	1,411	25.8%	13.3%	2.07
Bloomfield	16,982	61.5%	979	74.4%	12.8%	1.21
Wolcott	13,175	5.4%	50	18.0%	12.6%	3.32
Brookfield	12,847	8.1%	131	20.6%	12.5%	2.54
Seymour	13,260	9.8%	603	22.1%	12.3%	2.26
Bridgeport	109,401	73.3%	1,305	85.0%	11.7%	1.16
Clinton	10,540	6.1%	220	16.8%	10.7%	2.75
Groton Town	31,520	20.4%	529	31.0%	10.6%	1.52
Ledyard	11,527	13.4%	671	23.7%	10.3%	1.77
Black						
Windsor	23,222	32.20%	1,600	54.2%	22.0%	1.68
Norwich	31,638	8.96%	858	29.6%	20.6%	3.30
Manchester	46,667	10.15%	1,297	28.9%	18.8%	2.85
Derby	10,391	6.03%	61	24.6%	18.6%	4.08
Hartford	93,669	35.80%	6,978	53.5%	17.7%	1.49
East Hartford	40,229	22.52%	2,462	39.6%	17.1%	1.76
Bridgeport	109,401	31.82%	1,305	48.5%	16.7%	1.52
West Haven	44,518	17.70%	728	34.2%	16.5%	1.93
Hamden	50,012	18.28%	331	34.7%	16.5%	1.90
Middletown	38,747	11.68%	865	28.1%	16.4%	2.41
New Haven	100,702	32.16%	3,355	48.5%	16.3%	1.51
Groton City*	7,960	7.70%	500	24.0%	16.3%	3.12
New London	21,835	15.18%	820	30.5%	15.3%	2.01
Naugatuck	25,099	4.11%	645	19.2%	15.1%	4.68
Vernon	23,800	4.70%	1,095	19.6%	14.9%	4.18
Bloomfield	16,982	54.76%	979	69.3%	14.5%	1.26
Stratford	40,980	12.76%	365	26.3%	13.5%	2.06
Enfield	33,218	2.63%	1,053	15.3%	12.7%	5.81
Shelton	32,010	2.07%	151	13.9%	11.8%	6.72
Windsor Locks	10,117	4.27%	151	15.9%	11.6%	3.72
Waterbury	83,964	17.37%	474	28.9%	11.5%	1.66
New Britain	57,164	10.67%	2,214	22.1%	11.5%	2.07

Department Name	Number of Residents	Residents	Resident Stops	Non-White Resident Stops	Difference	Ratio
Hispanic						
Danbury	64,361	23.25%	789	53.6%	30.4%	2.31
Willimantic	20,176	28.88%	592	53.4%	24.5%	1.85
New Britain	57,164	31.75%	2,214	54.8%	23.0%	1.73
Waterbury	83,964	27.54%	474	45.8%	18.2%	1.66
Meriden	47,445	24.86%	1,263	41.2%	16.3%	1.66
Derby	10,391	12.37%	61	26.2%	13.9%	2.12
Norwalk	68,034	22.67%	1,225	36.0%	13.3%	1.59
Bethel	14,675	6.65%	713	19.1%	12.4%	2.87
New London	21,835	25.08%	820	36.7%	11.6%	1.46
Stratford	40,980	11.92%	365	23.3%	11.4%	1.95
Norwich	31,638	10.59%	858	21.7%	11.1%	2.05
Manchester	46,667	9.89%	1,297	20.8%	10.9%	2.10
Groton City*	7,960	11.80%	500	22.6%	10.8%	1.92
Naugatuck	25,099	7.77%	645	18.4%	10.7%	2.37
East Haven	24,114	8.43%	661	19.1%	10.6%	2.26
East Hartford	40,229	22.91%	2,462	33.3%	10.4%	1.45
Torrington	29,251	6.92%	3,750	17.1%	10.2%	2.48
Stamford	98,070	22.87%	1,707	32.9%	10.0%	1.44
East Windsor	9,164	4.34%	370	14.3%	10.0%	3.30

Table 5. 5: High Ratio of Resident Population to Resident Stops (Tier II)

Department Name	Number of Residents	Residents	Resident Stops	Non-White Resident Stops	Difference	Ratio
All Non-White						
Plymouth	9,660	2.5%	376	12.2%	9.8%	4.94
Wilton	12,973	8.1%	680	17.5%	9.4%	2.16
Plainville	14,605	10.0%	356	18.8%	8.8%	1.88
New Milford	21,891	9.7%	721	18.0%	8.3%	1.86
Monroe	14,918	7.6%	687	14.3%	6.7%	1.89
Old Saybrook	8,330	5.2%	271	11.4%	6.3%	2.22
Guilford	17,672	5.7%	287	11.5%	5.8%	2.03
Easton	5,553	5.6%	44	11.4%	5.8%	2.04
Putnam	7,507	3.4%	454	8.8%	5.4%	2.61
Winsted	9,133	6.1%	206	11.2%	5.0%	1.82
Black						
Ledyard	11,527	3.10%	671	12.5%	9.4%	4.04
Meriden	47,445	7.80%	1,263	17.2%	9.4%	2.20
East Windsor	9,164	5.96%	370	14.9%	8.9%	2.49
Ansonia	14,979	9.74%	1,470	18.3%	8.6%	1.88
Bristol	48,439	3.24%	723	11.8%	8.5%	3.63
South Windsor	20,162	3.68%	799	11.3%	7.6%	3.06
Seymour	13,260	2.25%	603	9.6%	7.4%	4.28
East Haven	24,114	2.47%	661	9.7%	7.2%	3.92
Groton Town	31,520	6.07%	529	13.2%	7.2%	2.18
Wethersfield	21,607	2.75%	1,411	9.4%	6.6%	3.40
Wolcott	13,175	1.53%	50	8.0%	6.5%	5.22
Newington	24,978	2.99%	805	8.6%	5.6%	2.86

Department Name	Number of Residents	Residents	Resident Stops	Non-White Resident Stops	Difference	Ratio
Willimantic	20,176	4.08%	592	9.6%	5.5%	2.36
Farmington	20,318	2.20%	706	7.6%	5.4%	3.47
Rocky Hill	16,224	3.77%	1,223	9.1%	5.3%	2.41
Hispanic						
Enfield	33,218	4.00%	1,053	13.7%	9.7%	3.42
Bristol	48,439	7.65%	723	17.0%	9.4%	2.22
Wallingford	36,530	6.71%	800	15.9%	9.2%	2.37
Clinton	10,540	4.41%	220	13.2%	8.8%	2.99
Newington	24,978	6.39%	805	14.4%	8.0%	2.26
Vernon	23,800	5.21%	1,095	12.9%	7.7%	2.47
Brookfield	12,847	3.79%	131	11.5%	7.7%	3.02
New Milford	21,891	5.46%	721	12.9%	7.4%	2.36
Windsor Locks	10,117	3.46%	151	10.6%	7.1%	3.06
Wethersfield	21,607	7.10%	1,411	13.7%	6.6%	1.93
Shelton	32,010	5.17%	151	11.3%	6.1%	2.18
Seymour	13,260	5.53%	603	11.6%	6.1%	2.10
Plainville	14,605	5.18%	356	11.2%	6.1%	2.17
Hamden	50,012	7.58%	331	13.0%	5.4%	1.71
Plymouth	9,660	2.47%	376	7.7%	5.2%	3.12
Wolcott	13,175	2.83%	50	8.0%	5.2%	2.83

V.D: CONCLUSIONS FROM THE DESCRIPTIVE COMPARISONS

The descriptive tests outlined in the above sections are designed to be used as a screening tool to identify those jurisdictions with consistent data disparities that exceed certain thresholds. The tests compare stop data to two descriptive benchmarks: (1) statewide average and (2) resident-only stops that each cover three driver categories: Black, Hispanic, and Non-White. Department data is then measured against the resulting total of six descriptive measures for evaluation purposes.

In order to classify the disparities within the descriptive benchmarks, any disparity greater than 10 percentage points for a measure was given a weight of one (1) point. Any disparity of more than five, but less than 10 percentage points accompanied by a disparity ratio of 1.75 or above was given a weight of 0.5 points. Therefore, a department could score no more than six (6) total points.

Table 5.6 identifies the 10 departments with a disparity score of 3.5 or higher. A department was identified if the stop data was found to exceed the disparity threshold level in both of the benchmarks and a weighted total score of 3.5 or more. All department results are contained in Table E.7 of Appendix E.

Table 5.6: Departments with the Greatest Number of Disparities Relative to Descriptive Benchmarks

Department Name	Statewide Average			Resident Population			Point Total
	N	B	H	N	B	H	
Derby	13.2%			31.9%	18.6%	13.9%	4.0
Naugatuck	12.2%			24.0%	15.1%	10.7%	4.0
New Britain	12.4%			33.0%	11.5%	23.0%	4.0
Newington	23.0%		15.3%	15.4%	5.6%	8.0%	4.0
Stratford	16.1%			24.6%	13.5%	11.4%	4.0
East Haven	14.9%			16.0%	7.2%	10.6%	3.5
Enfield	12.8%			22.3%	12.7%	9.7%	3.5
Shelton	12.0%			15.0%	11.8%	6.1%	3.5
Wallingford	13.3%		10.0%	14.4%		9.2%	3.5
Windsor Locks	10.1%			16.4%	11.6%	7.1%	3.5

VI. ANALYSIS OF STOP DISPOSITIONS

In this section, we test disparities in the outcomes of traffic stops using a model that examines the distribution of dispositions conditional on race and the reason for the stop. Specifically, we test whether traffic stops made of non-White motorists result in different outcomes relative to their White peers following the model outlined in Equation 10 of Appendix A.6. Since ex-ante, it is unclear whether discrimination would create more or less severe traffic stop outcomes in the data, we simply test for equality in the distribution of outcomes across demography conditional on the motivating reason for the stop. Rather than making unreasonable assumptions about how discrimination should affect outcomes, we simply assume that the overall distribution will not be equal across races. Intuition is similar to hit-rate style tests, but we are unable to ex-ante sign the direction that we expect the bias to take. We implement the test by applying a multinomial linear probability model on the four possible stop outcomes and conditions on race and the reason for the stop. We then conduct a joint hypothesis test on the interaction between an indicator of race and the reason for the stop.

We account for differences in outcomes unrelated to this interaction term by including additional controls for age, gender, hour, day of the week, week of the year, and officer fixed effects. In terms of possible outcomes, we regress indicators for warning (no search), arrest (no search), ticket/misdemeanor (search), warning (search), arrest (search), and where ticket/misdemeanor (no search) is the omitted category. We condition on the basis of the stop using five indicators for stops made on the basis of equipment violation, seatbelt/cellphone, registration/license, all other violations, and where speeding violations are the omitted category. We provide one important cautionary note about interpreting our test as causal evidence of discrimination. Ideally, this test would be performed on data containing *all* violations observed by the police officer before making a traffic stop and where we would include a control for the number of violations. In practice, data on traffic stops typically only contain the most severe reason that motivated the stop. In the absence of data on the full set of violations observed by police officers, we suggest that the reader interpret results from this test as providing descriptive evidence to be viewed in concert with other such empirical measures.

VI.A: AGGREGATE ANALYSIS OF STOP DISPOSITION, 2022

Table 6.1 presents the results of applying a multinomial logit to a sample of all traffic stops with six distinct stop outcomes regressed on race, stop basis, and their interaction. Unlike prior sections where we utilized the historical time series data in the aggregate analysis and a three-year combined sample for the department analysis, we focus on only the 2022 data in this section. Our focus on the 2022 data is because this test relies on the full sample of traffic stops rather than a smaller and more restrictive subsample. Below, we present the coefficient estimates on the interaction between race and the stop basis for each outcome relative to the omitted category, i.e., no search-ticket/misdemeanor issued. We find no discernible pattern that non-White motorists are treated differently in any uniform way relative to their White counterparts. However, a hypothesis test across all the interaction terms and all outcomes indicates that the difference in outcomes is still jointly statistically significant at the 99% level for each demographic group relative to White motorists.

Table 6.1: Multinomial Linear Probability Model of Outcome on Race/Ethnicity and Reason for Stop, All Traffic Stops 2022

	Non-White		Black		Hispanic		Black or Hispanic	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
No Search, Warning or No Action								
All Other	0.259	(0.16)	0.181	(0.173)	0.12	(0.102)	0.135	(0.123)
Equip.	-0.046	(0.177)	-0.102	(0.188)	-0.155	(0.119)	-0.165	(0.13)
Reg. or Lic.	0.463*	(0.149)	0.442*	(0.169)	0.259*	(0.111)	0.329*	(0.125)
Signal or Stop	0.028	(0.08)	0.015	(0.087)	-0.019	(0.076)	-0.049	(0.07)
Moving	0.4*	(0.11)	0.398*	(0.119)	0.3*	(0.088)	0.339*	(0.089)
No Search, Arrest								
All Other	-0.358*	(0.188)	-0.442*	(0.199)	-0.398*	(0.191)	-0.454*	(0.171)
Equip.	0.294	(0.226)	0.268	(0.235)	-0.119	(0.201)	0.046	(0.184)
Reg. or Lic.	0.054	(0.23)	0.015	(0.258)	0.08	(0.219)	0.009	(0.202)
Signal or Stop	-0.088	(0.157)	-0.081	(0.172)	-0.087	(0.176)	-0.115	(0.134)
Moving	-0.414*	(0.165)	-0.45*	(0.17)	-0.048	(0.144)	-0.249*	(0.121)
Search, Ticket or Misdemeanor								
All Other	-0.15	(0.181)	-0.275	(0.187)	-0.337*	(0.171)	-0.341*	(0.157)
Equip.	-0.049	(0.222)	-0.137	(0.229)	-0.36*	(0.208)	-0.284	(0.189)
Reg. or Lic.	0.378	(0.244)	0.323	(0.253)	0.419	(0.308)	0.328	(0.261)
Signal or Stop	0.27	(0.205)	0.272	(0.211)	0.061	(0.214)	0.14	(0.193)
Moving	-0.076	(0.228)	-0.092	(0.235)	-0.314	(0.237)	-0.224	(0.202)
Search, Warning								
All Other	-0.222	(0.299)	-0.308	(0.302)	-0.181	(0.334)	-0.277	(0.262)
Equip.	-0.123	(0.231)	-0.186	(0.24)	-0.099	(0.233)	-0.207	(0.175)
Reg. or Lic.	0.358	(0.37)	0.365	(0.38)	1.034*	(0.349)	0.6*	(0.31)
Signal or Stop	-0.389	(0.25)	-0.378	(0.252)	-0.477*	(0.27)	-0.463*	(0.218)
Moving	0.121	(0.272)	0.147	(0.284)	-0.014	(0.303)	0.053	(0.258)
Search, Arrest								
All Other	-0.496*	(0.204)	-0.626*	(0.206)	-0.159	(0.224)	-0.408*	(0.168)
Equip.	0.049	(0.272)	-0.041	(0.278)	-0.122	(0.254)	-0.12	(0.229)
Reg. or Lic.	0.299	(0.259)	0.284	(0.257)	0.478	(0.356)	0.336	(0.243)
Signal or Stop	-0.004	(0.232)	-0.041	(0.244)	-0.297	(0.258)	-0.185	(0.204)
Moving	-0.674*	(0.204)	-0.665*	(0.198)	-0.057	(0.246)	-0.361*	(0.173)
Chi^2	2.45E+02		2.48E+02		123.05		1.91E+02	
P-Value	0		0		0		0	
Sample Size	196,998		189,554		183,347		229,468	

Note 1: The coefficients are presented as log odds ratios and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.
Note 2: All specifications include controls for gender, age, hour, day of the week, and week of year fixed effects.
Note 3: Q-Values were estimated using a false discovery rate procedure following Simes (1986) and later refined by Benjamini and Hochberg (1995) and Benjamini and Yekutieli (2001).

Table 6.2 presents the results of applying a multinomial logit to a subset of traffic stops made by municipal police departments. As before, we tested for differences across six distinct stop outcomes for motorists of different races who were stopped for the same reason. Across all specifications, we do not observe any discernible pattern suggesting non-White motorists are treated differently in any uniform way. However, a joint hypothesis test across all the interaction terms and all outcomes

indicates that the difference in outcomes is statistically significant at the 99% level for each demographic group relative to non-Hispanic White motorists.

