

Trends in Racial Disparities in Traffic Stops: Brattleboro, Vermont 2014-19

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## Executive Summary

This study of Brattleboro traffic stops forms part of a statewide study of Vermont traffic stop data for 2014-2019. In each study of individual law enforcement agencies, we examine the data for racial disparities in several areas: racial share of stops, tickets vs. warnings, reasons for stops, arrest rates, search rates, and contraband “hit” rates. We also examine trends to determine whether racial disparities change over time. Finally, we comment on the completeness of the data collected by the Brattleboro Police Department (BPD).

Our main findings are that during this period of time in Brattleboro:

- Black and Hispanic shares of drivers stopped exceed their shares of the estimated driving population. The data indicate Black drivers were overstopped by between 31% to 60%, depending on the measure of the driving population used. Hispanics were overstopped by 46% relative to their estimated share of the driving population.
- Black and Hispanic drivers were less likely than white drivers to be stopped for safety reasons, and were significantly more likely to experience pretextual stops than white drivers—stops more likely to be used to investigate “suspicious” behavior and therefore more prone to racial bias.
- Black drivers are significantly more likely to be issued a ticket than white, Asian, and Hispanic drivers, although, overall in Brattleboro the rate of ticketing is much lower than in other police jurisdictions. Over 85% of stops receive only a warning.
- The arrest rate of Black drivers was 4.8 times that of white drivers.
- Black drivers were more than 9 times as likely to be searched subsequent to a stop than white drivers. There were no discretionary searches of Hispanic drivers and Asian drivers were less likely to be searched than white drivers.
- Blacks were less likely to be found with contraband than white drivers despite their higher search rates, although the Black-white difference in contraband rates is not statistically significant.

Regarding trends in racial disparities:

- Over time, the racial disparities in search and contraband hit rates have increased. Trends in the share of stopped drivers who are Black and disparity in the share of stops that are investigatory have also worsened. The Black/white disparity in arrest rates reached a peak in 2016-18 before declining somewhat.
- From 2015 to 2019, the number of traffic stops has fallen about 8.5% in Brattleboro but stops of Black and Hispanic drivers have increased by 129% and 35%, respectively. Overall, Brattleboro has a high volume of stops relative to its population size. This is noteworthy given that Brattleboro also has a very high warning relative to ticket rate.

In terms of data quality, we find:

- Race of the driver was omitted in 6.0% of stops—or 1,210 stops. To put that magnitude into comparison, during the entire period there were only 568 recorded stops of Black drivers. Moreover, in more than 98% of the stops with

no race recorded, all other fields were complete. While there has been some reduction in missing data over time, even in 2019, 3.6% of all rows of data were missing race of driver. Stop reason was missing in about 0.9% of all stops as well. Black drivers are also 2.9 times more likely than white drivers to have no data recorded for the reason they are stopped. Brattleboro Police Department could benefit from additional attention to this problem so as to improve the quality and reliability of their data.

# Racial Disparities in Traffic Stops: Brattleboro, Vermont 2014-19

## I. Introduction

In 2013, the Vermont legislature enacted a bill requiring all law enforcement agencies to: 1) adopt a fair and impartial policing policy, and 2) collect race data on traffic stops beginning in September 2014 and to make those data publicly available.<sup>1</sup> Two of the authors of this study conducted the first statewide analysis of racial disparities in traffic policing using that data (Seguino and Brooks 2017). That report covered 29 law enforcement agencies with data for 2015 for most agencies for which data was available.

In the 2017 study, we reported results for all agencies for which we had data, but due to small sample sizes for a number of agencies, we were only able to make statistical inferences on racial disparities for the state as a whole and for the larger cities and towns.

With several additional years of data and thus larger sample sizes, it is possible to provide statistical analysis for a larger number of agencies. It is also possible for us to evaluate trends over time. This report, which will form a component of a statewide report, analyzes data for Brattleboro, Vermont for 2014-2019. Brattleboro Police Department (BPD) collected data on 20,208 traffic stops during this period of time.

Our study aims to identify whether there are racial disparities in traffic stops and outcomes of the stop in Vermont law enforcement agencies. Our focus is primarily on actions that require officer discretion on whom to stop, arrest, and search. For this reason, we exclude analysis of arrests based on a warrant, and externally generated stops. That said, officer behavior is influenced by agency leadership and culture, the extent of implicit bias and other trainings related to race, as well as policies that shape officer decisions.<sup>2</sup>

The law requires that the following traffic stop data be collected and made available to the public: race, age, and gender of driver; reason for stop; type of search, if any; evidence found during the search, if any; and the outcome of the stop. In Vermont, driver's licenses do not include race/ethnicity of the driver. The race of driver indicated in incident reports on traffic stops is based on officer perception. In analyzing each agency's data, we identify racial shares of stops as compared to racial shares of the driving population, and racial disparities, if any, in reasons for a stop, arrest rates, search rates, and contraband "hit" rates.<sup>3</sup>

In the next section, we provide an overview of the data, identify methodological issues of relevance to our analysis, and report on the quality of Brattleboro's traffic stop data. We report descriptive data on key indicators in Section III of this report, and we discuss results

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<sup>1</sup> The bill is 20 V.S.A. § 2366.

<sup>2</sup> For example, some agencies have a policy that a stopped driver found to be driving with a suspended license is automatically given a citation. Thus, not all officer decisions are the result of discretion. To some extent, the results reflect the role of leadership, training, agency culture, and policies.

<sup>3</sup> Additional data would have been helpful to include in our analysis, but this would require a change to the legislation that has not yet been forthcoming. For example, the type of contraband found, the state the vehicle is registered in, the duration of the stop, officer-level data, and stop numbers would improve the ability to assess the degree, if any, of racial disparities in traffic policing.

of the hit rate test as well. In Section IV, we assess trends over time in racial disparities, using 3-year trends (2014-16, 2015-17, etc.) instead of year by year in order to expand the sample size. In Section V, we conduct a logit analysis to determine the probability of a search and of finding contraband, based on a variety of factors (such as age, gender, and reason for the stop) in addition to the race of the driver. This analysis helps us to control for the context of the stop thereby better isolating the role of race of driver in a search or finding of contraband. Section VI concludes and in the appendix we provide supplemental data and information on missing data.<sup>4</sup>

It should be noted that not all racial disparities are due to racially biased policing (or racial profiling). Racial profiling is defined as the use by law enforcement officials of race or ethnicity as a basis of criminal suspicion. The U.S. Department of Justice, in a 2003 memorandum that specifically banned racial profiling in federal law enforcement, stated, “In making routine or spontaneous law enforcement decisions, such as ordinary traffic stops, federal law enforcement officers may not use race or ethnicity to any degree, except that officers may rely on race and ethnicity if a specific suspect description exists” (U.S. Department of Justice 2003).

There may, however, be legitimate reasons for racial disparities in traffic policing. For example, motorists of some racial/ethnic groups may have worse driving behavior than other groups. Age of driver is inversely related to risky driving behavior (Ivers, *et al* 2009). If the driving population of some racial has a larger proportion of younger drivers compared to other racial groups, for example, racial disparities may be expected. Race may also correlate with traffic stop disparities for reasons outside the control of law enforcement. For example, U.S. minorities have higher poverty rates than white Americans. This may result in a larger share of minorities driving with a suspended license due to the accumulation of unpaid parking or traffic citations. Racial disparities in this case are not necessarily due to bias of police officers but rather are a function of systemic racism in which people of color face worse economic outcomes than those who identify as white.

In the absence of explicit evidence of criminal behavior, racial profiling or racial bias in policing may stem from implicit bias – the reliance on unconsciously held racial stereotypes such as the association of skin tone with criminality, especially as regards young males of color. Good people hold such biases. Indeed, no one who has grown up in U.S. culture is immune from the widespread portrayal of these negative stereotypes. For the purposes of our study, we conduct two analyses to help distinguish between racial disparities and racial bias in traffic policing. First, we use the hit rate test, examining racial differences in the percentage of searches that yield contraband (Section III). Second, we conduct a multivariate (logit) analysis to control for other factors that contribute to the decision to a search of a vehicle allowing us to estimate the net effect of race itself controlling for these other factors. If race continues to be statistically significant after controlling for these other factors, there is

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<sup>4</sup> Full details on the methodology used in this study are available at: [https://www.uvm.edu/sites/default/files/Department-of-Economics/faculty/Data\\_Quality\\_and\\_Methodology\\_for\\_Traffic\\_Stop\\_Data\\_Analysis.pdf](https://www.uvm.edu/sites/default/files/Department-of-Economics/faculty/Data_Quality_and_Methodology_for_Traffic_Stop_Data_Analysis.pdf)

more reason for concern. We conduct a similar analysis of the probability of contraband being found in a search (Section V).

A note on language used in this report is warranted. Race is not a biological category but rather, is a socially constructed concept. Moreover, language about race is fluid, and reflects political changes over time. For example, Hispanic has become less politically acceptable and is now widely replaced by Latinx (a gender neutral form of Latina/o). We retain the use of Hispanic in this report only because this is terminology used in police traffic stop data reports. Second, in just the last year, the term BIPOC (Black, Indigenous, and other People of Color) has come to replace people of color or minorities. We determined the term is still too new to be widely familiar and thus retain older terminology for these conceptual categories. And finally, the capitalization of black and white groups is contested, with some arguing for black to be capitalized but not white and more recently, some argue all racial groups should be capitalized. We capitalize black but not white, as proposed by the *Columbia Journal Review*.<sup>5</sup> We made these decisions, not because we believe our approach is “right” but rather to note how fluid and rapidly changing race language can be, and to underscore that we are aware of the complexities of race language in the U.S.

## II. Data Overview, Methodology, and Data Quality

The data in Table 1 provide an overview of the traffic stop data generated by the Brattleboro Police Department (BPD) from 2014-19. As can be seen, a total of 20,208 stops were made. The percentage of stops in which a citation was issued is lower than in a number of other towns at 12.5%.