Table 6.2: Multinomial Linear Probability Model of Outcome on Race/Ethnicity and Reason for Stop, Municipal Traffic Stops 2022

	Non-White		Black		Hispanic		Black or Hispanic	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
No Search, Warning or No Action								
All Other	0.313	(0.233)	0.293	(0.243)	0.272*	(0.118)	0.27*	(0.163)
Equip.	0.074	(0.208)	0.047	(0.219)	-0.017	(0.12)	-0.013	(0.139)
Reg. or Lic.	0.759*	(0.219)	0.787*	(0.245)	0.588*	(0.137)	0.677*	(0.166)
Signal or Stop	0.031	(0.107)	0.046	(0.12)	-0.01	(0.085)	-0.018	(0.092)
Moving	0.533*	(0.16)	0.521*	(0.173)	0.355*	(0.127)	0.406*	(0.129)
No Search, Arrest								
All Other	-0.065	(0.246)	-0.061	(0.254)	-0.09	(0.215)	-0.112	(0.197)
Equip.	0.192	(0.259)	0.212	(0.271)	-0.079	(0.241)	0.038	(0.215)
Reg. or Lic.	-0.131	(0.278)	-0.091	(0.315)	0.182	(0.276)	0.002	(0.243)
Signal or Stop	-0.256	(0.172)	-0.177	(0.187)	-0.111	(0.218)	-0.163	(0.164)
Moving	-0.365*	(0.212)	-0.42*	(0.221)	-0.117	(0.221)	-0.275	(0.191)
Search, Ticket or Misdemeanor								
All Other	0.053	(0.203)	-0.057	(0.211)	-0.107	(0.184)	-0.119	(0.172)
Equip.	0.094	(0.234)	0.006	(0.241)	-0.185	(0.211)	-0.124	(0.188)
Reg. or Lic.	0.611*	(0.279)	0.564*	(0.293)	0.642*	(0.363)	0.573*	(0.305)
Signal or Stop	0.369*	(0.197)	0.386*	(0.199)	0.12	(0.229)	0.231	(0.19)
Moving	0.151	(0.272)	0.091	(0.283)	-0.12	(0.285)	-0.059	(0.238)
Search, Warning								
All Other	-0.126	(0.352)	-0.135	(0.361)	-0.11	(0.379)	-0.139	(0.304)
Equip.	0.098	(0.266)	0.084	(0.276)	0.05	(0.251)	0.027	(0.18)
Reg. or Lic.	0.537	(0.434)	0.599	(0.444)	1.285*	(0.374)	0.866*	(0.34)
Signal or Stop	-0.239	(0.286)	-0.181	(0.287)	-0.413	(0.296)	-0.305	(0.239)
Moving	0.458	(0.309)	0.483	(0.319)	0.127	(0.308)	0.315	(0.27)
Search, Arrest								
All Other	-0.317	(0.271)	-0.401	(0.272)	0.349	(0.269)	-0.092	(0.217)
Equip.	0.006	(0.314)	-0.059	(0.321)	0.148	(0.304)	-0.035	(0.272)
Reg. or Lic.	0.46*	(0.277)	0.471	(0.287)	0.931*	(0.389)	0.605*	(0.257)
Signal or Stop	-0.066	(0.244)	-0.086	(0.256)	-0.1	(0.339)	-0.115	(0.242)
Moving	-0.697*	(0.275)	-0.716*	(0.279)	0.225	(0.34)	-0.307	(0.251)
Chi^2	1.72E+02		1.63E+02		122.82		1.47E+02	
P-Value	0		0		0		0	
Sample Size	136,504		131,908		126,916		161,558	

Note 1: The coefficients are presented as log odds ratios and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.
Note 2: All specifications include controls for gender, age, hour, day of the week, and week of year fixed effects.
Note 3: Q-Values were estimated using a false discovery rate procedure following Simes (1986) and later refined by Benjamini and Hochberg (1995) and Benjamini and Yekutieli (2001).

Table 6.3 presents the results of applying a multinomial logit to a subset of traffic stops by the Connecticut State Police. As before, we tested for differences across six distinct stop outcomes for motorists of different races who were stopped for the same reason. Across all specifications, we do not observe any discernible pattern suggesting non-White motorists are treated differently in any

uniform way. However, a joint hypothesis test across all the interaction terms and all outcomes indicates that the difference in outcomes is statistically significant at the 99% level for each demographic group relative to White motorists. Note that we cannot obtain estimates for Hispanic motorists as the baseline category is seemingly nonexistent for Hispanic motorists stopped by State Police in 2022.

Table 6.3: Multinomial Linear Probability Model of Outcome on Race/Ethnicity and Reason for Stop, State Police Traffic Stops 2022

	Non-White		Black		Hispanic		Black or Hispanic	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
No Search, Warning or No Action								
All Other	0.456*	(0.093)	0.311*	(0.098)	0.077*	(0.111)	0.198*	(0.079)
Equip.	-0.071	(0.125)	-0.119	(0.132)	-0.249	(0.128)	-0.227*	(0.101)
Reg. or Lic.	0.176*	(0.073)	0.097	(0.079)	-0.083*	(0.143)	-0.033	(0.06)
Signal or Stop	-0.071	(0.125)	-0.096	(0.146)	0.108	(0.086)	-0.017	(0.106)
Moving	0.28*	(0.067)	0.267*	(0.073)	0.235*	(0.121)	0.251*	(0.059)
No Search, Arrest								
All Other	-0.398*	(0.196)	-0.576*	(0.204)	-0.466	(0.2)	-0.514*	(0.164)
Equip.	0.23	(0.474)	0.25	(0.477)	-0.489	(0.234)	-0.159	(0.412)
Reg. or Lic.	0.418	(0.381)	0.258	(0.405)	-0.216	(0.269)	0.034	(0.33)
Signal or Stop	0.252	(0.51)	0.073	(0.59)	-0.706	(0.206)	-0.217	(0.503)
Moving	-0.392*	(0.217)	-0.431*	(0.227)	0.017	(0.201)	-0.205	(0.179)
Search, Ticket or Misdemeanor								
All Other	-0.628	(0.385)	-0.712*	(0.392)	-1.064	(0.212)	-0.91*	(0.337)
Equip.	0.556	(0.584)	0.599	(0.589)	-1.445*	(0.237)	-0.102	(0.556)
Reg. or Lic.	0.073	(0.445)	0.068	(0.448)	0.25	(0.378)	0.064	(0.385)
Signal or Stop	0.384	(1.034)	-0.074	(1.259)	0.782	(0.231)	0.434	(0.951)
Moving	-0.347	(0.461)	-0.281	(0.465)	-1.389	(0.289)	-0.699	(0.433)
Search, Warning								
All Other	0.235	(0.841)	-0.119	(0.874)	0.596	(0.38)	0.149	(0.777)
Equip.	-0.361	(0.566)	-0.432	(0.575)	0.222	(0.25)	-0.245	(0.512)
Reg. or Lic.	0.102	(0.788)	0.012	(0.79)	-0.12*	(0.373)	-0.169	(0.73)
Signal or Stop	-1.313	(1.205)	-0.966	(1.196)	-17.56	(0.302)	-1.277	(1.181)
Moving	-0.826	(0.512)	-0.827	(0.518)	-0.273	(0.313)	-0.748	(0.475)
Search, Arrest								
All Other	-0.576*	(0.34)	-0.708*	(0.351)	-0.779	(0.254)	-0.657*	(0.291)
Equip.	0.408	(0.617)	0.444	(0.622)	0.028	(0.304)	0.28	(0.522)
Reg. or Lic.	-0.664	(0.844)	-0.622	(0.849)	-0.655*	(0.386)	-0.546	(0.621)
Signal or Stop	-0.049	(0.772)	0.188	(0.784)	0.364	(0.331)	0.047	(0.657)
Moving	-0.512	(0.368)	-0.424	(0.379)	-0.59	(0.325)	-0.438	(0.314)
Chi^2	8.73E+01		6.97E+01		148.01		8.03E+01	
P-Value	0		0		0		0	
Sample Size	58,925		56,166		55,003		66,020	

Note 1: The coefficients are presented as log odds ratios and standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.
Note 2: All specifications include controls for gender, age, hour, day of the week, and week of year fixed effects.
Note 3: Q-Values were estimated using a false discovery rate procedure following Simes (1986) and later refined by Benjamini and Hochberg (1995) and Benjamini and Yekutieli (2001).

The previous estimates aggregate all traffic stops across multiple departments and should be considered an average effect. Although the results from this section find a statistically significant disparity in the rate of non-White traffic stops made by municipal police departments in Connecticut, these results do not identify the geographic source of that disparity. The results of a department-level analysis are presented in the next section, and the source of specific department-wide disparities is better identified.

VI.B: DEPARTMENT ANALYSIS OF STOP DISPOSITION, 2022

The analysis presented at the state level shows that non-White motorists are treated differently, in terms of disposition, relative to their White counterparts, even when they are stopped for the same reason. By construction, the aggregate analysis does not investigate the source of these disparities in specific municipal police departments or State Police troops. The analysis presented in this section seeks to better identify the sources of that disparity by running the same test for individual municipal departments and State Police troops. This section estimates Equation 10 of Appendix A.6 separately for each municipal department and State Police troops. Thus, each set of estimates includes a vector of town-specific controls for the hour, day of the week, and department-fixed effects. We identify all departments and State Police troops found to have a disparity that is statistically significant at the 95% level in either the Hispanic or Black alone groups.

Ordinarily, we would present the results from estimating the equality test in stop dispositions for non-White motorists relative to their White peers in individual policing agencies. However, according to this test, no department was found to have a statistically significant disparity in post-stop outcomes in 2022. Table F.1 of Appendix F contains the full set of results.

VII: ANALYSIS OF VEHICULAR SEARCHES

This section contains the results of analyzing post-stop outcomes using a hit-rate approach following Knowles, Persico, and Todd (2001). The hit-rate approach relies on the idea that motorists rationally adjust their propensity to carry contraband in response to their likelihood of being searched by police. Similarly, police officers rationally decide whether to search a motorist based on visible indicators of guilt and an expectation of the likelihood that a given motorist might have contraband. According to the model, we should expect the police to search a demographic group of motorists more often than Caucasians if they were also more likely to carry contraband. However, the higher level of searches should be proportional to this group's higher propensity to carry contraband. Thus, without racial animus, we should expect the rate of successful searches (i.e., the hit rate) to be equal across different demographic groups regardless of differences in their propensity to carry contraband.[12]

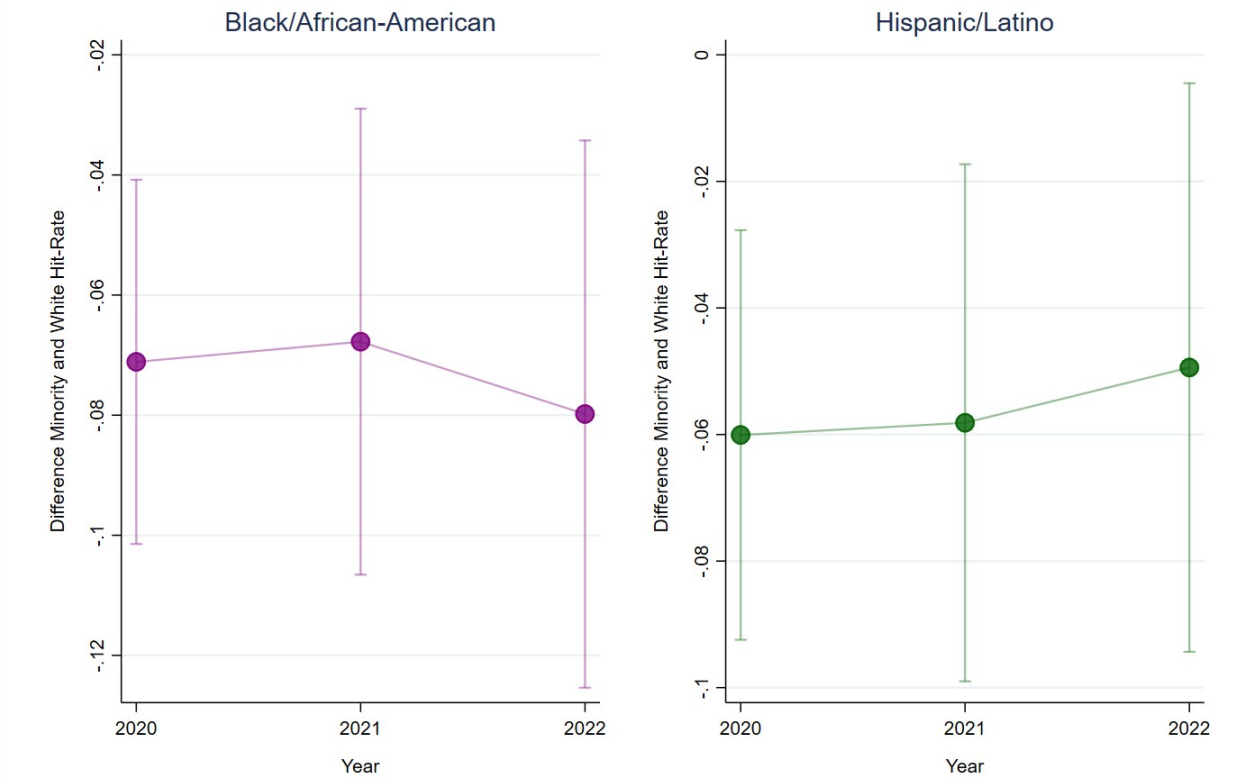
In this test, discrimination is interpreted as a preference for searching non-White motorists that manifests in the data as a statistically lower hit rate relative to White motorists. In technical terms, the testable implication derived from this model is that the equilibrium search strategy, without group bias, will equalize the rate of contraband found relative to the total number of searches (i.e., the hit rate) across motorist groups. In our application, we test for the presence of a disparity in the rate of successful searches using a nonparametric test, the Pearson X^2 test. Note that this test inherently says nothing about disparate treatment in the decision to stop motorists, as it is limited in scope to vehicular searches. Our analysis focuses on discretionary searches, which we define as those identified as "other" searches. We exclude inventory searches since those are likely correlated with other offenses and race.

VII.A: AGGREGATE ANALYSIS WITH HIT-RATES, 2022 AND 2020-22

Figure 7.1 presents a confidence interval between the difference in the hit rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of searches in 2020, 2021, and 2022. The vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for discretionary searches of non-White motorists relative to White motorists. A negative difference indicates that non-White motorists are searched disproportionately relative to the rate at which police actually find contraband when compared with their White peers. Across the period 2020-22, the share of discretionary searches when contraband is found for Black motorists ranged from 33.4% to 45.1% and from 36.5% to 46% for Hispanic motorists. The hit rate for both Black and Hispanic motorists stood lower than that for White motorists, which ranged from 41.4% to 51.8% over the period. The difference in the rate of successful searches between Black and Hispanic relative to White motorists was negative and highly significant at the 99% level every year. In general, the test consistently shows a disparity in the likelihood a non-White motorist is searched by police in Connecticut, which has gotten smaller but is still relatively large in magnitude.

[12] Although some criticism has risen concerning the technique and extensions have suggested that more disaggregated groupings of searches be used in the test, the ability to implement such improvements is limited by the small overall sample of searches in a single year of traffic stops. Despite these limitations, the hit-rate analysis is still widely applied in practice and contributes to the overall understanding of post-stop police behavior in Connecticut.

Figure 7. 1: **Aggregate Hit-Rate Analysis by Year, All Searches 2020-22**



Notes: Coefficient estimates are obtained from Table 7.1 of the 2020 and 2021 annual reports and the 2022 estimates from the table below.

Table 7.1 contains the results of the hit-rate test formally applied to all departments in Connecticut in 2022. As seen below, the rate of successful searches for White motorists was 41.4% in 2022. Relative to White motorists, the hit rate for the four non-White subgroups was lower and ranged from 33.4% to 36.5%. The difference in hit rates for each group was statistically significant at the 99% level. In aggregate, Connecticut police departments are less successful when conducting searches of non-White motorists relative to their White peers, which indicates potential adverse treatment towards non-White drivers on the part of police.

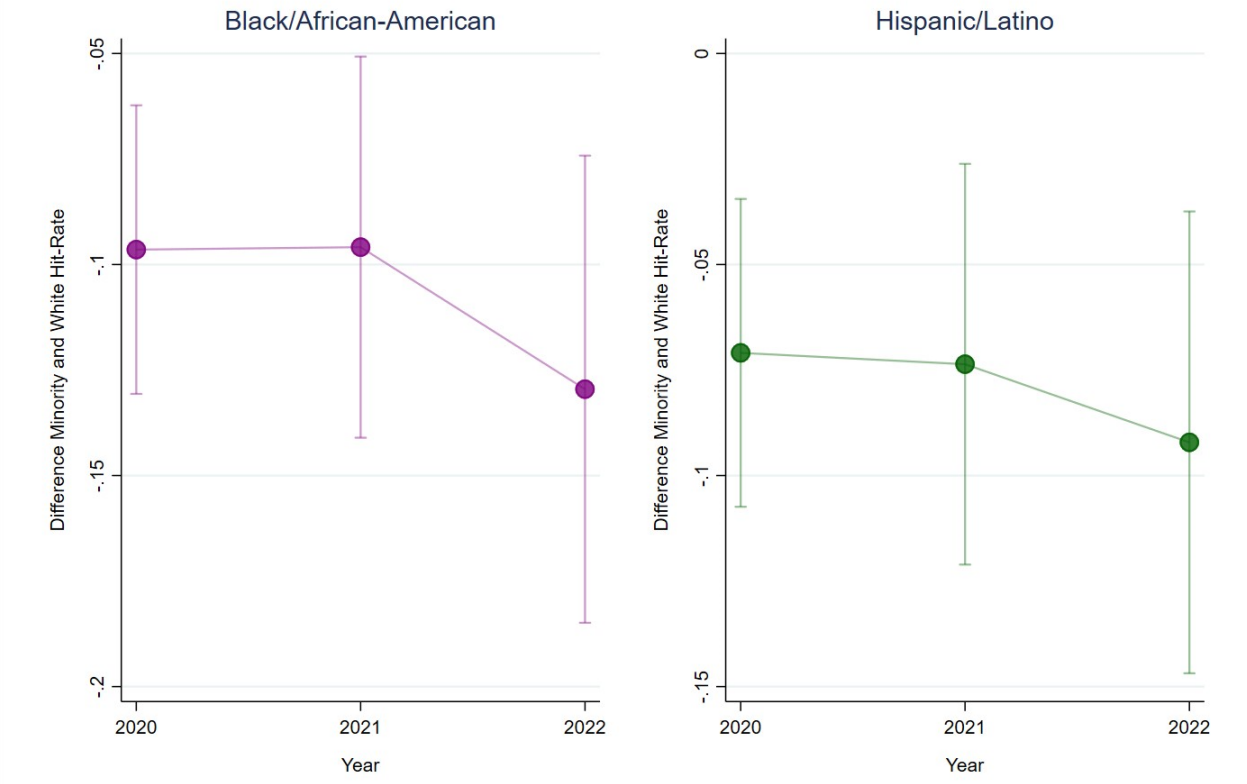
Table 7. 1: Chi-Square Test of Hit-Rate, All Searches 2022

Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	41.397%	33.417%***	33.416%***	36.457%**	35.345%***
Contraband	385	271	266	319	574
Searches	930	811	796	875	1624
Chi^2	N/A	11.755	11.628	4.625	9.239
P-Value	N/A	0.001	0.001	0.030	0.002

Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. The sample includes all consent and probable cause searches in 2022.

Figure 7.2 presents a confidence interval between the difference in the hit rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of other searches for municipal departments in 2020, 2021, and 2022. As before, the vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for searches of non-White motorists relative to White motorists. A negative difference indicates that non-White motorists are searched disproportionately often relative to the rate at which police actually find contraband when compared with their White peers. Across the period 2020-22, the share of other searches when contraband is found for Black motorists ranged from 34.2% to 47% and from 37.9% to 49.2% for Hispanic motorists. The range in both Black and Hispanic hit rates stood lower than that for White motorists, which ranged from 47.2% to 56.5% over the period. As with the aggregate results, the results for municipal departments indicate that searches of non-White motorists are more likely to be unsuccessful than White motorists. All disparities were significantly different from zero at a level greater than 99% confidence. The test consistently shows a disparity in the likelihood that municipal police in Connecticut search a non-White motorist.