Table 1. Overview of Data, 2014-19

	Observations	Rates
<i>Total Stops</i>		
incl. EGS	20,208	
excl. EGS	20,040	
2014	1,530	
2015	3,975	
2016	2,289	
2017	5,171	
2018	3,438	
2019	3,637	
<i>Citations</i>	2,503	12.5%
<i>Arrests</i>	161	0.8%
<i>Searches</i>	78	0.4%
<i>Contraband</i>	35	0.2%
<i>Contraband as % of searches</i>	35	44.9%

Note: EGS is externally generated stops. All rates, annual totals, and outcome data exclude EGS. Rates are as a percentage of total stops, including those where race of driver is unknown.

<sup>5</sup> To see the reasoning for this rule, see <https://www.cjr.org/analysis/capital-b-black-styleguide.php>.

Our focus is primarily on policing decisions based on officer discretion although it is impossible to entirely disentangle the role of agency culture and leadership from individual officer decisions. In order to restrict our attention to discretionary decisions and actions, in the following analysis we exclude stops that are externally generated. Externally generated stops are those that rely on external information to initiate a stop. An officer may be directed to stop a vehicle, for instance, in response to a be-on-the-lookout (BOLO) alert. In this case, the stop is not initiated by the officer. In the case of Brattleboro, 0.8% or 168 of all stops were externally generated. These exclusions reduce our sample size to 20,040 traffic stops. The percentage of these stops that resulted in an arrest for violation<sup>6</sup> was 0.8%, while 0.4% of stopped vehicles were searched. And contraband was found in 0.1% of all stops. Less than half the searches (44.9%) yielded any type of contraband.

A challenging problem in the data, not only for Brattleboro but other agencies as well, is that more than one row in the raw data appeared to refer to the same stop in a number of cases. This typically occurs if there is more than one outcome to a stop. For example, the officer may issue the driver a citation as well as a warning. This scenario would result in 2 lines of data—one for each outcome—and would lead to over-counting of stops, absent efforts to identify stops with multiple outcomes. We therefore developed a method for detecting and reconciling multiple row stops by matching age, race, gender, and date of stop. We retained all information in the multiple rows with regards to tabulating the outcomes of stops while counting each stop only once.

A summary of the raw data for all racial/ethnic groups is provided in Appendix A.1. In the analysis that follows, however, we report data on white, Black, Hispanic, and Asian drivers, omitting Native Americans due to the small sample size that limits our ability to make sound inferences about the results for that group. In the case of Brattleboro, over the time period of this study 2014-2019, 4 drivers were identified by officers as Native American.

Appendix Tables A.1 and A.3a-3c detail information on missing data. Here, we note that in the event there is missing data (sometimes marked as “unknown”) those stops are dropped. The race of the driver was omitted in 1,210 stops or in 6.0% of all stops. To put that magnitude into context, during the entire period there were only 568 recorded stops of Black drivers. Thus, the number of stops missing race of driver was more than double the number of drivers identified as Black. Moreover, in more than 98% of the stops with no race recorded, all other fields were complete. We believe it is concerning that officers were able to record all information about a stop but failed to record race, a field that is legally required.

While there has been some reduction in missing data over time, even in 2019, 3.6% of all traffic stop reports were missing race of driver. In all years until 2019, the number of stops with drivers of unknown race has exceeded the number of identified Black drivers. Even in 2019, there were 142 stops with Black recorded as the driver’s race and only a slightly lower 132 with unknown race recorded. Stop reason was missing in about 1.0% of all stops as well. This missing data was not uniformly distributed. Black drivers are 2.9 times more likely than white drivers to have no data recorded for the reason they are stopped. Brattleboro Police Department could benefit from additional attention to this problem so as to improve the

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<sup>6</sup> We exclude arrests for warrant since we are focusing on officer discretion. In the case of Brattleboro, however, there were no arrests on warrant over this time period.

quality and reliability of their data. Appendix A.4 provides a list of all variables in this report with information on how they are measured.

### III. Descriptive Data Analysis of Traffic Stops

#### A. Racial Shares of Traffic Stops

A straightforward method for identifying racial disparities in traffic stops is to compare the racial shares of traffic stops with estimates of the racial share of the driving population. We use that method here. In theory, we would expect that each racial group's share of stops is roughly equal to their share of the driving population, absent any known systematic differences in driving behavior by race/ethnicity. One of the challenges is how to measure racial shares of the driving population, known as the "benchmarking problem." In other words, against what benchmark do we measure the racial shares of the drivers stopped to determine whether racial groups are overstopped or understopped?

Actual measurements of racial shares of Vermont's driving population would be costly to obtain, requiring observers to record the race of drivers at various times of day and locations. This labor-intensive method would likely yield inaccurate results because not all locations, times of day, or times of year could be captured without enormous expense. Further, the racial accuracy of traffic observations is likely to be limited in poor lighting conditions.

Two alternative benchmarks, therefore, are typically used to estimate racial disparities in traffic stops. One relies on the U.S. Census Bureau's estimate of racial shares of the population 15 years and older, using the American Community Survey (ACS) for 2013-17. This benchmark is not without its faults. Not everyone over 15 drives a vehicle and not everyone drives with the same degree of frequency. For example, on average, whites drive more than Blacks and Hispanics, a phenomenon related to income and wealth inequality by race (Tal and Handy 2005).<sup>7</sup> Thus, there may be reason to question whether the racial composition of the population in an area is the same as the racial composition of drivers on the road. That said, this benchmark could be enlightening, especially when coupled with alternative benchmarks.

The second benchmark we use is the racial composition of drivers involved in accidents in Vermont. Officers collect data on the race of drivers in accidents, and these data are reported to the Department of Motor Vehicles (DMV). This approach has emerged as an alternative method to determine an appropriate benchmark against which to compare racial shares of stops. This measure, too, has some weaknesses. It may overestimate Black and Hispanic shares of drivers due to racial dynamics in the U.S. Take, for example, the case of two white drivers involved in a minor traffic accident. These drivers are more likely to exchange insurance information and go on their way without calling the police than if one of the drivers is white and the other a person of color. In the latter case, white drivers may be

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<sup>7</sup> Baumgartner, *et al* (2018) report, for example, that 83% of whites own a car, compared to 53% of Blacks, and 49% of Hispanics. Whites also drive approximately 20% more miles per year than Blacks and Hispanics. In Vermont, we find similar racial differences with 19.3% of Blacks using public transportation or walking to work, compared to 6.9% of whites, according to ACS 2013-17 estimates.

more likely to involve the police due to potential implicit bias.

Alpert, *et al* (2004) recommend using only racial shares of not-at-fault drivers under the theoretical assumption that not-at-fault drivers represent a random sample of the driving population. In contrast, at-fault drivers may not comprise a random sample. For example, younger drivers are typically found to be lower quality drivers. Thus, age may be correlated with at-fault accidents, and the age composition of drivers may differ by race. We use all data from the DMV (including at-fault drivers), however, in order to maximize sample sizes, given the unreliability of estimates that result from the low number of observations for minority racial groups in Vermont.<sup>8</sup>

Data on racial shares of stopped drivers and the driving population are shown in Table 2. The share of stops relative to the share of population based on U.S. Census data is calculated only for Blacks, Asians, and whites. This is because the U.S. Census Bureau categorizes Hispanic as an ethnicity rather than race—and, thus, Hispanics may be white or non-white. In contrast, in numerous law enforcement agencies, police officers collecting data on traffic stops in Vermont do not distinguish between white and non-white Hispanics, and simply categorize Hispanics as a separate group. (Other agencies collect data on both race and ethnicity of the driver, but with ethnicity often left blank). The DMV accident data use the same racial/ethnic categories as Vermont law enforcement agencies for traffic stops, and so we can calculate the Hispanic share of drivers using that metric.

White drivers in Brattleboro comprised 94.9% of all stopped drivers from 2014 through 2019, with Blacks 3.0%, Asians 1.1% and Hispanics 1.0% of all drivers stopped. Inclusion of externally generated stops does not change these percentages. Black and Hispanic shares of the driving population are lower than their share of stops, whether using the ACS or DMV accident data. For example, the estimates of Black drivers' share of the driving population range from 1.9% to 2.3%, lower than their share of stopped drivers (3.0%).

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<sup>8</sup> The original study that uses accident data to measure racial shares of the driving population (Alpert, *et al* 2004) was based on accidents in a location with a much larger population. We use it as a plausible second benchmark, albeit one that is potentially noisy.

Table 2. Racial Shares of Stops, Reasons for Stops, and Post-Stop Outcomes

All years	White	Black	Asian	Hispanic
<b>Racial Shares of Stops</b>				
<i>Including externally generated stops</i>	94.8%	3.0%	1.1%	1.0%
<i>Excluding externally generated stops</i>	94.9%	3.0%	1.1%	1.0%
<i>Driver Percentage (ACS)</i>	95.0%	1.9%	3.1%	
<i>Driver Percentage (DMV Accident data)</i>	95.2%	2.3%	1.7%	0.7%
<i>Disparity Index (using ACS)</i>	1.01	1.60	0.35	
<i>Disparity Index (using DMV Accident data)</i>	1.00	1.31	0.63	1.46
<b>Stop Reason as % of All Stops</b>				
<i>Safety Stops</i>	92.4%	87.5%	94.1%	92.8%
Moving Violation	92.3%	87.5%	94.1%	92.3%
Suspicion of DWI	0.1%			0.5%
<i>Investigatory/Pretextual Stops</i>	5.9%	8.1%	2.9%	6.2%
Investigatory Stops	0.5%	1.6%		0.5%
Vehicle Equipment	5.5%	6.6%	2.9%	5.7%
<i>Externally Generated Stops</i>	0.9%	1.7%	0.5%	0.5%
<i>Multiple Reasons</i>	0.0%			
<i>Unknown Reason</i>	0.9%	2.6%	2.5%	0.5%
<b>Outcome Rates as a % of All Stops</b>				
<i>Warning Rate</i>	85.7%	74.3%	84.2%	82.9%
<i>Ticket Rate</i>	12.6%	23.2%	13.8%	15.5%
<i>Arrest for Violation Rate</i>	0.7%	3.7%	0.5%	2.1%
<i>Arrest for Warrant Rate</i>	0.0%	0.0%	0.0%	0.0%
<i>No Action Rate</i>	0.6%	0.0%	1.0%	0.0%
<i>Search Rates</i>				
Search rate (excl. searches on warrant)	0.3%	2.8%	0.5%	NA
Search rate (incl. searches on warrant)	0.3%	2.8%	1.0%	0.5%
<i>Hit rates (as a % of PC, RS &amp; Warrant Searches)</i>				
Hit rates (incl. all outcomes)	49.1%	37.5%	0.0%	0.0%
Hit rates (excl. warnings as outcomes)	36.8%	31.3%	0.0%	0.0%
Hit rates (outcome = arrest)	22.8%	18.8%	0.0%	0.0%

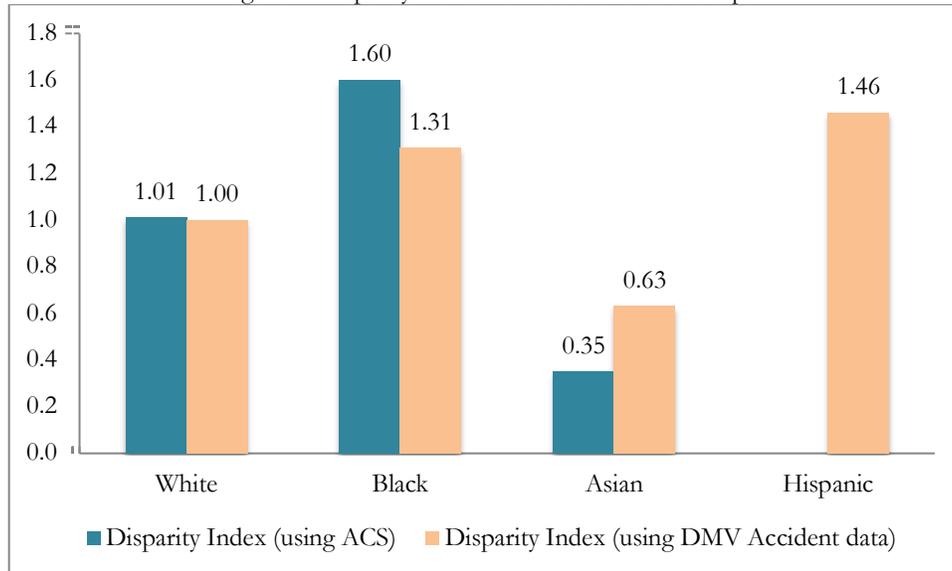
Note: ACS refers to the American Community Survey. NA is “not applicable.” U.S. Census Bureau data record Hispanics as an ethnicity, not race. Hispanics may be white or non-white. In contrast, Vermont law enforcement agencies treat the category of Hispanics as a mutually exclusive racial category. We therefore use only on DMV accident data for estimates of Hispanic share of the driving population. Outcome rates may not sum to 100% because more than one outcome per stop is possible.

The Disparity Index (DI) is used as a way to compare racial shares of stops and driving population across groups (Table 2 and Figure 1). The DI is simply the ratio of the racial share of stopped drivers divided by the racial share of the driving population. A DI that is greater than 1 indicates a group is overstopped relative to what would be expected, given its share of the driving population and a ratio of less than 1 indicates a group is understopped.

For Blacks in Brattleboro during this time period, that ratio ranges from 1.31 (3.0%/2.3%) using the DMV data to 1.60 (3.0%/1.9%) using ACS data. This implies the share of drivers stopped who are perceived to be Black is between 31% and 60% greater than their share of the estimated driving population. Hispanics, too, are overstopped relative to their share of the driving population, with a DI of 1.46. Put another way, Hispanic drivers are stopped at a rate this is about 46% greater than their estimated share of the driving population. In contrast, whether we use the ACS or DMV data, white drivers are stopped at a rate proportionate to their driving population share, while Asian drivers are understopped as compared to what would be expected, given their driving population shares.

For comparison, at the national level, Pierson, *et al* (2020), using data on almost 100 million traffic stops, find that Black drivers were roughly 50% more likely to be stopped than white drivers in stops conducted by municipal police departments. The authors use the local population as a benchmark, and thus their results are most comparable to our ACS stop disparity estimates. As can be seen, the Black racial share of stopped drivers in Brattleboro using ACS data is close to their estimated share at the national level.

Figure 1. Disparity Indices of Racial Shares of Stops



A final note on racial disparities in stops is necessary. The racial share of stops is one of the most contested metrics of racial disparities in traffic policing because of the limitations of the two available measures of the driving population (U.S. Census data and accident data). While the U.S. Census data may underestimate the minority shares of the driving population, given that it measures residents and not drivers, the accident data may overestimate minority shares of the population, given the possibility that not all accidents involve police reports. Most critical to our analysis, however, is post-stop outcomes. Once drivers have been stopped, we know the precise number of drivers of each racial group on which to base calculations of the frequency of post-stop outcomes. Therefore, while racial disparities in stops are noteworthy and should be taken into consideration, it is advisable to rely more heavily on post-stop outcomes to assess racial disparities in policing. We turn to that topic in the next section.

## B. Reasons for Stops

Officers record one of five possible reasons for a traffic stop: moving violation (such as exceeding the speed limit), suspicion of driving while under the influence (DWI), investigatory stop, vehicle equipment (such as obscured license plate), and externally generated stops. Investigatory stops are those in which officers stop a vehicle to investigate further whether a crime has been committed or not. The law requires that the officer have reasonable suspicion to conduct such as stop, based on specific and articulable facts. (As noted above, externally generated stops are not officer-initiated, but instead result from information from a person other than the officer making the stop). Table 2 shows the distribution of reasons for stops by race. By far the most common reason motorists in Brattleboro are pulled over is for moving violations (such as speeding), regardless of race of the driver. The second most common reason is vehicle equipment (such as a faulty taillight). Other reasons for stops are far less common.

Following Baumgartner, *et al* (2018), we categorize stops into two groups: *safety stops* and *investigatory/pretextual stops*. Safety stops have a clear purpose of promoting public safety. These include stops due to moving violation or suspicion of DWI. Pretextual stops (whose reasons are investigatory or vehicle equipment), legal under U.S. law, involve an officer stopping a driver for a traffic violation, minor or otherwise, to allow the officer to then investigate a separate and unrelated, suspected criminal offense. Pretextual stops are also more likely to be cases where racial disparities emerge. This is because investigatory/pretextual stops, often based on hunches or suspicion, may be influenced by racial stereotypes or generalizations about people's behavior, based on their group identity. Negative stereotypes about Blacks and Hispanics in the U.S. are extensive, as evidenced by the results of the Implicit Association Test (Banaji and Greenwald 2013). That negative racial stereotypes in U.S. culture are widespread is documented by social psychologist Jennifer Eberhardt (2019). Her research using social psychology experiments is designed to detect anti-Black bias, which is frequently unconscious or implicit.

If negative stereotypes were operative in Vermont (and there is no reason to think they would not be), we would expect Black and Hispanic drivers to have higher shares of investigatory/pretextual stops as compared to white and Asian drivers. This is in fact the case in Brattleboro for these years. The percentage of these stops is higher for Black drivers (8.1% compared to 5.9% for white drivers) and this difference is statistically significant ( $z=2.26$ ). That said, BPD does not conduct many such stops. That is, this type of stop is much less frequent for *all* racial groups than in a number of other towns and cities in Vermont. The Asian share of stops that are "investigatory" is lower than that of white drivers. For Hispanics, the share of stops that are pretextual is 6.2%, higher than the white rate. Neither the Asian nor Hispanic sample sizes are large enough to make reliable statistical inferences in this case.

## C. Post-Stop Outcomes

Post-stop outcomes are of particular interest in analyses of racial disparities in traffic stops. That is because, regardless of a law enforcement agent's ability to discern the race of the driver before a stop, she or he has had an opportunity to form a perception of the driver's

race once the vehicle has been stopped. This section explores what happens after a stop. Specifically, we ask whether drivers of different racial groups experience systematically different outcomes.

Possible outcomes of a stop are: no action taken, warning, citation, arrest, and search. Unlike in the case of stops where we only have estimates of the baseline driving population, in analyzing racial disparities in post-stop outcomes, we know with certainty the number of drivers who have been stopped by race, and therefore can assess racial differences in post-stop outcomes with greater precision than stops.

Table 2 reports Brattleboro Police Department’s post-stop outcomes by race. In order to make comparisons across racial groups, it is useful to consider outcomes experienced by minority drivers as compared to those of white drivers. Table 3 reports those ratios, whereby the percentage of stopped Black, Asian, and Hispanic drivers experiencing each outcome is divided by the white percentage (for example, the Black search rate divided by the white search rate). A ratio that is greater than one indicates the minority group is more likely to experience a particular outcome than white drivers, and a ratio of less than one indicates the minority group is less likely to experience a particular outcome.

Table 3. A Comparison of Post-Stop Outcomes: Ratio of Minority/White Rates

	Black/white	Asian/white	Hispanic/white
Warning rate	0.87	0.98	0.97
Ticket rate	1.84	1.09	1.23
Arrest rate	5.00	0.66	2.80
Search Rate	9.33	1.63	NA

Note: Arrests rates are for violations, and thus exclude arrests on warrant. Search types reported are probable cause or reasonable suspicion; searches on warrant are excluded. Externally generated stops are also excluded.

Black drivers are about 13% less likely to be given a warning than white drivers, and 84% more likely to be issued a citation ( $z=7.4$  for the ticket differential). Hispanic drivers are about 3% less likely than white drivers to receive a warning, and 23% more likely to be issued a citation. Asian drivers are 9% likely than white drivers to receive a citation.

Black drivers are 5 times more likely to be arrested in Brattleboro than white drivers ( $z=7.6$ ) and Hispanic drivers are 2.8 times more likely to be arrested subsequent to a stop than white drivers. In contrast, Asian drivers are less likely to be arrested than white drivers. That said, for both Asians and Hispanics, small sample sizes make these estimates unreliable.