Figure 7. 2: Aggregate Hit-Rate Analysis by Year, Municipal Searches 2020-22



Notes: Coefficient estimates are obtained from Table 7.2 of the 2020 and 2021 annual reports, and the 2022 estimates from the table below.

Table 7.2 contains the results of the hit-rate test formally applied to all municipal departments in Connecticut in 2022. As seen below, the rate of successful searches for White motorists was 47.2% in 2022. Relative to White motorists, the hit rate for each of the four non-White subgroups was lower and ranged from 34% to 37.9%. The difference in hit rates for each group was statistically significant at the 99% level. In aggregate, Connecticut municipal police departments are less successful when conducting searches of non-White motorists relative to their White peers, which indicates potential adverse treatment.

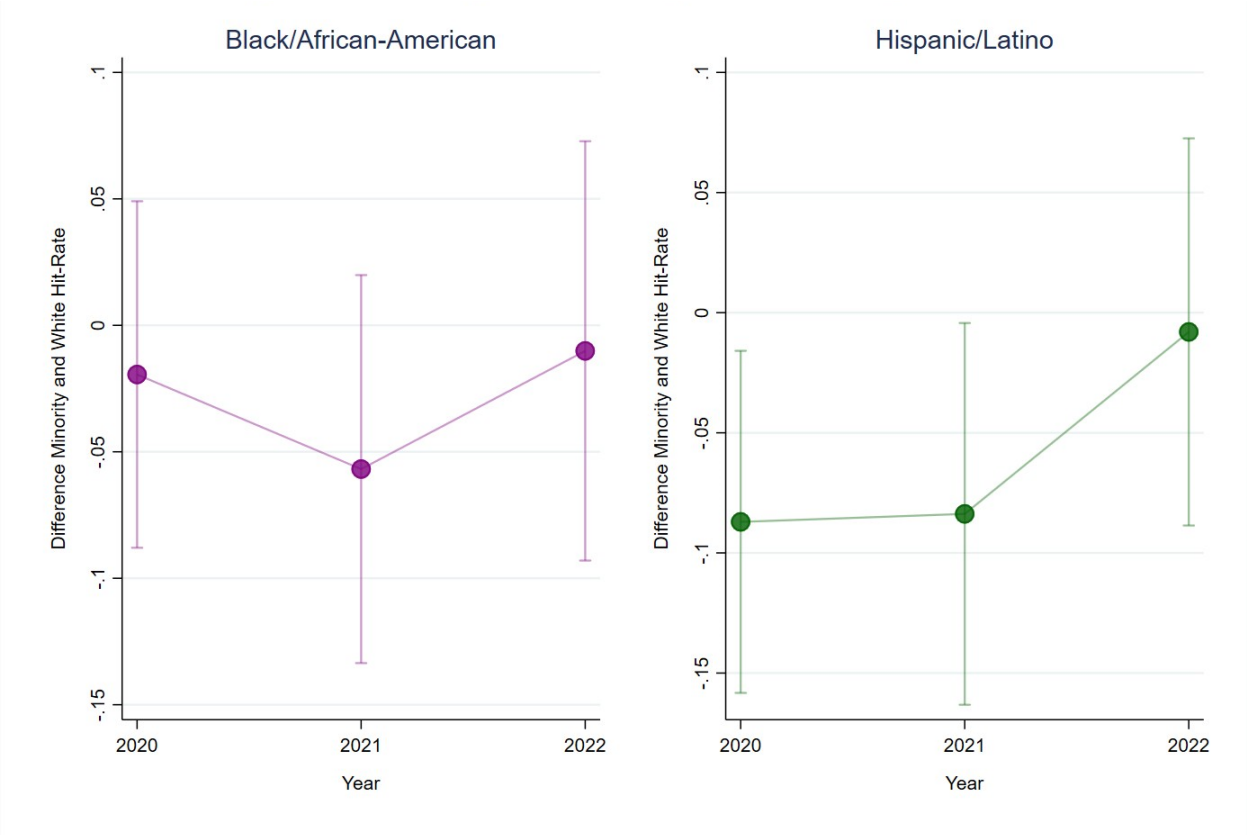
Table 7. 2: Chi-Square Test of Hit-Rate, Municipal Police Searches 2022

Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	47.159%	33.984%***	34.206%***	37.945%***	36.472%***
Contraband	274	209	209	255	457
Searches	581	615	611	672	1253
Chi2	N/A	21.544	20.735	10.843	18.913
P-Value	N/A	0.001	0.001	0.001	0.001

Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. The sample includes all discretionary searches in 2022.

Figure 7.3 presents a confidence interval between the difference in the hit rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of searches by State Police in 2020, 2021, and 2022. As before, the vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for searches of non-White motorists relative to White motorists. A negative difference indicates that non-White motorists are searched disproportionately relative to the rate at which police actually find contraband when compared with their White peers. Across the period 2020-22, the share of searches when contraband is found for Black motorists ranged from 31% to 38.8% and from 31.2% to 33.6% for Hispanic motorists. The range in both Black and Hispanic hit rates was periodically lower than that for White motorists, which ranged from 32% to 42% over the period. The results for State Police indicate that searches of non-White motorists were only more likely to be unsuccessful relative to White motorists for some of the years in the sample. The differences between these years and non-White motorists were significant at the 99% confidence level for all years except for Black motorists in 2020 and 2022.

Figure 7. 3: Aggregate Hit-Rate Analysis by Year, State Police Searches 2020-22



Notes: Coefficient estimates are obtained from Table 7.3 of the 2020 and 2021 annual reports, and the 2022 estimates from the table below.

Table 7.3 contains the results of the hit-rate test formally applied to all State Police Troops in Connecticut in 2022. As seen below, the rate of successful searches for White motorists was 32% in 2022. Relative to White motorists, the hit rate for the four non-White subgroups was lower and ranged from 30.98% to 31.8%. The difference in hit rates was not statistically significant for any non-White group. In aggregate, Connecticut State Police were no less successful when conducting searches of non-White motorists relative to their White peers in 2022.

Table 7.3: Chi-Square Test of Hit-Rate, State Police Discretionary Searches 2022

Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	31.988%	31.795%	30.978%	31.187%	31.436%
Contraband	111	62	57	63	116
Searches	347	195	184	202	369
Chi2	N/A	0.002	0.057	0.037	0.025
P-Value	N/A	0.962	0.811	0.846	0.874

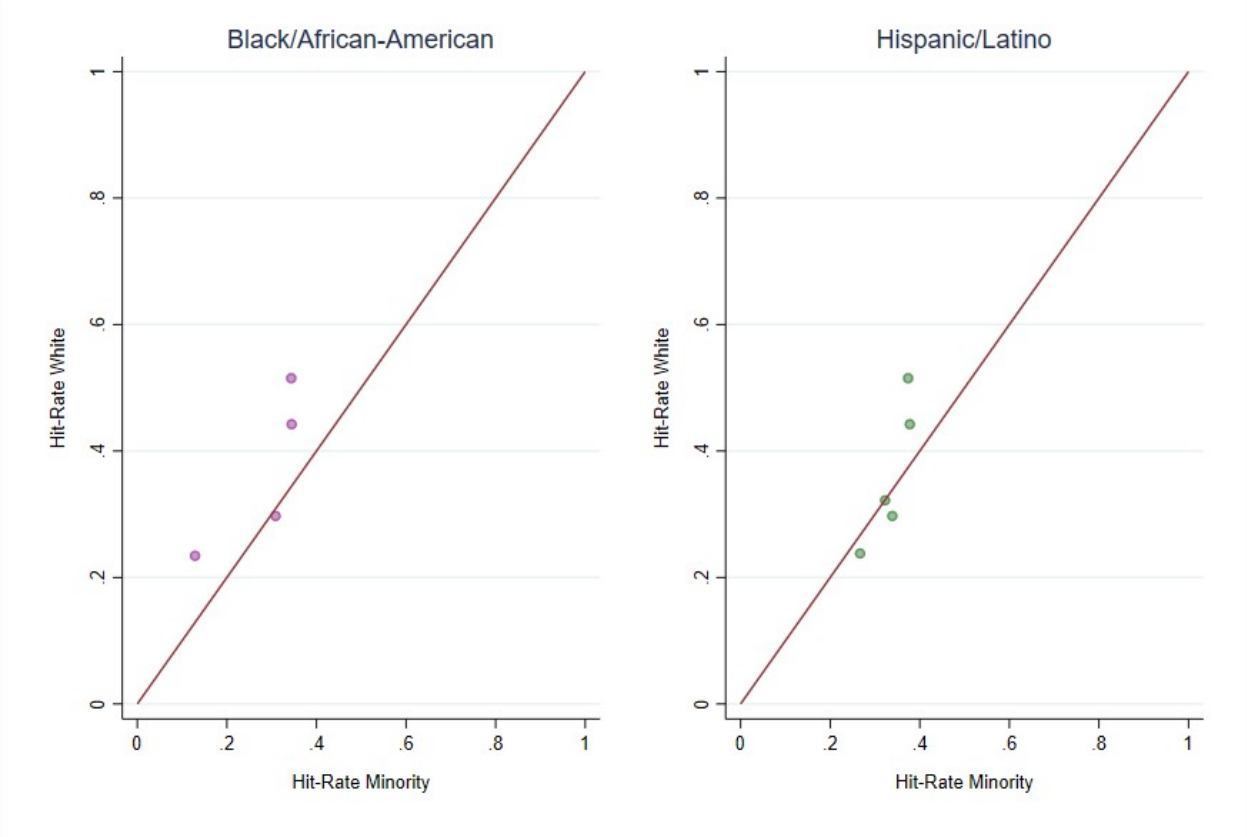
Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. The sample includes all discretionary searches in 2022.

VII.B: DEPARTMENT ANALYSIS WITH HIT-RATES, 2022 AND 2020-22

This subsection independently estimates differences in hit rates for each municipal department and State Police troop. We graphically present an estimate of the hit-rate test separately for each municipal department and State Police troop. We first provide results for the 2022 sample of the data as we have done in the prior three reports. However, we also leverage the full three-year sample from 2020-22 and graphically present estimates of the effect for smaller departments that previously had an insufficient sample to run the test annually. In this test, it is necessary to restrict the sample to only motorists stopped and subsequently searched by police. However, this restriction significantly reduces the estimation power in small samples. The figures and discussion below highlight only the departments with a statistically significant disparity in the Black or Hispanic alone categories for either the 2022 or combined 2020-22 samples. Identification requires that departments and State Police troops have a disparity that is statistically significant at or above the 95% level in either the Hispanic or Black alone groups. Further, we only highlight departments with a false discovery rate below 10%. We provide the full set of results in Tables G.1 and G.2 of Appendix G.

Figure 7.4 plots the likelihood that a Black (left panel) or Hispanic (right panel) motorist is searched by police relative to their White peers. Individual points on the figure represent specific municipal departments and State Police troops. The vertical axis plots the likelihood that a discretionary search of a White motorist results in contraband being found, and the horizontal axis plots the same likelihood for non-White motorists. The red 45-degree line represents parity (equal treatment) between police searches of non-White and White motorists. Thus, only departments falling above this line (top left quadrant) are more likely to search non-White motorists relative to Whites. We annotate only those departments where the difference is statistically significant at or above the 95% confidence level in the main specification and with a false discovery rate below 10%. The full results are contained in Table G.1 of Appendix G. Applying this test to the 2022 data, we do not identify any departments.

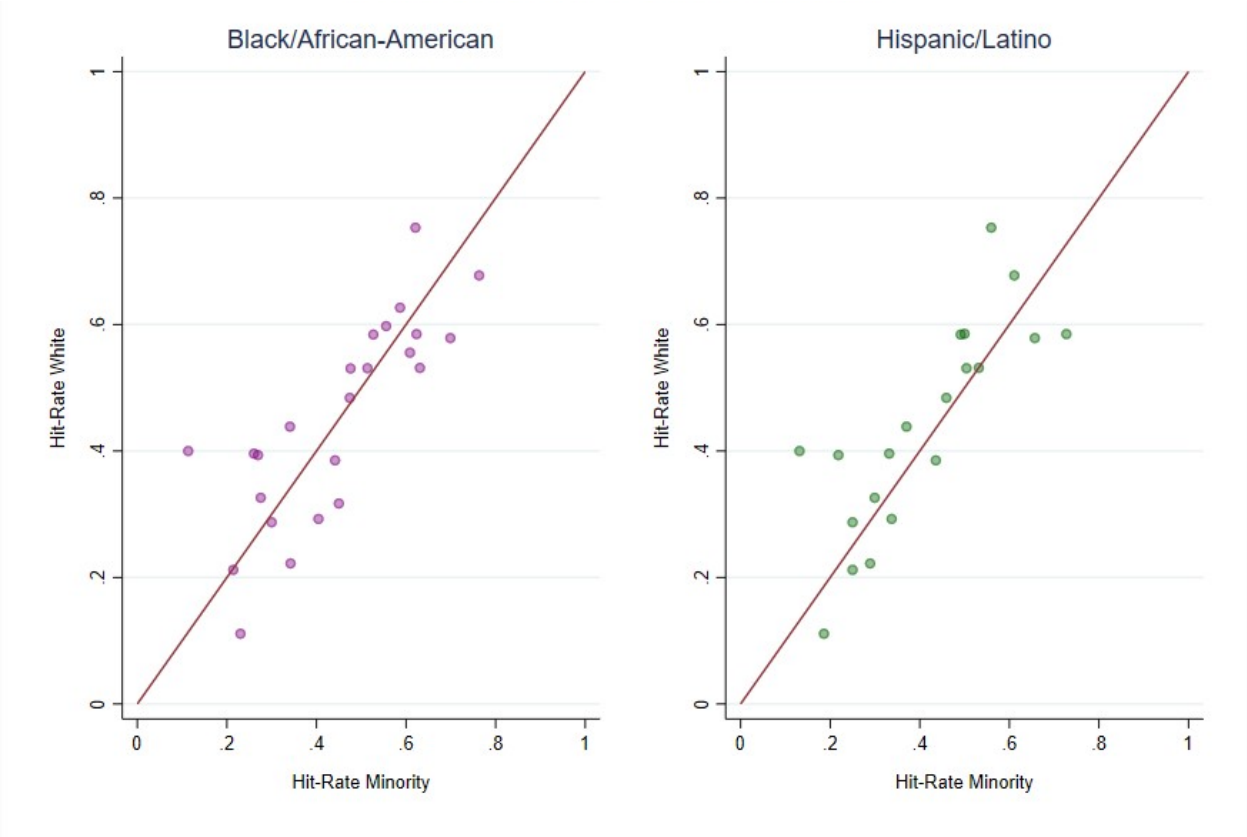
Figure 7. 4: Hit Rate Analysis by Department, All Discretionary Searches 2022



Notes: Hit rates are obtained from Table G.1 of Appendix G. Annotated departments include only those with a statistically significant disparity estimated non-parametrically with a confidence level at or exceeding 95% in the combined sample of discretionary searches. Identified departments also had a false discovery rate below 10%, as estimated by Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

As discussed, there are too few searches for this test to be applied to a single year of data for many small departments. Thus, Figure 7.5 plots the likelihood a Black (left panel) or Hispanic (right panel) motorist is searched by police relative to their White peers in a combined three-year sample. The full results are contained in Table G.2 of Appendix G. Applying this test to the 2020-22 data, we only identify CSP Headquarters (Black) and Hartford (Black) with a significant level exceeding 95% confidence and a false discovery rate below 10%.

Figure 7. 5: Hit Rate Analysis by Department, All Discretionary Searches 2020-22



Notes: Hit rates are obtained from Table G.2 of Appendix G. Annotated departments include only those with a statistically significant disparity estimated non-parametrically with a confidence level at or exceeding 95% in the combined sample of discretionary searches. Identified departments also had a false discovery rate below 10%, as estimated by Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

VIII: FINDINGS FROM THE 2022 AND 2020-22 ANALYSIS

This section summarizes the findings from the annual analysis of traffic stops conducted between January 1, 2022, and December 31, 2022, and the 2020 to 2022 three-year aggregate analysis conducted between January 1, 2020, and December 31, 2022.

VIII.A: AGGREGATE FINDINGS FOR CONNECTICUT, 2022 AND 2020-22

Municipal and State Police departments in Connecticut made 313,347 traffic stops in 2022 (829,000 in 2020-22), of which 59% were White motorists, 19% were Black, and 18% were Hispanic motorists. Recorded traffic stops increased by 14% in 2022 compared to 2021 but remained 39% lower than 2019. State police traffic stops increased by 39.5% in 2022 compared to 2021 but remained 35% lower than 2019. Municipal police increased traffic stops by 5% in 2022 compared to 2021 but still remain 40% lower than in 2019.

At the aggregate level, we present estimates using solar visibility analysis, a search hit-rate analysis, and a post-stop disposition analysis. The solar visibility analysis exploits quasi-random variation in sunset timing to identify potential discrimination in the decision to stop a motorist. According to the results from applying this test, the estimated change from daylight to darkness in the likelihood that a stopped motorist was Black or Hispanic was 0.3 and 0.0 percentage points, statistically indistinguishable from zero in 2022. The key identifying assumption of this test is that police officers who are inclined to racially profile motorists are better able to do so during daylight when the motorist race is more easily observed before making a traffic stop. According to this logic and the application of the test to the traffic stop data, Connecticut police were not any more likely to stop Black or Hispanic motorists on average in 2022.

In 2022, Municipal and State Police departments in Connecticut also conducted only 2,580 discretionary motor vehicle searches, of which 36% were White motorists, 31% were Black, and 34% were Hispanic motorists. At the aggregate level, we present estimates comparing the likelihood a search resulted in contraband being found for White motorists relative to non-White motorists. In addition, we compare the disposition of traffic stops across these groups after conditioning on the motivation for the traffic stop. The rate at which discretionary searches of White motorists yielded contraband was 41% in 2022, while the rate at which searches of Black and Hispanic motorists yielded contraband was 33% and 36%, respectively, in 2022. The key identifying assumption of this test is that, if police are unbiased, they will only search non-White motorists more often than Whites relative to their expected likelihood of carrying contraband. The lower hit rate for non-White motorists is suggestive of potential bias on the part of police. The stop disposition analysis did not reveal any discernible pattern regarding how non-White motorists are treated following a traffic stop but did indicate that they faced statistically different outcomes.