Search rate data used for Table 3 exclude searches based on a warrant.<sup>9</sup> Black drivers are searched at a rate that is more than 9 times greater than that of white drivers, a difference that is statistically significant ( $z=9.33$ ). Specifically, while 0.3% of white drivers were

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<sup>9</sup> Searches resulting from a warrant could reasonably be described as discretionary because they are the result of a driver refusing to consent to a search. In those cases, the officer impounds the vehicle and seeks a warrant from a judge. However, in order to be conservative in our approach to defining officer discretion, we exclude searches on warrant because a judge also participates in the decision to conduct a search.

searched during this period of time, 2.8% of Black drivers were searched. There was only 1 search of Asian drivers, and no searches of Hispanic drivers from 2014-19.

The results presented here with regard to higher arrest and search rates of Black drivers as compared to white drivers are consistent with those found in a number of national, state, and local studies. For example, Pierson, *et al* (2020) report national-level data on nearly 100 million US traffic stops, finding that Black drivers are searched at more than twice the rate of white drivers.<sup>10</sup> In a study of 20 million car stops in North Carolina from 2002-2016, Baumgartner, *et al* (2018) also find evidence of higher arrest and search rates of Black drivers. The ratio of Black to white search rates in North Carolina was roughly 2 to 1, similar to Pierson, *et al*'s (2020) results. The Black/white search rate disparity in Brattleboro, however, is more than four times greater than the national-level and North Carolina disparities.

Why might we observe racial differences in search rates? Search rate disparities may be justified if some groups (in this case, Blacks) are more likely to be carrying contraband than white drivers. Police may search vehicles, for example, in an attempt to interdict drugs (a reason that numerous police officers have given, in conversation with the authors of this study) and as a result, they may target Blacks and Hispanics on the basis of racial stereotypes about drug users and couriers are. Implicit bias based on faulty stereotypes may also play a role. For example, evidence shows that Black and white Americans sell and use drugs at similar rates (U.S. Department of Health and Human Services 2012, 2013).

Whether or not there is racial bias (implicit or explicit) in search racial disparities is a question that can be assessed by examining the productivity of searches, that is, the percentage of searches that result in contraband being found, often called the “hit” rate. Contraband in Vermont ranges from underage cigarette possession to stolen goods, to illegal drugs.<sup>11</sup> Absent racial bias (as compared to racial disparities), we would expect that officers should find contraband on searched minorities at the same rate as on searched white drivers. If searches of minorities turn up contraband at lower rates than searches of white drivers, the hit rate test is consistent with the argument that officers base their searches of minority drivers on less evidence than they require as a basis for initiating searches of white drivers. Put another way, minority hit rates that are lower than white hit rates are an indication that police may be oversearching minorities (or under-searching white drivers) and that racial bias has influenced the officer's decision on whom to search.

Vermont law enforcement agencies are only required to report on whether or not contraband is found and are not required to report the type of contraband. As a way to get at racial differences in the severity of contraband found, we differentiate contraband by type in our analysis, and we group hits by the severity of the outcome as follows: a) hit rates for all outcomes (warning, ticket, arrest), b) hit rates in which contraband leads to a ticket(s) and/or an arrest, and c) the arrest-worthy contraband hit rate.

In conducting the hit rate test, we focus on white and Black drivers. The number of searches of Asian and Hispanic drivers is small, preventing hit rate comparisons of these groups to

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<sup>10</sup> Pierson, *et al* (2020) do not report racial differences in arrest rates.

<sup>11</sup> Note that firearms for those 21 and over are not necessarily contraband in Vermont, but for those under 21, firearms would be considered contraband.

whites. We find that the productivity of searches of Black drivers is lower than that of white drivers for all three hit rates (Table 2). In searches that result in any outcome, the hit rate for white drivers is 49.1% compared to 37.5% for Black drivers. This difference is not statistically significant ( $z=0.82$ ), possibly attributable to the low number of searches. Similarly, the difference between the lower Black hit rate as compared to the white hit rate for outcomes that lead at least to a ticket and/or arrest is not statistically significant ( $z=0.41$ ), but again is noteworthy, especially given the large search Black-white search rate disparities.

#### IV. Trends Over Time

The adoption of fair and impartial policing policies and the availability of traffic stop data may incentivize agencies to review their policies and to conduct trainings on race, policing, and implicit bias. It is therefore useful to explore trends in racial disparities over time to track the effect of such training and exposure to statewide discussions on racial disparities in policing.

First, we examine trends in the number of stops per year in total and by race (for raw data, see Table A.2b). From 2015 (our first year of complete data) to 2019 the total number of stops decreased by 8.5%. Unusually, most of that decrease is due to a reduction in the number of drivers whose race was recorded by police as unknown—that percentage decreased by 78%. Asians, too, experienced a decline in stops of 15%. Stops of white drivers increased slightly by 1.5%. In contrast, stops of Black drivers increased by 129.0%, more than doubling, and stops of Hispanic drivers increased by 34.6%, respectively. The very different stop trends are perplexing and it would be useful for the BPD to explore the cause of these of these divergent racial trends.

For 2019, we estimate that white drivers were stopped at a rate of 6,003 per 10,000 white residents<sup>12</sup> compared to 5,915 in 2015 (Figure 2). That said, the white stop rate has been as high as 8,821 per 10,000 white residents (in 2017) during this time period. For Black drivers, the rate in 2015 was 5,586 per 10,000 Black residents, rising to 12,793 in 2019—more than one stop per estimated Black resident in Brattleboro. In all years, the Asian stop rate per 10,000 residents is substantially lower than the white rate. For example, even in 2017 when stop rates were high for all racial groups, the Asian stop rate was 3,764 compared to 8,821 for whites. For all drivers, the stop rates in Brattleboro are very high relative to the national average of 8.6% (or 860 out of 10,000) of drivers stopped per year.<sup>13</sup>

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<sup>12</sup> ACS data is used to calculate an estimated rate per 10,000 residents. Because we do not have ACS estimates of Hispanics, this racial category is omitted from Figure 2. Stop rates are calculated, using white drivers as an example, as:  $[(\text{number of stops of white drivers}/\text{number of white residents } 15+)\times 10,000]$ . Similarly, the stop rate of Black and Asian drivers is their stop numbers divided by the number of Black and Asian residents of Brattleboro 15 and older, all multiplied by 10,000.

<sup>13</sup> U.S. Department of Justice (2018: 1).

Figure 2. Trends in Stops Rates per 10,000 Residents

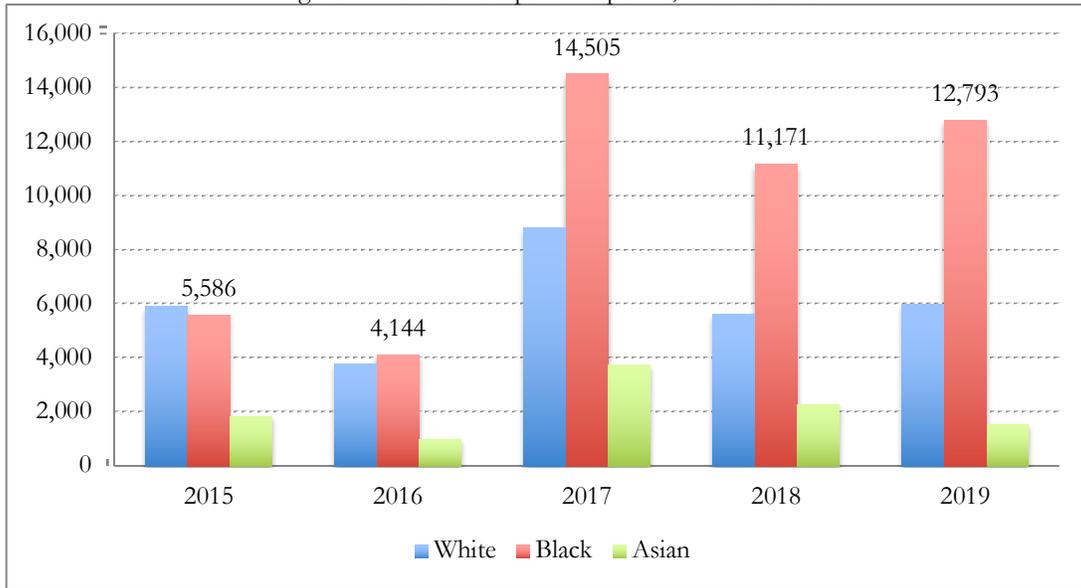
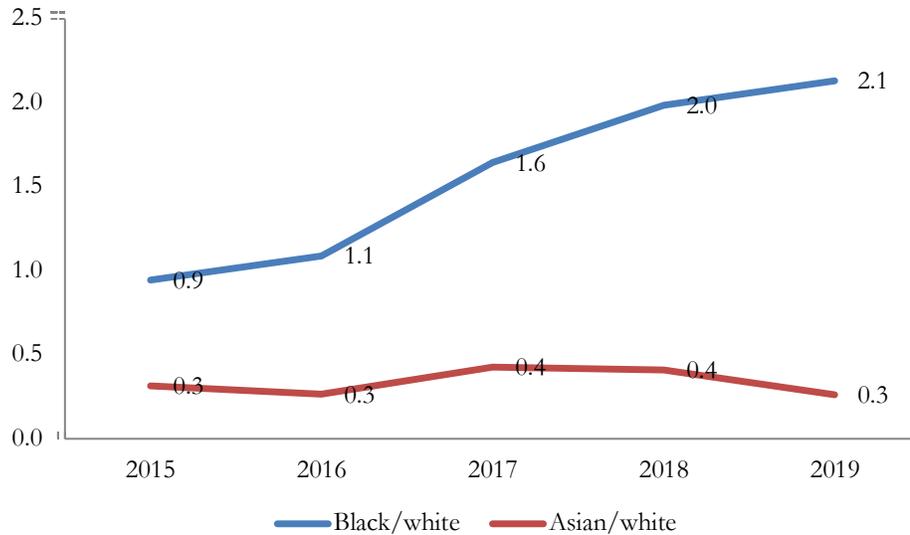


Figure 3 plots the ratio of Black to white stop rates and Asian to white stop rates. The Black-white ratio was 0.9 in 2015, meaning that Black drivers were stopped at a lower rate per capita than white drivers in that year. The Black/white ratio has risen over time to 2.1 in 2019. That is, the Black and white stop rates have gone from parity (approximately) in 2015 to Blacks being stopped at double the rate of white drivers per 10,000 estimated residents. The Asian to white rate has mildly fluctuated over this time period, and continues to be about one third that of white drivers in 2019.

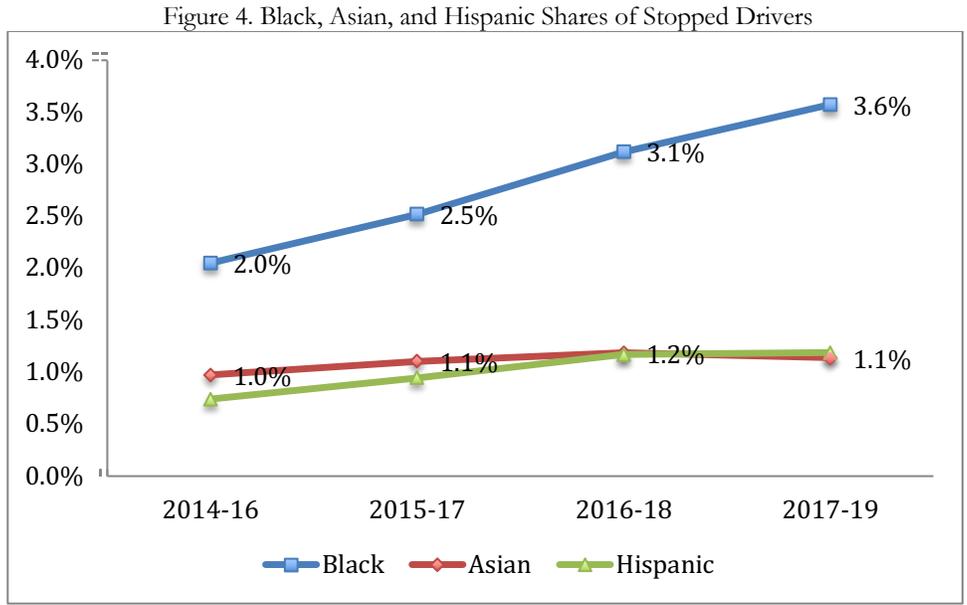
Figure 3. Trends in Ratio of Black/White and Asian/White Stop Rates



We also present data on trends in stop shares, and arrest, search, and hit rates. Due to small sample sizes, we calculate three-year moving trends instead of one-year trends to increase

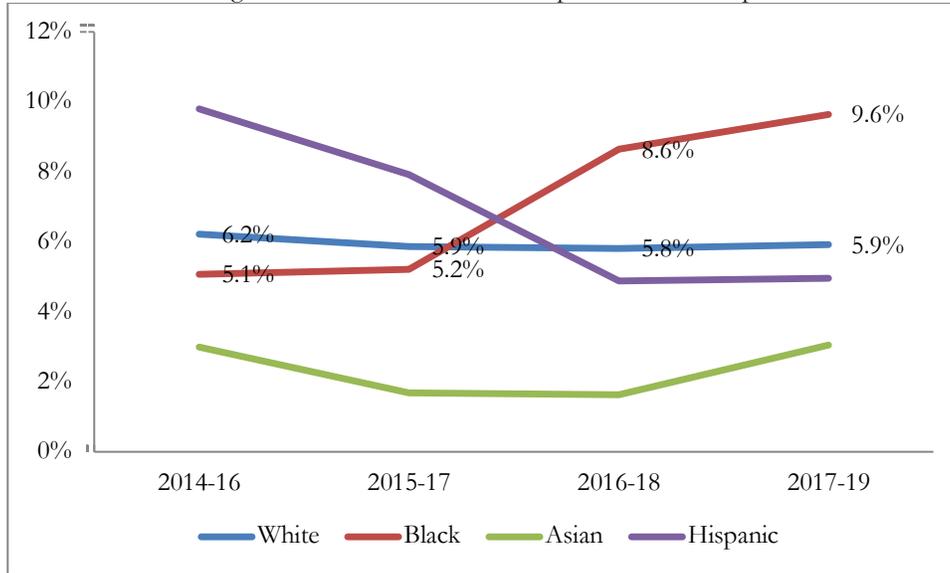
our sample sizes. Specifically, we look at data for 2014-16, 2015-17, etc. (See Table A.2a. for the raw numbers on which the following figures are based).

Figure 4 portrays trends in the share of stops of Black, Asian, and Hispanic drivers. It is noteworthy that the Black share of stopped drivers has risen by 50% percent over this time period, from 2% of all stops to 3.6%, while the Asian and Hispanic shares have stayed relatively constant.



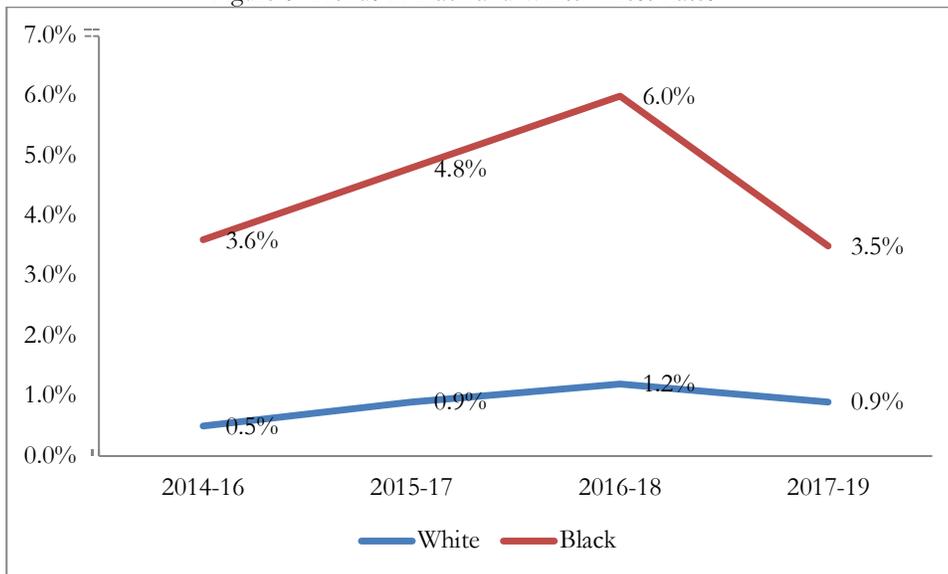
Of interest, as noted, is the percentage of stops that are pretextual—that is, for which the reason for the stop is investigatory or vehicle equipment. This type of stop is one that is more likely to be susceptible to bias than a safety stop. Figure 5 shows trends in pretextual stops as a share of all stops by race (we include Asians, despite the small sample size, to demonstrate the consistency of Asian stop shares with other indicators in this report). They indicate more favorable treatment of this group as compared not only to other minorities but also white drivers). We also note that BPD is much more focused on safety stops than pretextual stops, compared to other agencies in Vermont, with no more than 6.1% of all stop reasons identified as investigatory/pretextual. The pretextual share of all stops of Black drivers had been lower than the white share in 2014-16, but it is now higher (9.6% for Black drivers, compared to 5.9% for white drivers). The Hispanic share of stops for which the reason is pretextual has been falling over time and is now lower than the white share.

Figure 5. Trends in Pretextual Stops as % of All Stops



In all years, the Black arrest rate exceeds the white rate, and this gap widened substantially in 2016-18, falling again in 2017-19 (Figure 6). This decrease in disparity is notable, but we also observe that in 2017-19, the ratio of Black to white arrest rates is 3.9. That is, Black drivers in that time period were arrested at a rate almost 4 times that of white drivers. Asian and Hispanic arrest rate numbers are omitted due to small sample sizes.

Figure 6. Trends in Black and White Arrest Rates



White and Black trends in search rates are shown in Figure 7. (Asian and Hispanic combined searches totaled 5 over this entire time period and are thus omitted due to the small sample sizes). Search rates for white drivers have been relatively stable over this entire time period. In contrast, the Black search rate has risen, peaking in 2016-18 and

falling slightly to 3.0% in 2017-19, a rate that is roughly 10 times greater than the white search rate.

Figure 7. Trends in Black and White Search Rates

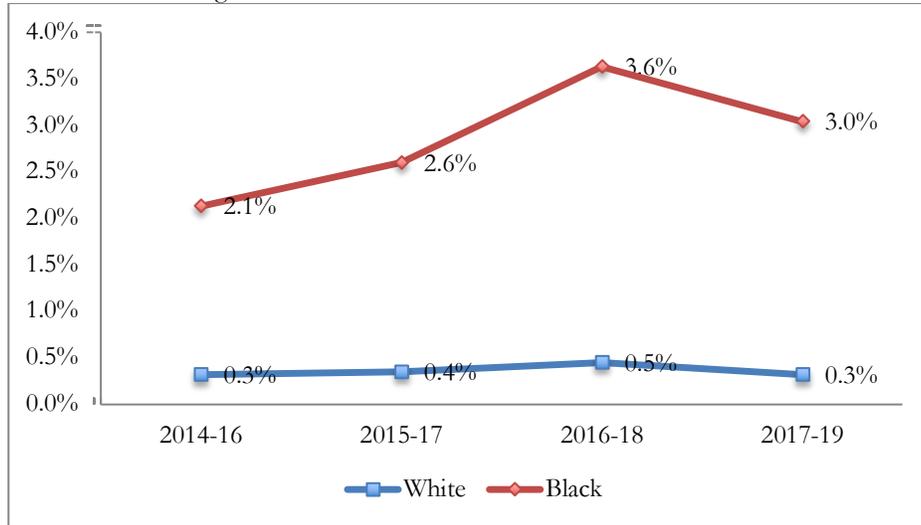
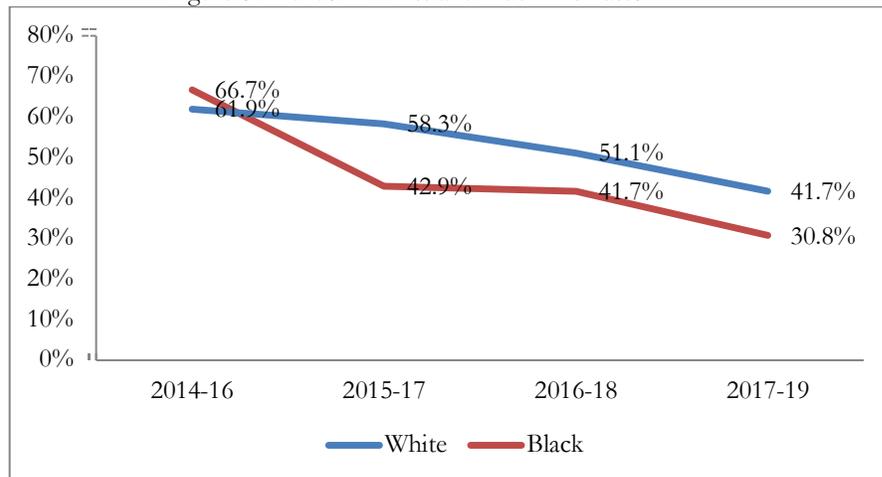