VIII.B: SOLAR VISIBILITY ANALYSIS FINDINGS, 2022 AND 2020-22

To better identify the source of these racial and ethnic disparities, each analysis was repeated at the department level for the 2022 calendar year and the 2020 to 2022 aggregate sample. The threshold for identifying individual departments was the presence of a statistically significant disparity at the

95 percent level in the Black or Hispanic alone categories.[13] Here, the unit of analysis is a municipal department or State Police Troop where disparities could be a function of a number of factors, including institutional culture, departmental policy, or individual officers.[14]

We identify four State Police Troops in the three-year aggregate sample. State Police Headquarters and Troop D were also identified in our 2020 and 2021 analysis. We also identified two municipal police departments in the three-year aggregate sample[15]. For all departments identified in this report with disparities across all robustness tests, we conclude that there is strong evidence that a disparity exists in the rate of non-White traffic stops made during daylight conditions. These departments include:

State Police Headquarters

State Police Troop Headquarters was identified on the solar visibility analysis in the 2020-22 sample for Black and Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood that a stopped motorist was Black and Hispanic totaled 16.9% and 17.4% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 7.2 percentage points or 43.7% relative to the dependent mean. The likelihood of a stopped motorist being Hispanic grew by 5.4 percentage points or 31.0% relative to the dependent mean.

State Police Troop D

State Police Troop D was identified on the solar visibility analysis in the 2020-22 sample for Black and Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood that a stopped motorist was Black and Hispanic totaled 7.7% and 8.6% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 2.9 percentage points or 37.5% relative to the dependent mean. The likelihood of a stopped motorist being Hispanic grew by 2 percentage points or 23.2% relative to the dependent mean.

State Police Troop E

State Police Troop E was identified on the solar visibility analysis in the 2020-22 sample for Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood of a stopped motorist being Hispanic totaled 11.4% overall. Conditioning on the day of the week and time of day, the likelihood a stopped

[13] Put simply, there must have been at least a 95 percent chance that the motorists were more likely to be stopped at a higher rate relative to white non-Hispanic motorists.

[14] Since department or state police barrack estimates represent an average effect of stops made by individual officers weighted by the number of stops that they made in 2022, it is possible that officer-level disparities exist in departments that were not identified.

[15] Glastonbury was identified with statistically significant disparities in the 2022 sample for Hispanic motorists. There was not sufficient data available to estimate robustness checks using a subsample of moving violations. Wethersfield was also identified with statistically significant disparities in the 2022 sample for Hispanic motorists, but only in the robustness checks.

motorist was Hispanic grew by 2.2 percentage points or 19.6% relative to the dependent mean.

State Police Troop H

State Police Troop H was identified on the solar visibility analysis in the 2020-22 sample for Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood of a stopped motorist being Hispanic totaled 22.5% overall. Conditioning on the day of the week and time of day, the likelihood of a stopped motorist being Hispanic grew by 5.2 percentage points or 23.1% relative to the dependent mean.

Berlin:

Berlin was identified on the solar visibility analysis in the 2020-22 sample for Black and Hispanic motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood of a stopped motorist being Black and Hispanic totaled 12% and 14.7% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 7.2 percentage points or 60% relative to the dependent mean. The likelihood of a stopped motorist being Hispanic grew by 7.1 percentage points or 48.4% relative to the dependent mean.

Guilford:

Guilford was identified on the solar visibility analysis in the 2020-22 sample for Black motorists. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During this test's sample window, the likelihood of a stopped motorist being Black totaled 3.4% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 1.7 percentage points or 50.3% relative to the dependent mean.

VIII.C: OTHER STATISTICAL AND DESCRIPTIVE MEASURE FINDINGS, 2022 AND 2020-22

In addition to the four State Police troops and two municipal police departments identified to exhibit statistically significant racial or ethnic disparities in the solar visibility analysis, a number of other departments were identified using either the descriptive tests, stop disposition test, or KPT hit-rate analysis. These additional tests are designed as a screening tool to identify the jurisdictions where consistent disparities exceed certain thresholds in the data. Although it is understood that certain assumptions have been made in the design of each of these measures, it is reasonable to believe that departments with consistent data disparities that separate them from the majority of other departments should be subject to further review and analysis with respect to the factors that may be causing these differences.

Synthetic Control Analysis:

The results from estimating whether individual departments stopped more non-White motorists relative to their requisite synthetic control found 25 municipal police departments and 7 State Police troops to have a disparity that was statistically significant at the 95 percent level in the Black or Hispanic alone categories. *Troop I, East Haven, Farmington, Hamden, New Haven, Newington, North Haven, Orange, Plymouth, South Windsor, Wallingford, Waterford, Wethersfield,* and *Wolcott* were identified in the 2022 sample and the aggregate 2020 to 2022 sample. *Troop HQ, Troop A, Troop L, Naugatuck, Newtown, Plainville, Vernon, West Haven,* and *Windsor* were identified only in the 2022 sample. *Branford, Troop E, Troop G, Troop H, Easton, Granby, Middlebury, New London, Trumbull, Willimantic,* and *Woodbridge* were identified only in the three-year aggregate analysis.

Descriptive Statistics Analysis:

The descriptive tests are designed as an additional tool to identify disparities that exceed certain thresholds that appear in a series of census-based benchmarks. The two descriptive benchmarks compared to (1) the statewide average and (2) the resident-only stops. Although 60 municipal police departments were identified with racial and ethnic disparities when compared to one or more of the descriptive measures, only *Derby, Naugatuck, New Britain, Newington,* and *Stratford* exceeded the disparity threshold in both measures with a score of at least four out of six.

Stop Disposition Analysis:

Similar to 2021, we find no discernible pattern of non-White motorists being treated differently in any uniform way relative to their White counterparts in the stop disposition test. No departments were found to have a statistically significant disparity in post-stop outcomes in 2022.

KPT Hit-Rate Analysis:

The results of this test, applied to the aggregate search data for all departments in Connecticut, show that departments are less successful in motorist searches across all non-White groups, which is a potential indicator of disparate treatment. There were no municipal police departments or State Police Troops found to have a disparity in the hit rate of non-White motorists relative to White motorists for the 2022 sample. In the combined 2020-22 aggregate sample, there was one municipal police department (Hartford) and one state police troop barracks (HQ) found to have a disparity in the hit rate of non-White motorists relative to White motorists.

VIII.D: FOLLOW-UP ANALYSIS

The analysis presented in chapters III through VII of this report should be utilized as a screening tool by which researchers, law enforcement administrators, community members, and other appropriate stakeholders focus resources on those departments displaying the greatest disparities in their respective stop data. As noted previously, racial and ethnic disparities in any traffic stop analysis do not, by themselves, provide conclusive evidence of racial profiling. Statistical disparities do, however, provide significant evidence of the presence of idiosyncratic data trends that warrant further analysis.

In order to determine if a department's racial and ethnic disparities warrant additional in-depth analysis, researchers review the results from some of the analytical sections of the report. The

threshold for identifying significant racial and ethnic disparities for departments is described in each section of the report (ex. departments with a statistically significant disparity at the 95 percent level in the black or Hispanic alone categories in the Veil of Darkness methodology were identified as statistically significant). A department is identified for a follow-up analysis if it meets any one of the following criteria:

1. A statistically significant disparity in the one-year or three-year Veil of Darkness analysis
2. A statistically significant disparity in the one-year or three-year KPT hit rate and Stop Disposition analyses

In general, we continue to identify far fewer departments in this report than in the previous year's studies, with two municipal departments (**Berlin** and **Guilford**) and four State Police troops (**State Police Headquarters**, **Troop D**, **Troop E**, and **Troop H**. The municipal departments and State Police Troops were only identified in the three-year aggregate veil of darkness sample. Based on the above-listed criteria and past research considerations, it was recommended that an in-depth follow-up analysis be conducted for the **Guilford** police department. Unlike other agencies in this report, an in-depth follow-up analysis of the Guilford traffic stop data has never been conducted.

In addition to being identified with racial and ethnic disparities in this study, the **Berlin** police department was identified with racial and ethnic disparities in the 2015-16 Traffic Stop Data Analysis and Findings report. An in-depth analysis, with recommendations, was completed and published as part of the 2015-16 Traffic Stop Data Analysis and Findings Supplemental report released in October 2018. The follow-up analysis and subsequent departmental interventions were not completed until 2018. Therefore, it is reasonable that any changes made by the department would not be reflected in their data until late 2018 or early 2019. We reviewed the data covered in this analysis period and did not believe the agency's disparity was a significant enough deviation to warrant additional analysis. We will continue monitoring the department's data to determine if additional analysis is warranted in the future.

Although this year we formally identified **Troop D**, **Troop E, Troop H,** and **Headquarters** with statistically significant racial and ethnic disparities, a comprehensive five-year analysis of traffic stop disparities for the entire State Police was published in May 2020 as part of the 2018 Traffic Stop Data Analysis and Findings report. Many challenges are associated with assessing the racial and ethnic disparities identified within the State Police compared to municipal police departments. We will continue to monitor State Police aggregate and Troop level trends for significant variations and to determine if additional comprehensive analysis is warranted.

It is also worth noting that the Connecticut Racial Profiling Prohibition Project advisory board authorized a comprehensive audit of racial profiling records submitted by the Connecticut State Police between January 1, 2014, and December 31, 2021. The audit identified inaccurate infraction records submitted to the racial profiling database by troopers and constables during all years of the audit. The inaccurate records most likely had a small but statistically significant impact on any analysis, including Connecticut State Police data between 2014 and 2021. This report covered the 2020 through 2022 calendar years. The full audit can be found on our website at www.ctrp3.org.

PART II: 2022 FOLLOW-UP ANALYSIS

IX: FOLLOW-UP ANALYSIS INTRODUCTION

The information presented in the subsequent section consists of a follow-up report conducted for the Guilford police department, which warranted further analysis. Although Troop D, Troop E, Troop H, and the Headquarters Troop were identified with statistically significant racial and ethnic disparities, a comprehensive five-year analysis of traffic stop disparities for the entire State Police was published in May 2020 as part of the 2018 Traffic Stop Data Analysis and Findings report. The Berlin Police Department was also identified, and a comprehensive follow-up analysis was published in October 2018. We will continue to monitor Berlin Police and State Police aggregate and Troop level trends for significant variations and to determine if additional comprehensive analysis is warranted in the future.

An enhanced analysis aims to better understand the reasons for racial and ethnic disparities in traffic stop data. Disparities can result from the interplay of various factors that can be identified and further explored through a more in-depth examination of the data. Although there are some factors common to policing in general, the true nature of policing can differ from one community to another based on a variety of unique factors. Police administrators must deal with a variety of crime and disorder problems. Traffic stop disparities can be influenced by factors such as the location and frequency of traffic crashes, high call-for-service volume areas, high crime rate areas, and areas with major traffic generators, such as shopping and entertainment districts, to name a few. Police administrators frequently decide how to effectively deploy police resources based on their perception of the community's needs.

To understand the factors that might be contributing to traffic enforcement decisions, we first sought an understanding of where traffic enforcement occurs in the community. The best way to complete this task is to map traffic stops for each identified community. Police officers are required to report the location of a traffic stop in a manner that would allow the stop to be identified on a map. In some cases, technology allows the officer to capture the specific longitude and latitude coordinates for the stop. In other cases, the officer enters a descriptive location such as the number, street, or street and nearest cross street.

The project staff worked with the Guilford Police Department and mapped traffic stops during the study period. We had a significant percentage of location coordinates and mapped stops by census tract. Each community is broken up into census tracts to help understand the different makeup of a community. According to the United States Census Bureau, a census tract is “a small, relatively permanent statistical subdivision of a county or equivalent entity updated by local participants before each decennial census as part of the Census Bureau’s Participant Statistical Areas Program.” Census tract boundaries generally follow visible and identifiable features. Also, census tracts generally have a population size between 1,200 and 8,000 people, with an optimum size of about 4,000. A unique number identifies each census tract.

Researchers can better understand the demographics of a subsection of a community by breaking down traffic stops into census tracts. A census tract analysis provides a better understanding of population demographics and allows researchers to focus on the unique attributes of a subsection of a community, such as major traffic generators, crash rates, local crime problems, and calls for service. Neighborhoods can vary greatly within a community; a more detailed analysis will help better understand the information presented in the initial study.

In addition to reviewing stop data by census tract, researchers conducted a descriptive analysis of traffic stops by major corridors. The location information typically identified the road where the traffic stop was conducted. Our findings from the department-level descriptive analysis of the Guilford police department are presented in the subsequent section.

X: GUILFORD FOLLOW-UP ANALYSIS SUMMARY

Racial and ethnic disparities in any traffic stop analysis do not, by themselves, provide conclusive evidence of racial profiling. Statistical disparities suggest a unique pattern that warrants further analysis. Based on the pre-established criteria for identifying racial and ethnic disparities in traffic stops, Part I of this report recommended that the Racial Profiling Prohibition Project staff conduct an in-depth analysis for the Guilford Police Department.

According to the results from the Solar Visibility[16] analysis, the Guilford Police Department indicated a statistically significant disparity in the rate at which Black motorists were stopped during daylight relative to darkness in the three-year aggregate sample. The solar visibility analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the likelihood that a stopped motorist was Black totaled 3.4% overall. Conditioning on the day of the week and time of day, the likelihood that a stopped motorist was Black grew by 1.7 percentage points or 50.3% relative to the mean. These results were statistically significant at a level greater than 95 percent and robust to include a variety of controls, officer-fixed effects, and a restricted sample of moving violations. Although certain assumptions have been made in the design of each methodology, it is reasonable to conclude that departments with consistent data disparities separating them from most other departments should be subject to further review and analysis concerning the factors that may have caused these differences.

During the three-year study period, the Guilford Police Department made 3,472 traffic stops. Of these, 14.0% were non-White driver stops (7.3% Hispanic and 3.5% Black). Table 10.1 below compares summary racial data for reported traffic stops in Guilford over three years.

Table 10. 1: Guilford Traffic Stops – 2020 - 2022

	2020 Stops		2021 Stops		2022 Stops	
White	924	88.2%	544	85.1%	1,529	85.6%
Black	35	3.3%	25	3.9%	61	3.4%
AsPac*	20	2.0%	10	1.6%	40	2.2%
AI/AN**	8	0..8%	7	1.1%	17	1.0%
Hispanic	60	5.7%	53	8.3%	139	7.8%
Total	**1,047**		**639**		**1,786**	

*Asian Pacific

** American Indian/Alaska Native

[16] The solar visibility methodology is a research approach used to study racial bias in police stops. This method examines traffic stop data during the transition from daylight to darkness, comparing the rates at which drivers of different races are stopped by the police. The underlying idea is that, as it becomes dark, it becomes harder for officers to identify the race of a driver before stopping the vehicle. In essence, this methodology controls for the visibility of a driver's race by comparing stop rates in conditions where race is more and less discernible, allowing researchers to isolate the impact of racial bias on police stopping behavior.

X.A: Descriptive Analysis of the 2020-22 Traffic Stop Data

The racial and ethnic disparities in the Guilford data were studied using a more detailed review of traffic enforcement during the study period. The disparity was identified as part of the three-year aggregate analysis, and the department was able to provide detailed stop location information for each stop. Part of the analysis involved mapping all the stops, if possible, using the location data provided by the department and any enhancements we could make. We also reviewed major corridors and roadways where substantial traffic enforcement occurred. Of the traffic stops in Guilford, 84% occurred on just 13 roadways. More specifically, stops on one roadway (Boston Post Road/Route 1) account for 19% of all stops.

According to the 2020 decennial census from the United States Census Bureau, Guilford has approximately 22,073 residents. Approximately 14% of the population is non-White. Table 10.2 outlines the basic demographic information for Guilford residents according to the 2020 decennial census.

Table 10. 2: Guilford Population

Race/Ethnicity	Population Total	% Population Total
White Non-Hispanic	19,085	86.5%
Black Non-Hispanic	217	1.0%
AsPac Non-Hispanic	782	3.5%
Hispanic	1,135	5.1%
Other	854	3.9%
Total	**22,073**	

Guilford is approximately 48 square miles in area, making it one of the larger towns in Connecticut in terms of land area. The town is located along the Interstate 95 corridor and is considered a shoreline community with Long Island Sound as its southern border. Guilford shares a border with several neighboring towns and cities, including Madison to the west, Branford to the east, North Branford to the north, Durham to the northwest, and Killingworth to the northeast. Like Guilford, all surrounding towns are predominantly White demographically, with an average White population of 93% (compared to Guilford's White driving age population of 86%). Of the drivers stopped in Guilford, only 27% were town residents.

Several major traffic generators contribute to the flow of vehicles through the town. The town center, particularly around Guilford Green, is a focal point for local traffic. Downtown features a mix of retail stores, restaurants, offices, and cultural attractions. Guilford's proximity to the Long Island Sound and its numerous parks and recreational facilities attracts visitors and residents from all over the state and beyond.

The town has several major roadways facilitating transportation within and around the area. Interstate 95 (I-95) traverses the town, providing a crucial north-south route for commuters and travelers. I-95 has three exits on the northbound side and three on the southbound side. US Route 1, or the Boston Post Road, runs east-west through the southern portion of town. It is one of the primary commercial corridors in Guilford. It is a major thoroughfare for local traffic, connecting residents to businesses, shopping centers, restaurants, and other amenities. Other major roadways include Route 77 (Church Street/Madison Road), Route 146 (Leetes Island Road), and Route 80 (State Street). Route 77 runs north to south from the Durham border to just south of Route 1. Route 146 runs east

to west from the Branford border near the shoreline until it intersects with Route 1, and Route 80 connects North Branford to Killingworth and intersects with Route 77. These roadways play a crucial role in connecting Guilford with nearby towns.