Figure 8 shows trends in white and Black contraband hit rates. Asian and Hispanic hit rates are not shown due to small sample sizes. As the graph indicates, hit rates have been falling for both white and Black drivers over this time period, suggesting lower search productivity. This could be evidence of inefficient policing especially in conjunction with the high number of stops per capita and the low rate of ticketing relative to warnings. The Black hit rate has fallen at a faster pace than the white rate. (In 2014-16, the Black hit rate exceeded the white rate). The Black-white trend and disparity in hit rates is similar when we exclude warnings or no action taken (not shown here), that is, when we focus on contraband that results in a ticket and/or arrest. The widening racial disparity in hit rates (albeit somewhat modest) is occurring in a context of an increase in the Black share of stopped drivers and substantial growth in the number of Black stops.

Figure 8. Trends in White and Black Hit Rates



## V. Logit Analysis

In this analysis, our focus is on searches and contraband. Our goal is to examine further for evidence that minority drivers receive less favorable treatment by controlling for possible confounding variables. To do this, we use multivariate logistic regression analysis to calculate the probability of a search occurring and separately, contraband being found, controlling for other factors that may influence the decision to search or of contraband being found. Why is this useful? Some driving behaviors and circumstances may co-vary with race, and could be the dominant reason behind a search rather than the race of the driver. Failing to control for such factors risks misattributing search rate differences to race rather than the explicit behavior of the driver. If, even after controlling for factors like gender, age, reason for stop, and time of day, which we are able to control for, we still find that race is a statistically significant predictor of a search, then that provides additional evidence that the race of the driver, independent of these other factors, influences traffic policing in Brattleboro.

### A. Probability of a Search

We first report results from the probability of a driver being searched by race. The full model takes this general form:

$$\begin{aligned} \text{Probability of Search} = & \beta_0 + \beta_b * \text{Black} + \beta_a * \text{Asian} + \beta_h * \text{Hispanic} + \beta_{na} * \text{Native American} + \\ & \beta_m * \text{Male} + \beta_{age} * \text{Age} + \beta_k * \text{Time of Day}_k + \beta_i * \text{Day of Week}_i + \\ & \beta_j * \text{Reason for Stop}_j + \text{Residual}. \end{aligned}$$

Dummy variables for each racial group are included, with white the excluded racial category. The coefficients, reported in Table 4, for each of the driver race variables can be interpreted as the odds of a search for a driver of that race as compared to the odds for white drivers with the same characteristics. This is called the *odds ratio* because it is the ratio of the odds of a non-white driver being searched over the odds that a white driver is searched. An odds ratio of 1 indicates equal probabilities of being searched. A ratio that is greater than one indicates a group is more likely to be searched than the omitted or benchmark group (that is, white drivers). Finally, an odds ratio that is less than 1 is indicative of a lower probability of a group being searched relative to the omitted group.

The coefficient on *Male* indicates the odds a male driver will be searched as compared to the odds a female driver will be searched. We include a control for the driver's age, measured in years, as an explanatory variable. We also control for time of day, with the excluded category the *afternoon*. We control for day of the week, with *Friday* the omitted day. The coefficients on days of the week indicate the odds of being searched on those days as compared to Fridays.

We control for the reason for the stop in two ways. First, we include all reasons for a stop as explanatory variables. The excluded category for this set of variables is *moving violation*. The coefficients on the *Reason for Stop* variables indicate the odds of being searched for each reason for stop divided by the odds of being searched due to moving

violation, where the reason is one of the following: suspicion of driving while under the influence (DWI), investigatory stop, multiple reasons for a stop (where the officer indicated more than one reason for the stop), for reasons unknown (that is, the reason was not stipulated in the incident report), and vehicle equipment. This control can help to eliminate misattribution of race to search disparities, if for example, any racial group is more likely to be DWI. In the second method, we disaggregate the reasons for a stop into safety stops and pretextual stops. The omitted variable in this case is *safety stops*. In this case, the coefficient on the *Pretextual Stop* variable indicates the odds of being searched if the stop was pretextual (investigatory or vehicle equipment) divided by the odds of being searched due to moving violation.

Controlling for all of these factors allows us to interpret the race variable, net of the impact of these other control variables. Results are shown in Table 4. Of primary interest is whether the race variables are statistically significant (as designated by the asterisks). If they are, this implies that independent of any other factors that may lead to an officer's decision to search a vehicle, race influenced the officer's decision to initiate a search.

We report results on three variations of our basic model. We start with a basic model (Model 1 in Table 4), in which race of the driver is our only explanatory variable. The results show that Black drivers are 9.1 times more likely to be searched than white drivers. (This represents the ratio of the odds of a Black driver being search compared to the odds of a white driver being searched). In contrast, the odds an Asian driver will be searched are 3 times greater than the odds of a white driver being searched. The odds ratio for Hispanic drivers is 1.62. Neither the Asian nor Hispanic odds ratios are statistically significant, however. The number of Native American drivers was small and so was omitted.

In Model 2, adding controls for gender, age of driver, time of day, day of week, and reason for stop, we find that the odds of a male driver being searched are 1.5 times greater than the odds a female driver will be searched, but again this is not statistically significant. The odds ratio on age indicates a lower probability of being searched, the older the driver, and this is statistically significant. The probability of a search is substantially lower in the morning than in the afternoon. The odds of an evening search are greater than in the afternoon, but this is not statistically significant. None of the coefficients on days of the week are statistically significant except Monday for which the odds of a search are greater than on Fridays.

Table 4. Odds Ratios of Probability of a Search (Compared to White Drivers)

Variables	(1)	(2)	(3)
	Race only	With all controls and stop reason	With all controls and pretextual stop control
Black	9.112*** (2.608)	5.946*** (1.811)	6.622*** (1.953)
Asian	3.124 (2.258)	3.589* (2.635)	3.558* (2.601)
Hispanic	1.619 (1.637)	1.151 (1.197)	1.291 (1.313)
Male		1.513 (0.395)	1.695** (0.436)
Age		0.971*** (0.001)	0.970*** (0.001)
Morning		0.128*** (0.0783)	0.133*** (0.0807)
Night		1.018 (0.256)	0.873 (0.216)
Saturday		0.698 (0.308)	0.686 (0.298)
Sunday		0.785 (0.355)	0.742 (0.331)
Monday		1.945* (0.742)	1.821 (0.685)
Tuesday		1.230 (0.514)	1.130 (0.468)
Wednesday		0.616 (0.315)	0.551 (0.279)
Thursday		0.910 (0.424)	0.780 (0.359)
Investigatory stop		22.78*** (9.770)	
Suspicion of DWI		30.33*** (32.75)	
Unknown stop reason		18.17*** (9.432)	
Vehicle equipment		3.463*** (1.109)	
Pretextual stop			5.873*** (1.471)
Constant	0.003*** (0.001)	0.005*** (0.001)	0.005*** (0.001)
No. of observations	18,634	18,570	18,573

Note: Standard errors are in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The odds of an investigatory stop leading to a search are almost 23 times the odds for a stop initiated due to a moving violation. This is noteworthy because Black drivers are somewhat more likely to be subject to an investigatory search than white drivers. The odds ratio on all other reasons for a search as compared to a stop based on a moving violation are also greater than the odds of a search when the reason for the stop is moving violation, and all are statistically significant. The odds a Black driver will be searched in this model, after controlling for other factors, compared to the odds for a white driver, are 5.95. That is, even controlling for other factors, the odds a Black driver will be searched in Brattleboro are about 6 times greater than the odds a white driver will be searched. The coefficient continues to be statistically significant at the one percent level. That is, we can reject the null hypothesis that there is no difference in search rates between Black and white drivers with a high degree of certainty. Because Black drivers in Brattleboro are more likely to be subject to investigatory stops/pretextual stops than white drivers, we should be careful interpreting the smaller coefficient on the Black/white odds ratio in Model 2 as being a more accurate measure of disparity compared to the model without controls for type of stop.

The odds Asian drivers are searched are 3.59 times greater than the white odds of a search, after controlling for other factors, and in this model, the differences in odds are statistically significant.

In Model 3, we include two categories of *Reason for Stop*—safety stops (the omitted variable) and pretextual stops. The results indicate that when the reason for the stop is pretextual, the odds drivers will be searched are about 5.9 times greater than the odds of a search if the reason is a safety stop.

Taken together, these results suggest that Black/white and Asian/white disparities in search rates are extremely robust, regardless of the contextual factors controlled for. Moreover, the levels of disparity indicated by the logistic regressions are very similar to the search rate ratio in Figure 7. The use of more rigorous statistical techniques does not in any meaningful way change the nature of the descriptive data findings.