The U.S. Census Bureau divides Guilford into five census tracts. Census tract 1903.03 is in the northern portion of town from the Durham border to Route 80. In addition to having the largest residential population, it is also the largest geographic census tract. Census tracts 1903.01 and 1903.02 are divided between Durham Road from Route 80 to I-95. Tract 1902 runs from I-95 to the shoreline, and the West River splits tracts 1902 and 1901. Finally, tract 1901 is the smallest geographic census tract in town, covering most of Guilford Center and a large portion of the Boston Post Road.

Figure 10.1 shows the distribution of each census tract in terms of the White and non-White populations. The resident driving age population in each census tract varies from about 2,500 to about 5,100 people, with the largest concentration of people (29% of the total population) in tract 1903.01. The census tracts have a predominately White non-Hispanic resident population, with the most diverse population in tract 1903.02. The three census tracts to the north of I-95 have the largest residential population in the town.

Figure 10. 1: Guilford Population by Census Tract

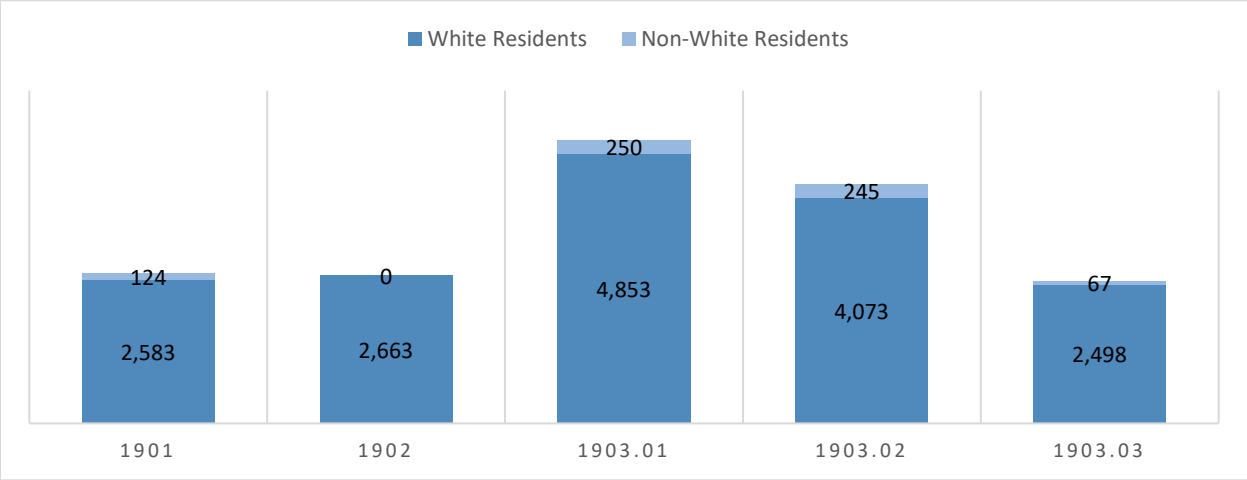
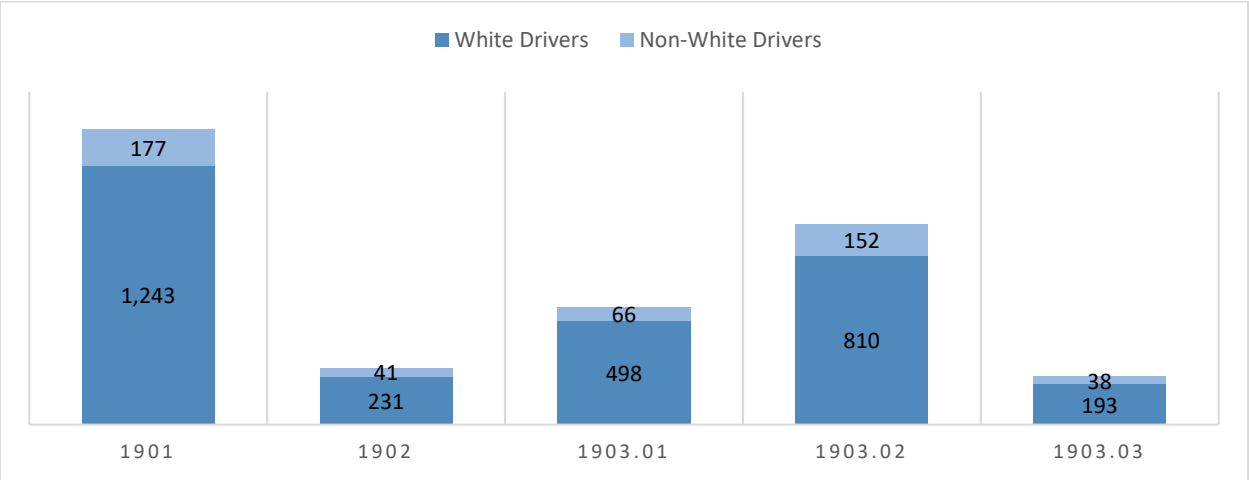


Figure 10.2 illustrates the volume of traffic enforcement that occurred in each Guilford census tract.[17] The largest traffic enforcement activity (41%) occurred in the smallest geographical census tract (1901) in the southern portion of town, including a busy section of the Route 1 corridor and two of the three exits from I-95.

[17] A total of 23 stops could not be mapped. These are not considered in our analysis, for purposes of discussing traffic stops by census tract.

Figure 10. 2: Traffic Stops by Census Tract

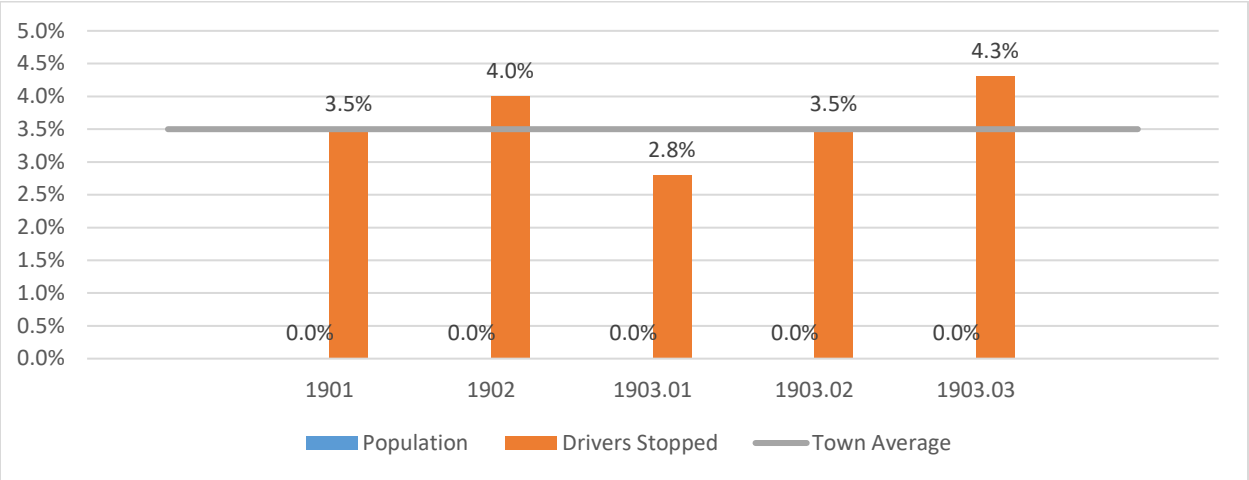


X.B: Traffic Stop Breakdown by Census Tract and Race/Ethnicity

In Guilford, 14% of all drivers stopped were non-White drivers, classified as all non-White drivers but predominantly Black or Hispanic drivers. Guilford's resident population is also 14% non-White. The resident population has a larger percentage of Asian Pacific Islanders and two or more races than are reflected in the stop demographics. This might suggest a disparity in the proportion of Black and Hispanic drivers stopped during the study period. However, the racial and ethnic makeup of different areas of Guilford and the influence of out-of-town drivers varies by census tract.

Figure 10.3 shows the difference between the local Black resident population and the Black drivers stopped by census tract. The overall percentage of Guilford traffic stops involving Black drivers was 3.5%. The percentage of Black drivers stopped exceeded the town average of 3.5% in two census tracts (1902 and 1903.03) and was equivalent to the town average in two of the census tracts (1901 and 1903.02). There was a positive disparity above the resident Black driving age population in all census tracts. Over 83% of all Black drivers stopped were not Guilford residents.

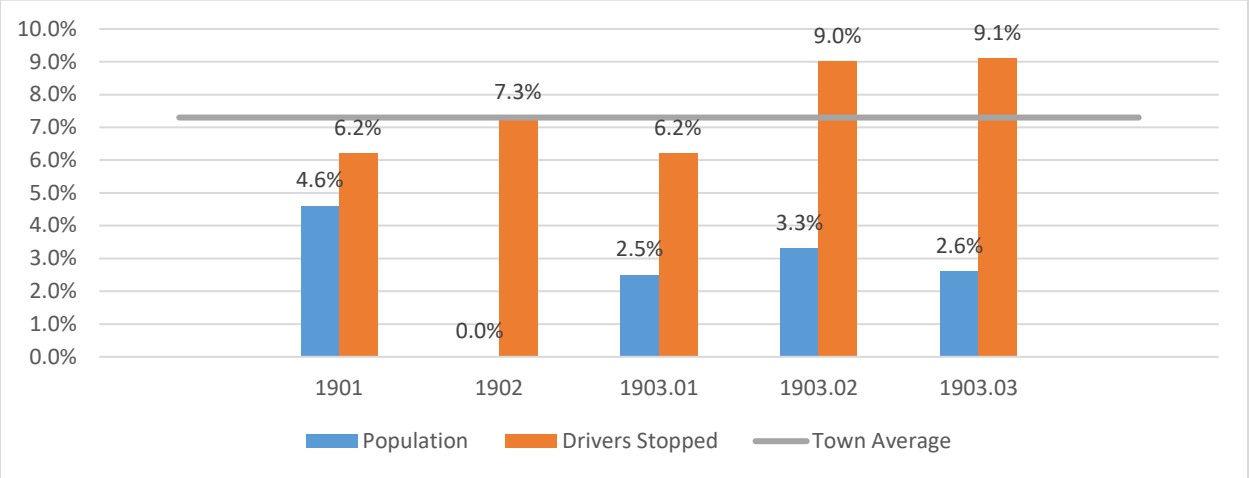
Figure 10. 3: Black Population Compared to Black Drivers Stopped by Census Tract



The Census Bureau does not include a racial or ethnic category in the census tract level data if fewer than 50 people are counted in a census tract.

Figure 10.4 shows the difference between the local Hispanic resident population and the Hispanic drivers stopped by census tract. The overall percentage of traffic stops involving Hispanic drivers was 7.3%. The percentage of Hispanic drivers stopped exceeded the town average of 7.3% in two census tracts (1903.02 and 1903.03). However, the percentage of Hispanic drivers stopped in tract 1902 was equivalent to the town average. There was a positive disparity above the Hispanic driving age population in all census tracts. Over 85% of all Hispanic drivers stopped were not Guilford residents.

Figure 10. 4: Hispanic Population Compared to Hispanic Drivers Stopped by Census Tract



X.C: Traffic Stop Breakdown by Roadway and Race/Ethnicity

In addition to the census tract-based analysis, we conducted separate analyses of the roadway corridors with the most traffic stops. There were six corridors or areas with more than 100 stops. The Boston Post Road, or Route 1, saw the most traffic stops, with 19% of all traffic stops. Long Hill Road and Route 77 each contributed approximately 12% of all traffic stops. Route 146, Goose Lane, and West Lake Avenue each saw moderate traffic enforcement. Lastly, five small streets near the

center of Guilford saw significant traffic enforcement. These five roads (Broad St., Church St., River St., State St., and Whitfield St.) accounted for 23% of all traffic stops in town. 62% of all traffic stops occurred on the six high-enforcement corridors. The five streets near Guilford Center account for 85% of all traffic stops. Figure 10.5 illustrates the volume of traffic enforcement that occurs on each high enforcement corridor and the roads near the town center.

Figure 10. 5: Traffic Stops by Major Roadway

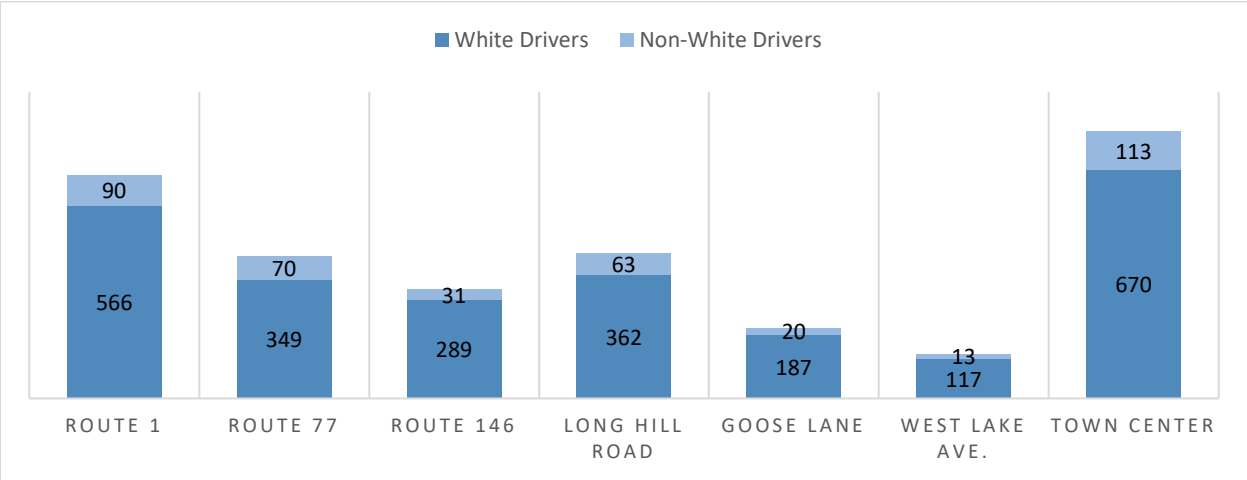


Figure 10.6 shows the percentage of Black drivers stopped on each major roadway in Guilford compared to the average percentage of Black drivers stopped in the town. The percentage of Black drivers stopped exceeded the town average of 3.5% on two of the six major roadways in the town and the town center streets. The roadways that exceeded the town average of Black drivers stopped accounted for 54% of all traffic stops and 63% of all stops of Black drivers. The two major corridors and the town center appear to have a larger presence of Black drivers than other areas of town.

Figure 10. 6: Black Drivers Stopped Compared to the Town Average

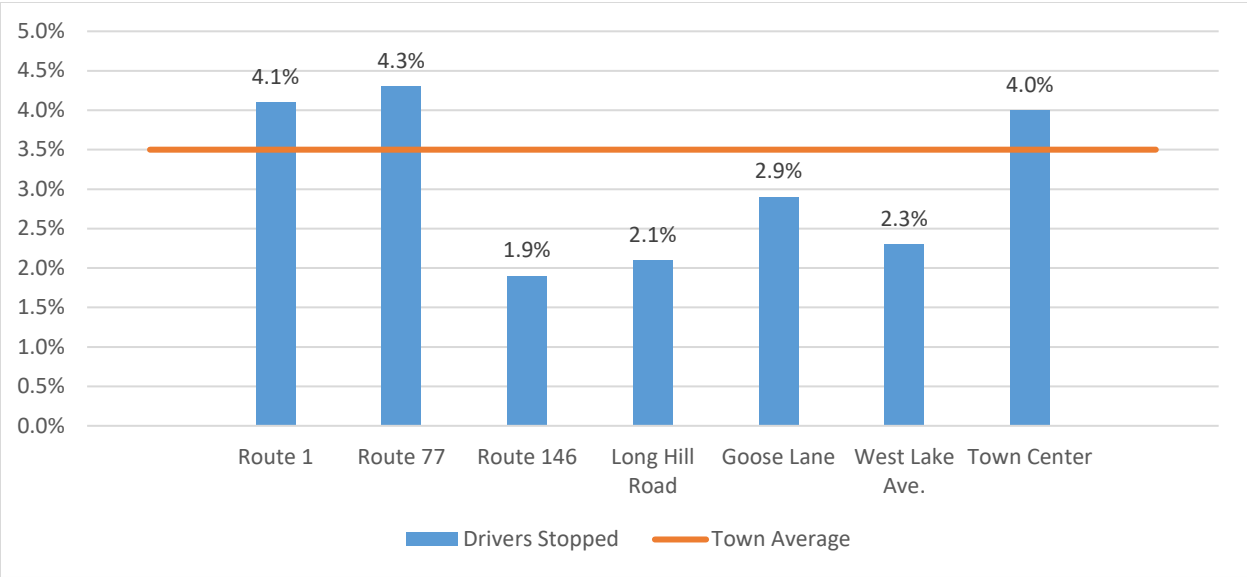
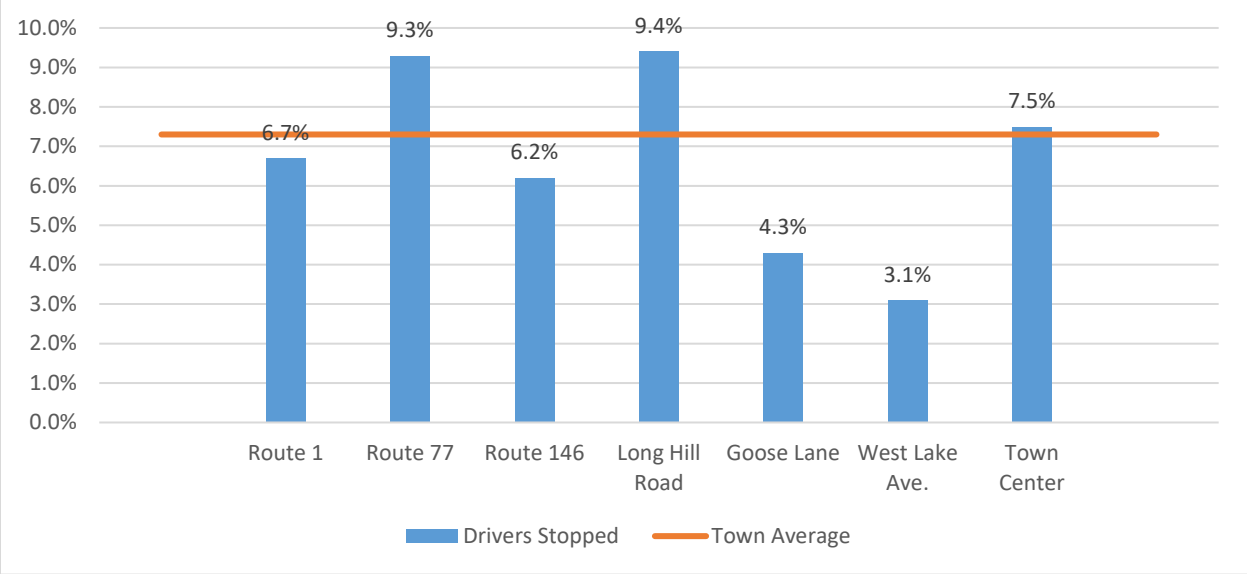


Figure 10.7 shows the percentage of Hispanic drivers stopped on each major roadway in Guilford compared to the average percentage of Hispanic drivers stopped in the town. The percentage of Hispanic drivers stopped exceeded the city average of 7.3% on two of the six major roadways in the town and the town center streets. The roadways that exceeded the town average of Hispanic drivers stopped accounted for 46% of all traffic stops and 55% of all stops of Hispanic drivers. Route 1, a major roadway with the most enforcement in the town, stopped a lower percentage of Hispanic drivers than the town average.