## B. The Probability of Finding Contraband

We conduct logistic regression analysis to assess the role of race in the probability of finding contraband, subsequent to a search. As in the analysis of search rates, we control for other factors that may influence the probability of contraband being found to avoid erroneously attributing to race the effect of other factors. Again, we exclude externally generated stops and searches based on a warrant. The equation we estimate is as follows:

$$\begin{aligned} \text{Probability of Finding Contraband} = & \beta_0 + \beta_B * \text{Black} + \beta_A * \text{Asian} + \beta_H * \text{Hispanic} + \beta_{Na} * \text{Native} \\ & \text{American} + \beta_M * \text{Male} + \beta_{age} * \text{Age} + \beta_K * \text{Time of Day}_k + \beta_j * \text{Day of Week}_j \\ & + \beta_l * \text{Reason for Stop}_l + \text{Residual}. \end{aligned}$$

Table 5 reports the results of the probability of contraband being found for searches for any outcome of the stop and search (that is, in which the result was a warning, a citation, or an arrest) for all years for which we have data. The results shown for Model 1, where the only explanatory variable is race of the driver, indicate that the odds of a search of a Black driver

yielding contraband are about 40% less than the odds a white driver will be found with contraband subsequent to a search. The difference is not, however, statistically significant, and that may be due to the small number of searches overall as well as a modestly low hit rate, at least as compared to other agencies in Vermont.

Because of the importance of the hit rate in our analysis, let's describe more precisely what the odds ratio coefficient means using the results from this simple regression. From Table 2, we find that 49.1% of searched white drivers are found with contraband and thus, 50.9% are not found with contraband. This implies an odds ratio for white drivers of  $49.1/50.9 = 0.96$ . In other words, the odds are roughly even that a search of a white driver will yield contraband. For Black drivers, we find in Table 2 that 37.5% of them are found with contraband so their odds ratio is  $37.5/63.5 = 0.60$ . The ratio of these two odds is the coefficient in our regression ( $0.60/0.94 = 0.62$ ), very close to the coefficient estimate on race when we formally run the logit regression.

The addition of controls in Model 2 does not meaningfully change the odds ratio of finding contraband in searches of Black as compared to white drivers. Again, that coefficient is statistically insignificant. In Model 3, we obtain similar results on the Black to white odds of contraband being found as in Model 2, but here, pretextual stops are shown to result in a higher probability of finding contraband than if the reason for the stop is for safety reasons. The odds ratio on pretextual stops, however, not statistically significant.<sup>14</sup>

Although the Black-white differences in the odds of contraband found during a search are not significant, we note two things. First, the relatively high percentage of stops for which the race of the driver is missing (6.6%) reduces the quality of the data, affecting measurement of all racial disparities in this study if the missing data is not random (that is, if for some reason, it is correlated with the race of the driver). BPD would be advised to dedicate efforts to improving the quality of the data and eliminating the problem of missing data in all categories, not just race. Second, the wide disparity in search rates is notable, even though the coefficients on the contraband odds ratio of Blacks relative to whites is statistically insignificant. More data would be helpful, and it may well show that contraband hit rates have converged, a positive development. Or, with more data, the hit rate difference may prove to be statistically significant, suggesting racial bias in the decision to search.

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<sup>14</sup> In results not reported here (but available on request), we recoded warnings as no contraband in order to focus on more serious types of contraband, specifically those that lead to a ticket or an arrest. We obtain broadly similar odds ratios on Black as compare to white drivers.

Table 5. Odds Ratios of Probability of Finding Contraband (Compared to White Drivers)

Variables	(1)	(2)	(3)
	Race only	With all controls and stop reason	With all controls and pretextual stop control
Black	0.621 (0.361)	0.646 (0.420)	0.654 (0.426)
Male		0.173** (0.133)	0.205** (0.149)
Age		0.953* (0.025)	0.950** (0.025)
Morning		3.477 (4.972)	3.492 (4.933)
Night		1.108 (0.680)	0.950 (0.539)
Saturday		0.217 (0.242)	0.189 (0.200)
Sunday		0.542 (0.627)	0.455 (0.502)
Monday		0.829 (0.750)	0.730 (0.635)
Tuesday		0.265 (0.273)	0.217 (0.218)
Wednesday		1.032 (1.337)	0.951 (1.182)
Thursday		0.195 (0.241)	0.199 (0.239)
Investigatory stop		1.407 (1.392)	
Unknown stop reason		1.362 (1.495)	
Vehicle equipment		0.762 (0.626)	
Pretextual stop			1.111 (0.681)
Constant	0.966 (0.256)	170.4** (363.2)	159.9** (334.9)
No. of observations	73	72	73

Note: Standard errors are in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

To sum up the results of the logistic regressions, adding controls for a variety of contextual factors has little effect on racial disparities in the probability of being searched and of contraband being found during a search. This is not to say that the controls were not meaningful or significant. Searches are more likely to happen under some conditions as compared to others (e.g., during investigatory stops as compared to motor vehicle stops). But even controlling for these factors, race continues to be a statistically significant factor in an officer's decision to search a vehicle. With regard to the question of racial bias as an

explanation for such disparities, the analysis shows that Black drivers are less likely to be found with contraband, although this difference is not statistically significant. In the event more data become available and the Black-hit rate differential is found to be statistically significant, such a finding is consistent with oversearching of that group of drivers. The BPD may want to monitor this carefully. As noted above in our trend analysis, despite these overall findings of significant oversearching, we are heartened that the degree of oversearching appears to be declining.

## VI. Conclusion

Vermont has embarked on a long-term project of using data to expand awareness of traffic policing and race. Because traffic stops are the most frequent interaction people have with the police, combined with the large number of traffic stops in any given year, data on stops can be a useful tool for understanding the extent of racial disparities in these interactions. They are, in other words, a way of holding up a mirror to ourselves.

Though data often and usually are imperfect, that does not preclude their usefulness. Efforts to improve data quality—and especially to eliminate missing race data—are important and should continue to be pursued. This is especially so in the case of Brattleboro where race of driver was missing in 6% of all reports and the number of stops with drivers of unknown race is twice as large as the number with a recorded Black driver. Missing data is relatively easy to address, and the BPD can improve the reliability of statistical analyses by working on collecting and recording more complete data.

In this report, we provide descriptive data on racial disparities in Brattleboro Police Department's traffic stops. We find that Black and Hispanic drivers' share of stops exceeds their estimated share of the driving population. The extent to which Black and Hispanic drivers are overstopped was 31 to 60% for Blacks and 46% for Hispanic drivers. Post-stop outcomes also give evidence of racial disparities, with Black and Hispanic drivers more likely than white drivers to be stopped for investigatory/pretextual reasons. The reason such stops are of interest in evaluating evidence of racial bias is that such stops are more likely to be used to investigate "suspicious" behavior and therefore more prone to racial bias.

There is a wide disparity in Black and white arrests rates, with Blacks almost 5 times more likely to be arrested subsequent to a stop. The Hispanic arrest rate was about 3 times greater than the white rate. Over time, the disparity between Black and white arrest rates has widened.

From 2014 to 2019, Black drivers were searched at a rate that was 9 times greater than of white drivers, and this disparity, too, has widened over time. We also report on a statistical analysis that controls for other factors that may influence the probability of being searched or of contraband being found during a search. Those results demonstrate that while other factors also contribute to the likelihood of either of those outcomes, racial disparities continue to exist when those factors are controlled for. In particular, Black drivers are substantially more likely to be searched than white drivers. They are less

likely to be found with contraband, although this difference is not statistically significant, given the small sample sizes.

In addition to these results, some interesting aspects of BPD policing emerge from the data we analyzed. While traffic stops have declined by about 11% in the last five years, stops of Black and Hispanic drivers have increased substantially over time and are at a high level. Police stop drivers in Brattleboro at a rate much higher than the national average. There are more stops of Black drivers in Brattleboro than the resident Black population over 15. Interestingly, BPD issues tickets in just 12.5% of all stops, a relatively low percentage. This phenomenon, coupled with the high and rising number of stops of Blacks, results in a question as to what explains the divergence in stops by race, and what, in particular, is the BPD's traffic policing strategy. Further, although Brattleboro's overall search rate is lower than that of many other agencies (0.4% in Brattleboro), their hit rate is also much lower at 44.9%, with just 20% (approximately) of searches that result in arrest-worthy contraband being found during the search.

Collectively, these results suggest that the race of the driver plays a role in officer decision-making in traffic policing in Brattleboro. This concerning finding coexists with some other positive aspects of Brattleboro's policing. The BPD has used race data in traffic policing as a management tool and as a means to make officers conscious of these disparities. Seguino and Brooks (2020) outline other steps the agency has taken to address racial disparities that may be due to bias, a process that may take time to bear fruit.

## REFERENCES

- Alpert, G., M. Smith, and R. Dunham. 2004. "Toward a Better Benchmark: Assessing the Utility of Not-at-fault Traffic Crash Data in Racial Profiling Research." *Justice Research and Policy* 6(1): 43-69.
- Banaji, M. and A. Greenwald. 2013. *Blind Spot: Hidden Biases of Good People*. Delacorte Press.
- Baumgartner, F., D. Epp, and K. Shoub. 2018. *Suspect Citizens: What 20 Million Stops Tell Us About Policing and Race*. Cambridge University Press.
- Eberhardt, J. 2019. *Biased: Uncovering the Hidden Prejudice That Shapes What We See, Think, and Do*. Penguin Books.
- Ivers, R., T. Senserrick, S. Boufous, M. Stevenson, H.-Y. Chen, M. Woodward, and R. Norton. 2009. "Novice Drivers' Risky Driving Behavior, Risk Perception, and Crash Risk: Findings from a DRIVE Study." *American Journal of Public Health* 99(9): 1638-1644.
- Ivers, R., T. Senserrick, S. Boufous, M. Stevenson, H.-Y. Chen, M. Woodward, and R. Norton. 2009. "Novice Drivers' Risky Driving Behavior, Risk Perception, and Crash Risk." *American Journal of Public Health* 99(9): 1638-1644.
- Persico, N. and P. Todd. 2008. "The Hit Rates Test for Racial Bias in Motor Vehicle Searches." *Justice Quarterly* 25: 37-53.
- Pierson, E., C. Simoiu, J. Overgoor, *et al.* 2020. "A Large-scale Analysis of Racial Disparities in Police Stops Across the United States. *Nature Human Behavior*. <https://doi.org/10.1038/s41562-020-0858-1>
- Seguino, S. and N. Brooks 2017. *Driving While Black and Brown in Vermont*. [https://www.uvm.edu/gice/pdfs/SeguinoBrooks\\_PoliceRace\\_2017.pdf](https://www.uvm.edu/gice/pdfs/SeguinoBrooks_PoliceRace_2017.pdf)
- Tal, G. and S. Handy. 2005 "The Travel Behavior of Immigrants and Race/Ethnicity Groups: An Analysis of the 2001 National Household Travel Survey." Report No. UCD-ITS-RR-05-24. Institute of Transportation Studies, University of California Davis.
- U.S. Department of Health and Human Services. 2012. "Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings." <https://www.samhsa.gov/data/sites/default/files/NSDUHresults2012/NSDUHresults2012.pdf>
- U.S. Department of Health and Human Services. 2013. "Results from the 2013 Survey on Drug Use and Health: Summary of National Findings." <https://www.samhsa.gov/data/sites/default/files/NSDUHresultsPDFWHTML2013/Web/NSDUHresults2013.pdf>
- U.S. Department of Justice. 2003. "Guidance Regarding the Use of Race by Federal Law Enforcement Agencies." <https://www.justice.gov/crt/guidance-regarding-use-race-federal-law-enforcement-agencies>
- U.S. Department of Justice. 2018. "Contacts Between Police and the Public, 2015." <https://www.bjs.gov/content/pub/pdf/cpp15.pdf>