Figure 10. 7: Hispanic Drivers Stopped Compared to the Town Average



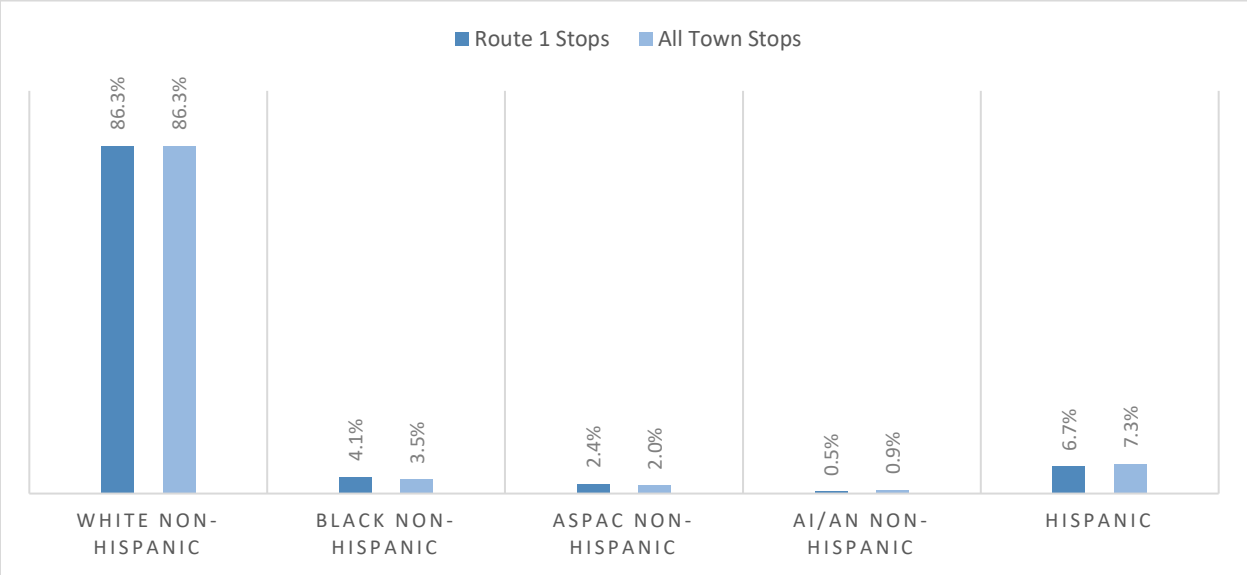
X.D: Traffic Stop Breakdown on Route 1

The largest percentage of stops on any roadway in Guilford, 19 percent, occurred on Route 1, also known as the Boston Post Road. Route 1 runs east-west for approximately six miles from the border of Branford at the intersection of Route 22 to the border of Madison as the road crosses over the East River. Route 1 is a vital transportation artery in Guilford, connecting residents to neighboring towns and providing access to major highways such as Interstate 95. This makes it convenient for commuters and travelers passing through the area. The road has various local businesses, restaurants, and other commercial establishments.

To help understand traffic flow on Route 1, the analysis looked at the average daily traffic (ADT) records reported by the Connecticut Department of Transportation (DOT). DOT is responsible for collecting traffic volume information for state and local roads throughout the state by placing counting stations at different points along the roadway for a period to count the cars that drive through that point. According to the ADT information along Route 1, approximately 11,400 vehicles a day cross into Guilford from Branford. On the other hand, only about 6,500 vehicles a day cross into Guilford from Madison. Traffic volume peaks at 14,000 vehicles daily where Route 1 intersects with Long Hill Road. This section of Route 1 is a high commercial activity area near the town center. The traffic volume remains between 12,000 and 14,000 vehicles daily until Route 1 crosses Interstate 95 toward Branford. Based on the traffic volume along Route 1, it is logical that there would be greater enforcement along the roadway, particularly in the central portions of Route 1, where there is more commercial activity, and it is closer to I-95.

656 traffic stops were made during the study period along Route 1. The overall percentage of traffic stops involving non-White drivers on Route 1 was 14%, equivalent to the town average. Approximately 7% of drivers stopped were Hispanic, and 4% were Black. This is equivalent to the town average of 7% Hispanic and slightly higher for Black drivers stopped. Figure 10.8 shows the proportion of traffic stops on Route 1 by race and ethnicity compared to the town-wide average for all stops.

Figure 10. 8: Route 1 Traffic Stops by Race/Ethnicity

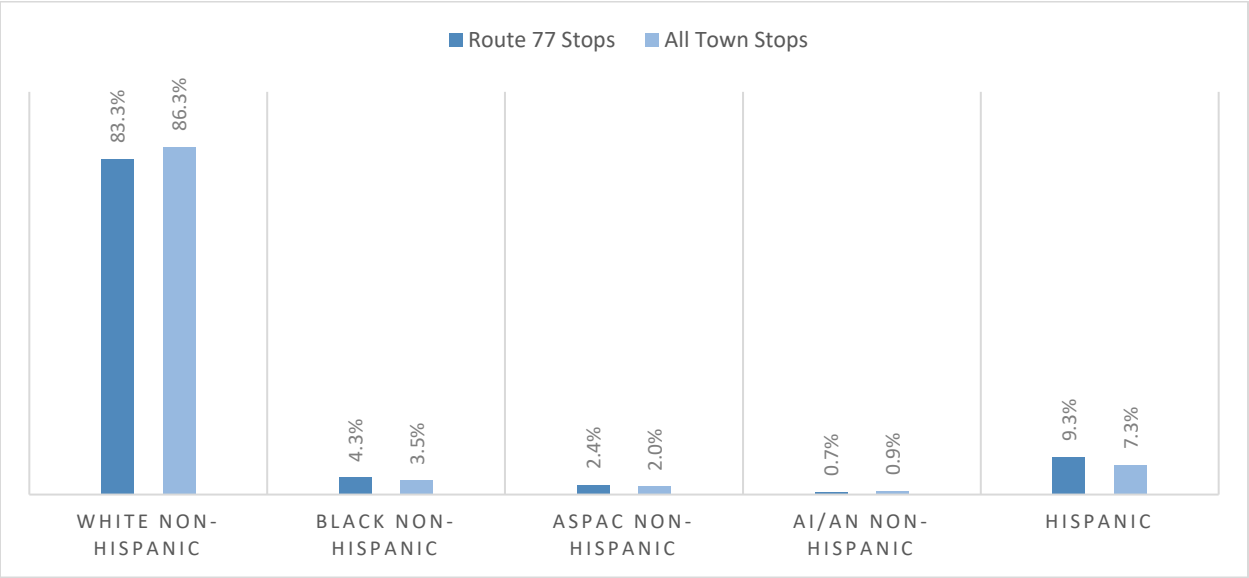


X.E: Traffic Stop Breakdown on Route 77

Route 77, also known as Durham Road, is a road that runs for about 12 miles in Guilford from the northern border of town at the Durham line until it intersects with Route 146, just south of Route 1. The route changes names after it crosses I-95 and becomes Church Street. For this analysis, when we refer to Route 77, we only refer to the 10.5-mile stretch of roadway north of I-95. Our town center analysis considers the Church Street portion of the roadway. While Route 77 is primarily rural, local businesses are still scattered along the road. Route 77 is a high-traffic corridor with approximately 4,300 vehicles a day traveling along the northernmost section of the roadway from the Durham border until it passes Stepstone Hill Road, where the traffic volume increases to approximately 8,000 vehicles a day. Traffic volume peaks at approximately 11,000 vehicles daily as Route 77 crosses I-95 at exit 58 and turns into Church Street.

A total of 419 traffic stops were made during the study period along Route 77. The overall percentage of traffic stops involving non-White drivers was 17%, over three percent higher than the town average. Approximately 9% of drivers stopped were Hispanic, and 4% were Black. The percentage of Hispanic drivers is about two percent higher than the town average of 7%, and the percentage of Black drivers is about 1 percent higher than the town average of 3.5%. Figure 10.9 shows the proportion of traffic stops on Route 77 by race and ethnicity compared to the town-wide average for all stops.

Figure 10. 9: Route 77 Traffic Stops by Race/Ethnicity

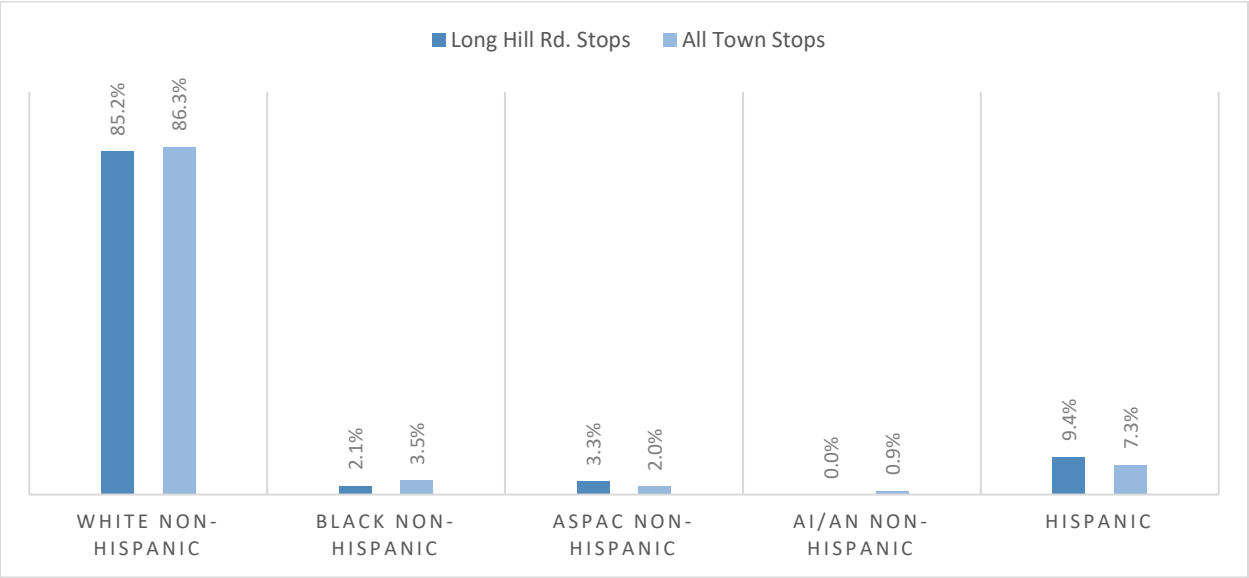


X.F: Traffic Stop Breakdown on Long Hill Road

Long Hill Road is a road that runs for about 6 miles in Guilford along the western portion of the town from Wilburs Lane south until it intersects with Route 1. The most significant portion of Long Hill Road begins at the intersection of Route 80 and traverses south to the intersection of Route 1. Long Hill Road passes through primarily residential areas of Guilford. Along the road, you'll find a mix of single-family homes, condominium complexes, and apartment buildings. The road is near several schools and community facilities. These include elementary schools, middle schools, and recreational centers. The roadway serves as a vital artery within the town. There is a moderate amount of traffic consistently along the entire roadway, with approximately 3,700 vehicles traveling daily.

425 traffic stops were made during the study period along Long Hill Road. The overall percentage of traffic stops involving non-White drivers was 15%, about one percent higher than the town average. Approximately 9% of drivers stopped were Hispanic, and 2% were Black. The percentage of Hispanic drivers is about two percent higher than the town average of 7%, and the percentage of Black drivers is about 2 percent lower than the town average of 3.5%. Figure 10.10 shows the proportion of traffic stops on Long Hill Road by race and ethnicity compared to the town-wide average for all stops.

Figure 10. 10: Long Hill Road Traffic Stops by Race/Ethnicity

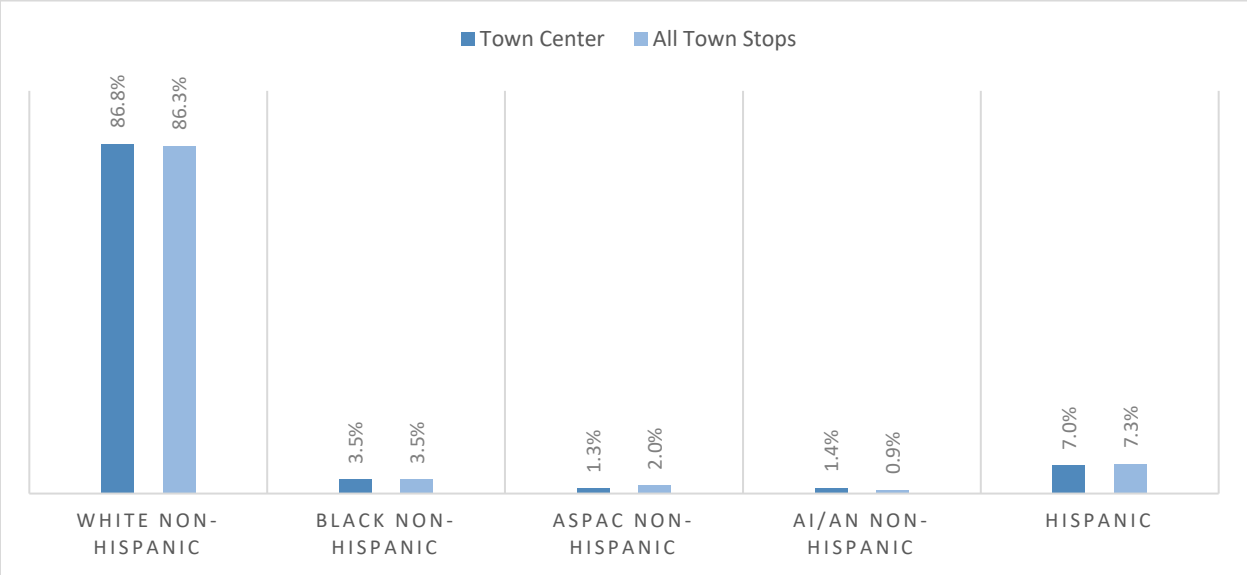


X.G: Traffic Stop Breakdown on Selected Streets Near the Town Center

The area classified as the town center in Guilford is composed of many streets, 6 of which account for 27% of all traffic stops in Guilford. These streets include Boston Street, Broad Street, Church Street, River Street, State Street, and Whitfield Street. Boston Street is a part of Route 146 and runs West-East, starting at the intersection of Whitfield Street near Guilford Center. The roadway continues east until it intersects with Route 1. Church Street is also part of Route 77 after the roadway crosses I-95 and heads south until it intersects with Broad Street. Church Street had 325 traffic stops during the study period, and all other streets identified in the town center area had between 75 and 150 stops each during the study period. The selected streets near the town center are not particularly high-traffic areas individually but combined reflect a generally busy town center area. An average of 5,300 vehicles drive on Broad Street each day. The section of Church Street near the town center has approximately 3,900 vehicles a day. Whitfield Street is also a busy roadway near the town center, with approximately 5,200 vehicles daily.

During the study period, 933 traffic stops were made along the selected streets near the town center. The overall percentage of traffic stops involving non-White drivers on these roads was 13%, equivalent to the town average. Approximately 7% of drivers stopped were Hispanic, and 3.5% were Black. Both the percentage of Hispanic drivers and Black drivers stopped was equivalent to the town average. Figure 10.11 shows the proportion of traffic stops on the selected streets near the town center by race and ethnicity compared to the town-wide average for all stops.

Figure 10. 11: Selected Streets Near the Town Center Traffic Stops by Race/Ethnicity



X.H: Regional Enforcement Campaign Efforts

Recently, Guilford has participated in regional traffic enforcement initiatives. The South-Central Connecticut Traffic Unit consists of officers from Branford, East Haven, Guilford, Madison, North Branford, and North Haven. The regional traffic unit aims to improve traffic safety within Guilford and the surrounding communities. It was created in June 2022 and, by the end of the 2022 calendar year, had reported making more than 1,315 traffic stops in all the participating communities.

When a Guilford police officer participates in the regional traffic unit, they report their stop activity through the Guilford records management system. This means that these stops are reported as part of Guilford's total number of stops in a calendar year. The location of stops conducted within the boundaries of Guilford is reported in the same manner as all other stops made in town. However, suppose a Guilford officer is working in another jurisdiction as part of the enforcement effort. In that case, the location of the stop is often reported as the address of the police department. Guilford provided a list of all traffic stops conducted by Guilford police officers as part of the regional traffic unit.

In 2022, Guilford officers reported 166 traffic stops as part of the regional traffic unit. More than half of the stops (89) occurred in July 2022, and another significant amount (36) occurred in September 2022. According to the location data provided, enforcement efforts occurred in Madison near Hammonasset Beach State Park, in North Haven along Washington Avenue, in North Branford along Route 80, and in East Haven near Frontage Road.

The demographics of drivers stopped during the regional enforcement efforts were significantly different compared to overall town enforcement demographics. Of the drivers stopped by Guilford officers during regional enforcement, 76.5% were White (compared to 86% for all Guilford stops), 6.6% were Black (compared to 3.5% for all Guilford stops), and 13.8% Hispanic (compared to 7.3% for all Guilford stops). Regional enforcement had a larger impact on the racial demographics in Guilford for Black and Hispanic drivers in 2022 than for White drivers. Approximately 18% of Black

drivers stopped in 2022 were part of the regional enforcement effort, and 17% of Hispanic drivers, compared to only 8% of White drivers. Of the 10 Black drivers stopped during this enforcement effort, only one was stopped in Guilford, and of the 23 Hispanic drivers stopped, only four were stopped in Guilford. The disparity in stop demographics for regional enforcement is unsurprising given the demographic changes in the driving populations in the areas where regional enforcement efforts primarily occurred, especially in the jurisdiction outside Guilford.

X.I: Traffic Stop Distribution for Guilford Officers

Guilford's 3,472 traffic stops are comparable to those in other towns of its size. During the study period, traffic stop data was reported for 42 officers. The average number of stops made per officer was 83. Of the 42 officers reporting stops, 15 made fewer than 50 stops, 21 made between 50 and 150 stops, four made between 150 and 300 stops, and two made over 300 stops. The six officers making over 150 stops each collectively accounted for 42% of the Guilford stops. The two officers who made over 300 stops each accounted for 18% of all stops. Thus, a small portion of its officer force influences Guilford's stop data.

During the three-year study period, 32 officers stopped at least one driver reported as Black and 38 officers reported at least one Hispanic driver. Only 8 officers stopped more than 5 Black drivers, which accounted for 55% of all Black drivers. 13 officers stopped more than 5 Hispanic drivers, which accounted for 69% of all Hispanic drivers stopped. Two officers account for 22% of all Black drivers stopped, and two officers account for 20% of all Hispanic drivers stopped.

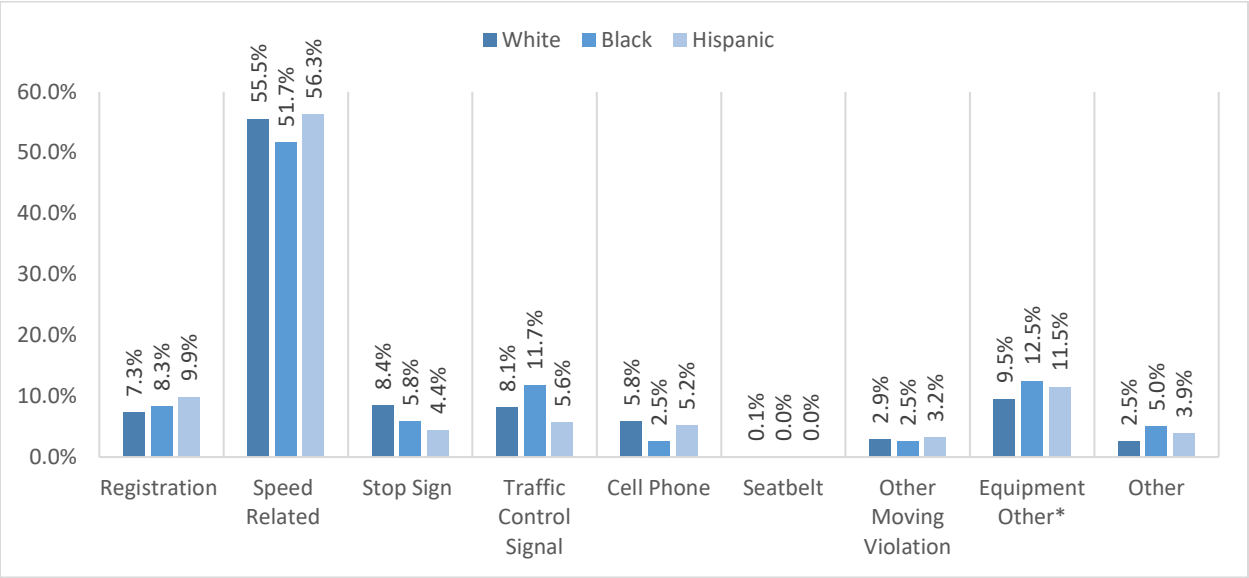
Researchers conducted a statistical analysis of individual officer stop patterns, limiting the sample of officers to those with 50 or more traffic stops during the study period. Based on these criteria, a total of 27 officers were examined. These officers were examined using a test that directly compared observable traffic stop characteristics distribution with each officer's benchmark group. All 27 officers were found to have benchmarks that convincingly captured the distribution of each officer's traffic stops. In other words, creating a reasonable comparison group for each officer based on their stop activities was possible. For the officers analyzed, none were identified as being statistically more likely to stop a non-White driver relative to their benchmark group.

X.J: Post-Stop Outcome Review

Reason for Stops

The reasons police stop a motor vehicle can vary significantly from department to department. Researchers reviewed the statutory authority that Guilford officers reported as the reason for stopping motor vehicles. The three most common reasons for stopping a motorist in Guilford cover about 74% of the total stops. The three largest stop categories were speeding (55%), Defective Lights (9.5%), and Stop Sign violations (8%). Figure 10.12 illustrates why officers stop a motor vehicle by race and ethnicity.

Figure 10. 12: Reason for Traffic Stop



*Equipment Other includes violations for defective lights, excessive window tint, or display of plate violations.

Reasons for traffic stops in Guilford vary by race and ethnicity. White drivers are more than twice as likely to be stopped for a cell phone violation compared to Black drivers and are somewhat more likely to be stopped for speeding and stop sign violations. On the other hand, Black drivers are more likely to be stopped for traffic control signal violations, administrative violations, and other equipment violations. Hispanic drivers were more likely to be stopped for registration violations than either White or Black drivers. Guilford conducts a higher percentage of stops for defective lights, display of plates, and general equipment violations compared to the state average.

While White drivers were stopped more frequently than Black or Hispanic drivers for more hazardous driving violations as a percentage of their total stops, Black and Hispanic drivers were stopped more frequently for equipment-related violations and administrative offenses than White drivers as a percentage of their total stops. The data shows that concerning the racial and ethnic demographics of those stopped, equipment-related violations (defective, improper, or inoperative lighting; display of plates; or window tinting) and administrative offenses are closely related to the frequency and location of where the stops are made. When these types of stops are made more frequently in locations where there are higher concentrations of non-White drivers, they tend to result in higher proportions of non-White drivers being stopped than White drivers. However, in many places, the data also shows that when these same types of stops are made in areas with a higher concentration of White drivers, the stop demographics shift toward White drivers, suggesting that the likelihood of finding violators may depend more on location than race.

We did notice that the reason for stopping a vehicle seems to vary by roadway in Guilford. In the town center, 17% of traffic stops are for stop sign violations, which is 9% more than the town average. 52% of stops are speed-related violations, 4% lower than the town average. Over 27% of stops on Route 1 were for traffic light violations, 19% more than the town average. There was also a significant concentration of defective lighting stops on Route 1, with almost a quarter of all stops on Route 1 resulting from a defective lighting violation. This was 14% higher than the town average. 73% of all defective lighting stops occurred on Route 1 and the town center. The type of enforcement

on Route 1 and the town center streets is unsurprising, given that these areas have more local roads with stop signs and traffic lights and may be less conducive to speeding. This area also appears to have a larger share of Black and Hispanic drivers traversing it, likely due to the proximity to I-95 and other major traffic generators in town. On the other hand, the primary reason for stopping a car was a speeding violation on all of the other high-traffic volume roadways in town. Over 87% of stops on Long Hill Road, 81% on Route 77, and 86% on Route 146 were for speed-related violations. This average was 25% to 30% greater than the town.

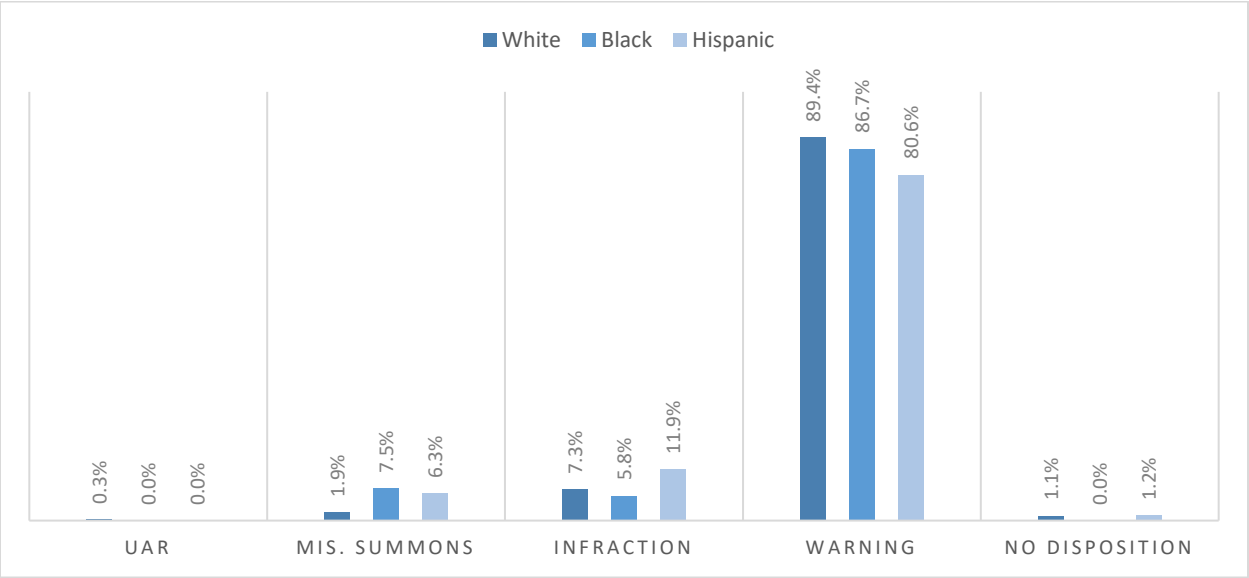
Speed-related motor vehicle enforcement appears to have had the greatest impact on overall traffic enforcement in Guilford. Over 58% of all speed-related stops occurred on the town center roads, Long Hill Road, and Route 77. The largest number of speed enforcement stops occurred on the five streets of the town center, with 21% of all speed stops. Interestingly, stops made on Route 77, Long Hill Road, Route 146, and West Lake Avenue were overwhelmingly for speeding violations. Between 80% and 90% of all stops on these roads were for speeding. More than half of all stops made on Goose Lane and the roads that make up the town center were for speeding violations. There were relatively low levels of speed enforcement on Route 1 (8% of stops).

Another important factor is that officers reported 78% of speed-related stops as "blind." This means officers report using a blind enforcement technique like radar, a laser, or other similar technology or method. The speed-related stops recorded as "blind" were likely the result of an officer using radar or laser technology. Of the speed-related stops recorded as "blind," the racial demographics were 87% white, 3.3% Black, and 6.9% Hispanic, which almost mirrored the racial demographics for all stops. The town center, which has the largest number of speed-related stops and the largest number of Black and Hispanic drivers stopped, appears to have an overall stop demographic equivalent to the blind stop demographics for Hispanic drivers. Blind speed-related stops in the town center were 1.3 percentage points greater than the stop demographics for all stops in the town center. The demographics of "blind" speeding stops indicate that the racial demographics of drivers on Guilford roadways were generally reflected in its stop activity.

Outcome of Stops

Most motor vehicle stops in Guilford (88.7%) resulted in the driver receiving a warning. The warning rate was significantly higher than the state average of 61%. In particular, Guilford issues a significantly greater number of written warnings (72%) than the state average (18%.) In discussions with the department, it was learned that Guilford officers are encouraged to provide drivers with documentation for each stop. Therefore, fewer verbal warnings were issued than in other jurisdictions. Black and Hispanic drivers were more likely to receive a misdemeanor summons as a percentage of their total stops. Black drivers were less likely to be charged with an infraction than White and Hispanic drivers. White drivers were more likely to receive a warning as a result of the stop. Figure 10.13 shows the outcome of motor vehicle stops by race and ethnicity.

Figure 10. 13: Outcome of Traffic Stop



Most violations of motor vehicle laws are designated as infractions, but some are not. The more serious violations can be reckless driving, operating under suspension, operating under the influence of alcohol or drugs, and operating an uninsured or underinsured vehicle. The system for collecting and reporting traffic stop data requires officers to record the statutory citation for the violation that was the basis for the stop and any subsequent charges that differed from and were more significant than the initial charge. This provides the data on the initial cause for making a stop as well as any subsequent, more serious charge. For example, suppose someone was initially stopped for a lesser reason, such as not wearing a seat belt or rolling through a stop sign. In that case, the officer might subsequently determine that the driver was operating with a suspended license. If this information is properly recorded, researchers can distinguish those stops from the ones that begin and end with the same charge.

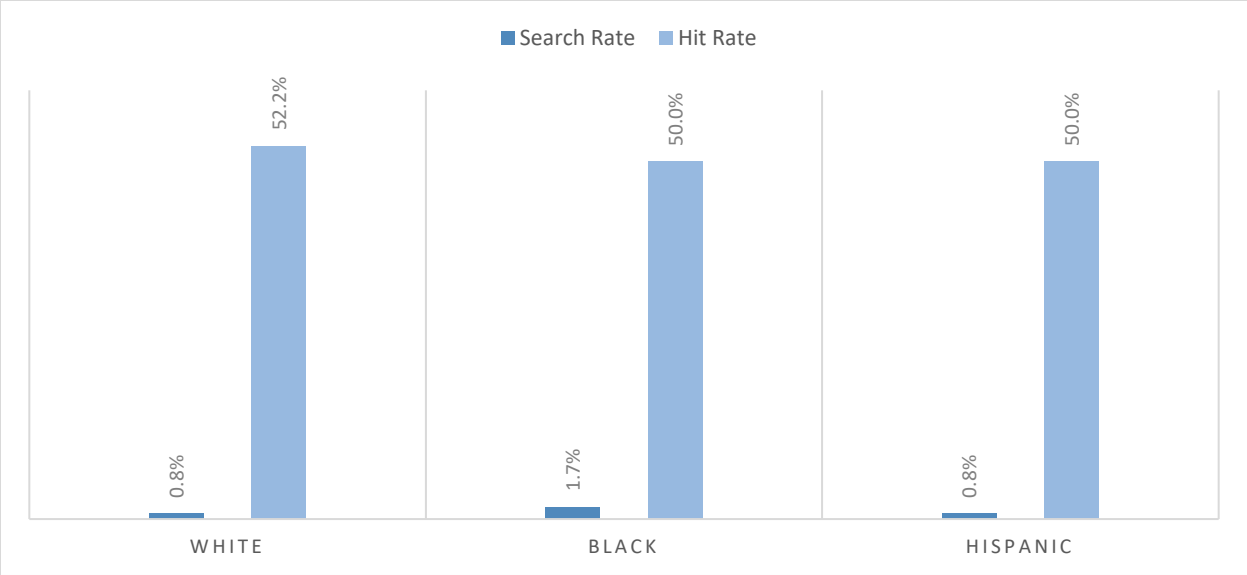
In Guilford, 83 of the stops made resulted in the issuance of a misdemeanor summons (2.4%), significantly less than the state average of 6%. Black and Hispanic drivers were more than three times as likely to be issued a misdemeanor summons following a stop than were White drivers (7% of Black and Hispanic drivers stopped compared to 2% of all White drivers). The sample size for both Black and Hispanic drivers was very small. Of the misdemeanor violation stops, 58 (70%) were initiated for a reason that was not a misdemeanor violation (e.g., speeding, stop sign violation, defective or improper lighting, etc.) However, once the officer interacted with the vehicle's operator, a misdemeanor violation should have been identified. Most of these stops resulted in a misdemeanor summons for a license- or registration-related issue. Unlike many infraction violations, officers have limited discretion in issuing a misdemeanor summons when a misdemeanor violation is identified.

Search Information

A review of department search information shows that less than 1% (27) of the drivers stopped in Guilford were subjected to a motor vehicle search. This rate of motor vehicle searches is below the state's 3% average. Black drivers were searched at a rate higher than White drivers, but the total number of searches was too small for this disparity to be meaningful. Of the 27 vehicles searched, 18 were subjected to an inventory search. It is common for inventory searches to be conducted before

towing a car, and all but one inventory search results in the car being towed. Guilford's inventory search policy is very clear that whenever the need arises for an officer to have a motor vehicle towed, the vehicle must be inventoried. Given the relatively small number of searches conducted and since most searches resulted from following the inventory policy, any differences are insignificant. Figure 10.14 illustrates the motor vehicle search rate and the rate at which contraband was found (the "hit rate").

Figure 10. 14: Search and Hit Rate (All Searches)



X.K: Additional Contributing Factors

Law enforcement administrators choose to deploy police resources within a community based on several factors, including where calls for service are more prevalent. The department provided researchers with general information on calls for service, which included calls for service and officer-initiated actions that were called into police dispatch. The logs report approximately 121,000 entries between 2020 and 2022. The volume of calls appears relatively equivalent to other similarly situated towns.

In addition to calls for service, law enforcement administrators also distribute police resources within a community based on traffic crash rates or where crime rates are higher. In addition to these factors, police presence may be greater where traffic volume is higher due to common factors that draw people into a community, such as employment and entertainment. Traffic enforcement actions are likely to be more prevalent in locations that attract greater police presence due to any of these factors. Basic information on crime, traffic crashes, and other economic factors associated with Guilford are important considerations that provide a context to explain the rationale for police deployments potentially.

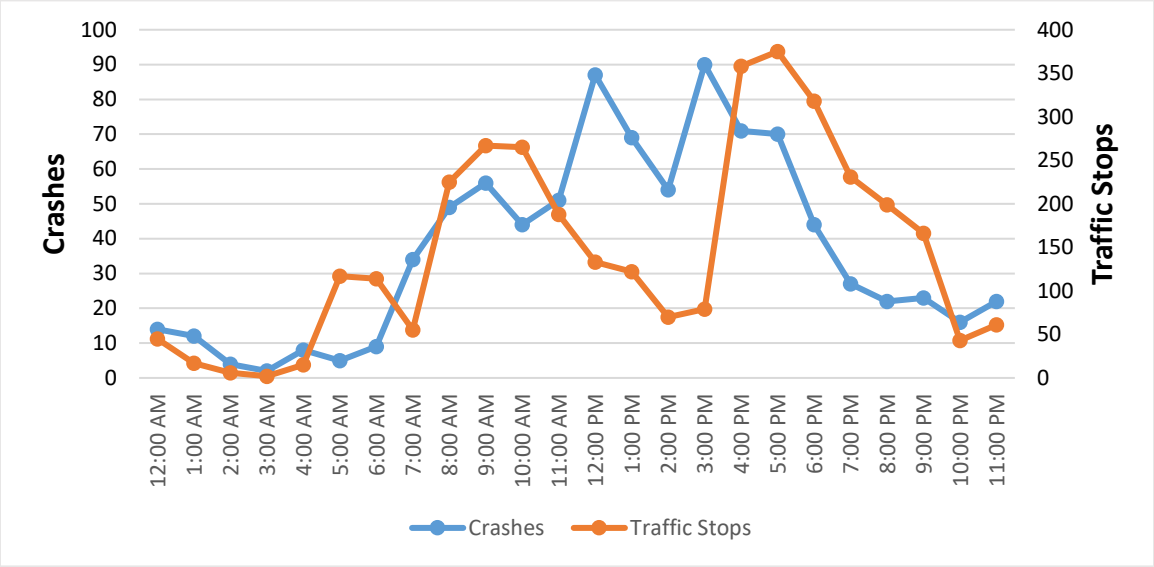
According to the Connecticut Economic Resource Center (CERC) town profiles, approximately 9,200 people work in Guilford, and its major employers include the town government, Yale-New Haven, Shoreline Med, Guilford Gravure Inc., and Moroso Performance Products.

During the study period, approximately 883 motor vehicle crashes occurred on roads patrolled by the Guilford Police Department. Approximately 283 crashes were reported in 2020, 276 crashes were reported in 2021, and 324 were reported in 2022. The largest number of traffic crashes occurred in

or near the town center. The Boston Post Road from I-95 at exit 57 to where the Boston Post Road nears I-95 at exit 58 is where Guilford experiences the largest number of crashes. Approximately half of all crashes appear in this area. In addition to many crashes on the Boston Post Road and near the town center, there are many crashes along Route 77, especially at the intersection with Route 80. Traffic crashes by roadways generally mirror the volume of traffic enforcement in town.

Figure 10.15 illustrates the time of day when traffic crashes were reported and the number of traffic stops during that period. Interestingly, Guilford appears to have the largest traffic crashes between 12:00 p.m. and 1:00 p.m. and between 3:00 p.m. and 4:00 p.m. However, traffic enforcement is relatively low during that period. This may partially result from a shift change, taking officers off the road for some time. It is also possible that traffic enforcement is lower during these periods due to police presence being required in the wake of a crash.

Figure 10. 15: Crashes Compared to Traffic Stops by Time of Day



X.L: Summary of Findings

The Guilford Police Department identified factors that contributed to some of the racial and ethnic disparity identified in the initial analysis of traffic stops. In particular, the department identified areas with the highest levels of traffic as some of the same areas with the highest levels of motor vehicle enforcement. They also indicated the impact that reported crime incidents, calls for service, and crashes along Route 1 and near the town center have had on the deployment of departmental resources. It is evident from the volume of traffic stops made along Route 1 and near the town center that the department concentrates its resources primarily in and around these areas, which comprise the high enforcement area in the town. Additionally, the participation in a regional traffic unit impacted the demographics of drivers reported as being stopped by Guilford police because those stops occurred in other jurisdictions with more diverse driving populations.

There were six roadways where 100 or more traffic stops occurred, accounting for 62% of all stops. Almost 19% of all traffic stops occurred on the Boston Post Road, with 4% of the stops involving Black drivers and 7% of the stops involving Hispanic drivers. The Boston Post Road is a primary corridor that extends along the entire southern portion of Connecticut, with 6 miles running through Guilford. In addition to the Boston Post Road, other roadways also stood out with higher levels of

traffic enforcement. These roads include Long Hill Road, Route 77, Route 146, Goose Lane, and West Lake Avenue. Five streets in and around the town center also accounted for the largest traffic stops. Approximately 27% of all traffic stops occurred on the five roads near the town center, with 3.5% involving Black drivers and 7% involving Hispanic drivers. I-95 also runs through the southern portion of town with three exits along the town corridor. It is clear from the analysis that traffic enforcement is heavily focused in and around the town center, including along the Boston Post Road.

Based on the average daily traffic counts provided by the Connecticut Department of Transportation, the level of stop activity along the Boston Post Road, Long Hill Road, and near the town center is logical, given the significant traffic volume in this area. Between 11,000 and 14,000 vehicles a day travel near the town center and along the Boston Post Road. Traffic volume is sustained at a high level in the town center and near the I-95 exit ramps, a high commercial activity area. Except for I-95, an interstate highway, the Boston Post Road and Route 77 are the busiest roads traveled in the town.

On average, 73% of the drivers stopped in Guilford were not residents. Non-resident Black and Hispanic drivers were more likely to be stopped than non-resident White drivers. Approximately 72% of the White drivers stopped were not town residents compared to 84% of Black drivers and 85% of Hispanic drivers. The influence non-resident drivers had on stop demographics affected roadways to varying degrees. Non-resident drivers most heavily affected the southern portion of town along the Boston Post Road and near the town center. Over 81% of all drivers stopped on the Boston Post Road, and 74% of the drivers who stopped on the roads near the town center were not residents of the town. About 70% of drivers stopped on all other roadways were not town residents.

Beginning in June 2022, Guilford began participating in a regional traffic enforcement unit. The South-Central Connecticut Traffic Unit consists of officers from Guilford and five surrounding communities. This regional effort brought Guilford officers to other communities and other officers into Guilford. Approximately 9% of all traffic stops reported by Guilford in 2022 were part of the regional traffic unit activities. These stops included a larger percentage of Black and Hispanic drivers than the average stop demographics in town. Stops made during the regional enforcement efforts primarily occurred on roads outside Guilford.

Guilford has 42 officers who made at least one traffic stop during the study period. The average number of stops made per officer was 83, but 6 officers (14% of the officer force) who made over 150 stops each accounted for 42% of all the traffic stops. The two most active officers who made more than 300 stops each collectively accounted for 18% of all traffic stops reported during the study period. 27 officers had a large enough sample to be included in a statistical evaluation. For the officers analyzed, none were identified as being statistically more likely to stop a non-White driver relative to their benchmark group.

Traffic Stop Outcomes

In Guilford, the three most common reasons for stopping a motorist make up 74% of the total stops. The three largest stop categories were for speeding violations (55%), Defective Lights (9%), and stop sign violations (8%). Black and Hispanic drivers were stopped at a higher rate for equipment-related violations than White drivers. Guilford stopped a higher percentage of drivers for defective lights, display of plate, and general equipment violations compared to the state average.

The type of traffic stop varied by roadway in Guilford. On the roadways near the town center, there was a larger focus on stop sign violations than in other areas. Along the Route 1 corridor, there was a more significant focus on traffic light violations and defective lighting violations. Most defective lighting violations (73%) were made on Route 1 and near the town center. The concentrated enforcement of stop sign and traffic light violations on Route 1 and near the town center was unsurprising, given that these areas are more conducive to these enforcement techniques. These same two areas also appear to have more Black and Hispanic drivers traversing the area, likely due to the major traffic generators and access to Interstate 95.

Speed-related motor vehicle enforcement appears to have had the greatest impact on overall traffic enforcement in Guilford. Although speed enforcement was a significant focus on most town roadways, stops on Route 77, Long Hill Road, Route 146, and West Lake Avenue were overwhelmingly for speed-related violations. The town center also had a significant number of speed-related stops. However, there was minimal speed enforcement along the Route 1 corridor. Officers reported 78% of speed-related stops as "blind." This means officers report using a blind enforcement technique like radar, a laser, a license plate recognition device, or other similar technology or method. The speed-related stops recorded as "blind" were likely the result of an officer using radar or laser technology. Of the speed-related stops recorded as "blind," the racial demographics were 87% White, 3.3% Black, and 6.9% Hispanic, which almost mirrored the racial demographics for all stops.

Regarding stop outcomes, most drivers received a warning (89%). The warning rate was significantly higher than the state average, but Guilford issued more written warnings, whereas other agencies overwhelmingly issued verbal warnings. The department indicated that officers are encouraged to document stops, which explains the high rate of written warnings issued. Black drivers were less likely to receive an infraction, and White drivers were more likely to receive a warning. Black and Hispanic drivers were more likely to receive a misdemeanor summons as a percentage of their total stops. The majority of the stops that resulted in a misdemeanor charge were initiated for a reason that was not initially a misdemeanor violation. However, a misdemeanor violation was identified once the officer interacted with the operator. Most of the misdemeanor charges were for a license or registration-related issue. Unlike many infraction violations, officers do not have discretion in issuing a misdemeanor summons when such a violation is identified.

The Guilford police searched fewer than 1% of the drivers they stopped, below the state average of 3%. Most searches were categorized as "inventory searches." Inventory searches are routinely conducted before a vehicle is towed so the department can categorize the inventory in the vehicle. Inventory searches are dictated by departmental policy, and officers have little discretion. Given the small number of searches conducted and since most searches resulted from following the inventory search policy, any search differences are insignificant.

Conclusion

Overall, the Guilford traffic stop data reflects the influence of Route 1, Long Hill Road, and the roads near the town center that appear somewhat more diverse than the predominantly White local driving-age population. These roads appear to have a relatively high level of enforcement and a relatively higher proportion of non-resident Black and Hispanic drivers traveling them. Guilford's participation in a regional traffic unit also influenced the stop demographics, particularly in 2022, because Guilford officers patrolled other, more diverse jurisdictions as part of the regional effort. Traffic enforcement in Guilford is largely focused on more serious safety-related violations,

particularly speed, stop signs, and traffic light violations. In most speed-related stops, officers determined to stop the driver using speed enforcement technology.

After a full review, the disparities do not appear excessive in nature. Still, the department would benefit from a periodic review of traffic enforcement policies as they relate to enforcement activity on Route 1 and near the town center to evaluate the extent to which they may have a disproportionate impact on non-White drivers.

X.M: Department Response

Below, on age 83, is a response to the follow-up analysis provided by the Guilford Police Department.

Christopher M. Massey
Chief of Police

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Salvatore J. Nesci
Deputy Chief of Police

June 17, 2024

Ken Barone
Associate Director
Institute for Municipal and Regional Policy
University of Connecticut
School of Public Policy
Hartford, CT

Dear Mr. Barone,

On behalf of the Guilford Police Department, I want to first express our appreciation to you and your team for the considerable amount of time and effort that was committed to conducting a thorough follow-up analysis of our traffic stop data after a statistical anomaly was identified in the three-year aggregate veil of darkness analysis for the period of 2020-2022. As a service-oriented organization that places great value on its partnership with the community, we were eager to support the follow-up analysis process to better understand the cause of this preliminary finding and appreciated that you and your team were equally committed to finding the contributing factor(s).

As members of the Guilford Police Department, we take great pride in our partnership with our community and our commitment to excellence. One of our primary functions as law enforcement is to provide traffic safety throughout the community, which is done primarily through education and enforcement. As your report notes, our department focuses heavily on more serious safety-related violations such as speeding as well as stop sign and traffic light violations. The follow-up analysis concludes that the disparities in our data "do not appear excessive in nature" and that "the Guilford traffic stop data reflects the influence of Route 1, Long Hill Road, and the roads near the town center that appear to be somewhat more diverse than the predominantly white local driving-age population." Additionally, the officer-level analysis confirmed that "none were identified as being statistically more likely to stop a non-White driver relative to their benchmark group." The report also noted that our participation in a regional traffic enforcement unit influenced our traffic stop data due to the fact that our officers were deployed to assist communities with more diverse driving populations. These findings supported our firm belief that the members of this department conduct traffic enforcement in a fair and impartial manner for the sole purpose of making the roadways in Guilford safer for all modes of travel.

Although the report does not suggest any specific policy or procedure changes at this time relative to our existing traffic enforcement initiatives, the report does suggest the "periodic review of traffic enforcement policies as they relate to enforcement activity on Route 1, and near the town center to evaluate the extent to which they may have a disproportionate impact on non-White drivers." We look forward to a continued partnership with you and your team in support of this suggestion. Thank you again for the work completed by you and your team.

Respectfully,
Chief Christopher Massey

REFERENCES

Anwar, Shamena and Hanming Fang. 2006. "An Alternative Test for Racial Bias in Law Enforcement: Vehicle Searches: Theory and Evidence". American Economic Review.

Antonovics, Kate and Brian G. Knight. 2009. "A New Look at Racial Profiling: Evidence from the Boston Police Department." The Review of Economics and Statistics. MIT Press, vol. 91(1), pages 163-177, February.

Chanin, Joshua and Megan Welsh and Dana Nurge and Stuart Henry. 2017. Traffic enforcement in San Diego, California: An analysis of SDPD vehicle stops in 2014 and 2015. Report. Public Affairs, San Diego State University.

Dharmapala, Dhammika and Stephen L. Ross. 2003. "Racial Bias in Motor Vehicle Searches: Additional Theory and Evidence". The B.E. Journal of Economic Analysis and Policy.

Grogger, Jeffrey and Greg Ridgeway. 2006. "Testing for Racial Profiling in Traffic Stops from Behind a Veil of Darkness". Journal of American Statistical Association.

Horrace, William C., and Shawn M. Rohlin. 2017. "How Dark Is Dark? Bright Lights, Big City, Racial Profiling." Review of Economics and Statistics 98, no. 2

Kalinowski, Jesse and Stephen L. Ross and Matthew B, Ross. 2017."Endogenous Driving Behavior in Veil of Darkness Tests for Racial Profiling." Working Papers 2017-017, Human Capital and Economic Opportunity Working Group.

Knowles, John and Nicola Persico and Petra Todd. 2001. "Racial Bias in motor Vehicle Searches: Theory and Evidence". Journal of Political Economy.

Hirano, Keisuke and Guido W. Imbens and Geert Ridder. 2003. "Efficient Estimation of Average Treatment Effects Using the Estimated Propensity Score," Econometrica, Econometric Society, vol. 71(4), pages 1161-1189, July.

Hirano, Keisuke and Guido W. Imbens. 2001. Health Services & Outcomes Research Methodology. 2: 259.

Masher, Jeff. 2017. "What The "Veil of Darkness" Says About New Orleans Traffic Stops." NOLA Crime News. Accessed February 22, 2017. https://nolacrimenews.com/2017/09/08/what-the-veil-of-darkness-says-about-new-orleans-traffic-stops.

McCaffrey, D and Gregory Ridgeway and Morral, A. 2004. "Propensity Score Estimation with Boosted Regression for Evaluating Causal Effects in Observational Studies.'" Psychological Methods, 9(4), 403–425

Persico, Nicola and Petra Todd. 2004. "Using Hit Rate Tests to Test for Racial Bias in Law Enforcement: Vehicle Searches in Wichita," NBER Working Papers 10947, National Bureau of Economic Research, Inc.

Renauer, Brian C. and Kris Henning and Emily Covelli. 2009. Prepared for Portland Police Bureau. Report. Criminal Justice Policy Research Institute.

Ridgeway, Greg. 2009. "Cincinnati Police Department Traffic Stops: Applying RAND's framework to Analyze Racial Disparities". Rand Corporation: Safety and Justice Program.

Ridgeway, Greg and John MacDonald. 2009. "Doubly Robust Internal Benchmarking and False Discovery Rates for Detecting Racial Bias in Police Stops." Journal of the American Statistical Association, Vol. 104, No. 486

Ritter, Joseph A. 2017 forthcoming. "How do police use race in traffic stops and searches? Tests based on observability of race." Journal of Economic Behavior \& Organization

Ritter, Joseph A. and David Bael. 2009. Detecting Racial Profiling in Minneapolis Traffic Stops: A New Approach. Center for Urban and Regional Affairs: Reporter. University of Minnesota.

Rosenbaum, Paul R., and Donald B. Rubin. 1983. The central role of the propensity score in observational studies for causal effects. Biometrika 70(1):41-55.

Ross, Matthew B. and James Fazzalaro and Ken Barone and Jesse Kalinowski. 2015. State of Connecticut Traffic Stop Data Analysis and Findings, 2013-14. Racial Profiling Prohibition Project. Connecticut State Legislature.

Ross, Matthew B. and James Fazzalaro and Ken Barone and Jesse Kalinowski. 2017. State of Connecticut Traffic Stop Data Analysis and Findings, 2014-15. Racial Profiling Prohibition Project. Connecticut State Legislature.

Taniguchi, T. and Hendrix, J. and Aagaard, B. and Strom, K., Levin-Rector, A. and Zimmer, S. 2017a. Exploring racial disproportionality in traffic stops conducted by the Durham Police Department. Research Triangle Park, NC: RTI International.

Taniguchi, T. and Hendrix, J. and Aagaard, B. and Strom, K., Levin-Rector, A. and Zimmer, S. 2017b. A test of racial disproportionality in traffic stops conducted by the Greensboro Police Department. Research Triangle Park, NC: RTI International.

Taniguchi, T. and Hendrix, J. and Aagaard, B. and Strom, K., Levin-Rector, A. and Zimmer, S. 2017c. A test of racial disproportionality in traffic stops conducted by the Raleigh Police Department. Research Triangle Park, NC: RTI International.

Taniguchi, T. and Hendrix, J. and Aagaard, B. and Strom, K., Levin-Rector, A. and Zimmer, S. 2017d. A test of racial disproportionality in traffic stops conducted by the Fayetteville Police Department. Research Triangle Park, NC: RTI International.

Worden, Robert E. and Sarah J. McLean and Andrew P. Wheeler. 2012. "Testing for Racial Profiling with the Veil-of-Darkness Method". Police Quarterly.

Worden, Robert E. and Sarah J. McLean and Andrew P. Wheeler. 2010. "Stops by Syracuse Police, 2006-2009". The John F. Finn Institute for Public Safety, Inc. Report.