APPENDIX

Table A.1. Brattleboro Raw Traffic Stop Data, 2014-19

All Years	White	Black	Asian	Hispanic	Native American	Unknown	Total
<b>Total Traffic Stops</b>							
<i>Including externally generated stops</i>	18,016	578	204	194	4	1,212	20,208
<i>Excluding externally generated stops</i>	17,862	568	203	193	4	1,210	20,040
<b>Reasons For Stops</b>							
<i>Safety Stops</i>	16,637	506	192	180	3	1,133	18,651
Moving Violation	16,625	506	192	179	3	1,133	18,638
Suspicion of DWI	12	0	0	1	0	0	13
<i>Investigatory/Pretextual Stops</i>	1,068	47	6	12	0	68	1,201
Investigatory Stop	82	9	0	1	0	1	93
Vehicle Equipment	986	38	6	11	0	67	1,108
<i>Externally Generated Stop</i>	154	10	1	1	0	2	168
<i>Multiple Reasons - Moving Violation &amp; Suspicion of DWI</i>	1	0	0	0	0	0	1
<i>Multiple Reasons - Moving Violation &amp; Vehicle Equipment</i>	2	0	0	0	0	0	2
<i>Multiple Reasons - Suspicion of DWI &amp; Vehicle Equipment</i>	0	0	0	0	0	0	0
<i>Unknown Stop Reason</i>	154	15	5	1	1	9	185
<b>Outcomes</b>							
<i>Ticket</i>	2,211	126	26	29	0	55	2,447
<i>Warning</i>	15,234	415	171	159	4	1,117	17,100
<i>No Action Taken</i>	128	0	2	0	0	21	151
<i>Arrest for violation</i>	130	20	1	4	0	2	157
<i>Arrest for warrant</i>	3	0	0	0	0	0	3
<b>Searches</b>							
<i>Total Stops with No Search</i>	17,626	543	198	191	3	1,192	19,753
No Search & Contraband & Arrest for violation	2	0	0	1	0	0	3
No Search & Contraband & No arrest	9	0	0	0	0	0	9
No Search (all others)	17,615	543	198	190	3	1,192	19,741
<i>Total Stops with Unknown Search</i>	179	9	3	1	1	16	209
<i>Total Stops with Search</i>	57	16	2	1	0	2	78
<i>Search with Probable Cause (PC)</i>	14	4	0	0	0	0	18
Stops with PC Searches, No contraband	7	2	0	0	0	0	9
Stops with PC Searches, Unknown contraband	0	0	0	0	0	0	0
Stops with PC Searches, Contraband	7	2	0	0	0	0	9
<i>Outcomes of PC Search</i>							
Stops with PC Searches, Contraband & Warning, No Action or Unknown	2	0	0	0	0	0	2
Stops with PC Searches, Contraband and Ticket	2	0	0	0	0	0	2
Stops with PC Searches, Contraband and Arrest	3	2	0	0	0	0	5
<i>Search with Reasonable Suspicion (RS)</i>	40	12	1	0	0	2	55
Stops with RS Searches, No contraband	21	8	1	0	0	1	31
Stops with RS Searches, Unknown contraband	0	0	0	0	0	0	0
Stops with RS Searches, Contraband	19	4	0	0	0	1	24
<i>Outcomes of RS Search</i>							
Stops with RS Searches, Contraband & Warning, No Action or Unknown	4	1	0	0	0	0	5
Stops with RS Searches, Contraband & Ticket	7	2	0	0	0	0	9
Stops with RS Searches, Contraband & Arrest	8	1	0	0	0	1	10
<i>Search with Warrant</i>	3	0	1	1	0	0	5
Stops with Warrant Searches, No contraband	1	0	1	1	0	0	3
Stops with Warrant Searches, Unknown contraband	0	0	0	0	0	0	0
Stops with Warrant Searches, Contraband	2	0	0	0	0	0	2
<i>Outcomes of Warrant Search</i>							
Stops with Warrant Searches, Contraband & Warning, No Action or Unknown	1	0	0	0	0	0	1
Stops with Warrant Searches, Contraband & Ticket	0	0	0	0	0	0	0
Stops with Warrant Searches, Contraband & Arrest	1	0	0	0	0	0	1

Table A.2a. Brattleboro Raw Traffic Stop Trend Data (3-year rolling trends)

All Years	White	Black	Asian	Hispanic	Native American	Unknown	Total
<b>Total Traffic Stops</b>							
<i>Excluding externally generated stops</i>							
2014-16	6,623	141	67	51	0	912	7,794
2015-17	10,190	269	118	101	2	755	11,435
2016-18	10,031	331	126	124	3	283	10,898
2017-19	11,239	427	136	142	4	298	12,246
<b>Reasons For Stops (excl. externally generated stops and unknown reasons)</b>							
<i>Safety Stops</i>							
2014-16	6,194	131	65	46	0	870	7,306
2015-17	9,570	254	116	93	2	714	10,749
2016-18	9,339	296	121	117	2	258	10,133
2017-19	10,443	375	127	134	3	263	11,345
2014-16 (% of stops)	93.8%	94.9%	97.0%	90.2%	0.0%	95.7%	94.0%
2015-17 (% of stops)	94.1%	94.8%	98.3%	92.1%	100.0%	95.0%	94.2%
2016-18 (% of stops)	94.2%	91.4%	98.4%	95.1%	100.0%	93.1%	94.1%
2017-19 (% of stops)	94.1%	90.4%	97.0%	95.0%	100.0%	90.1%	93.9%
<i>Pretextual Stops</i>							
2014-16	411	7	2	5	0	39	464
2015-17	597	14	2	8	0	38	659
2016-18	576	28	2	6	0	19	631
2017-19	657	40	4	7	0	29	737
2014-16 (% of stops)	6.2%	5.1%	3.0%	9.8%	0.0%	4.3%	6.0%
2015-17 (% of stops)	5.9%	5.2%	1.7%	7.9%	0.0%	5.1%	5.8%
2016-18 (% of stops)	5.8%	8.6%	1.6%	4.9%	0.0%	6.9%	5.9%
2017-19 (% of stops)	5.9%	9.6%	3.1%	5.0%	0.0%	9.9%	6.1%
<b>Outcomes (excl. externally generated stops)</b>							
<i>Tickets (one or more)</i>							
2014-16	1,049	39	10	10	0	47	1,155
2015-17	1,268	67	11	15	0	14	1,375
2016-18	1,047	80	12	17	0	2	1,158
2017-19	1,162	87	16	19	0	8	1,292
2014-16 (% of stops)	15.8%	27.7%	14.9%	19.6%	0.0%	5.2%	14.8%
2015-17 (% of stops)	12.4%	24.9%	9.3%	14.9%	0.0%	1.9%	12.0%
2016-18 (% of stops)	10.4%	24.2%	9.5%	13.7%	0.0%	0.7%	10.6%
2017-19 (% of stops)	10.3%	20.4%	11.8%	13.4%	0.0%	2.7%	10.6%
<i>Arrests for Violation</i>							
2014-16	30	5	0	0	0	0	35
2015-17	89	13	0	3	0	0	105
2016-18	123	20	0	4	0	2	149
2017-19	100	15	1	4	0	2	122
2014-16 (% of stops)	0.5%	3.6%	0.0%	0.0%	0.0%	0.0%	0.5%
2015-17 (% of stops)	0.9%	4.8%	0.0%	3.0%	0.0%	0.0%	0.9%
2016-18 (% of stops)	1.2%	6.0%	0.0%	3.2%	0.0%	0.7%	1.4%
2017-19 (% of stops)	0.9%	3.5%	0.7%	2.8%	0.0%	0.7%	1.0%
<b>Searches (excl. externally generated stops)</b>							
<i>Searches (PC, RS or Warrant)</i>							
2014-16	21	3	0	0	0	0	24
2015-17	36	7	0	0	0	0	43
2016-18	45	12	1	1	0	2	61
2017-19	36	13	2	1	0	2	54
2014-16 (% of Stops)	0.3%	2.1%	0.0%	0.0%	0.0%	0.0%	0.3%
2015-17 (% of Stops)	0.4%	2.6%	0.0%	0.0%	0.0%	0.0%	0.4%
2016-18 (% of Stops)	0.5%	3.6%	0.8%	0.8%	0.0%	0.7%	0.6%
2017-19 (% of Stops)	0.3%	3.0%	1.5%	0.7%	0.0%	0.7%	0.4%
<i>Contraband (All Outcomes)</i>							
2014-16	13	2	0	0	0	0	15
2015-17	21	3	0	0	0	0	24

2016-18	23	5	0	0	0	1	29
2017-19	15	4	0	0	0	1	20
2014-16 (% of Searches)	61.9%	66.7%	0.0%	0.0%	0.0%	0.0%	62.5%
2015-17 (% of Searches)	58.3%	42.9%	0.0%	0.0%	0.0%	0.0%	55.8%
2016-18 (% of Searches)	51.1%	41.7%	0.0%	0.0%	0.0%	50.0%	47.5%
2017-19 (% of Searches)	41.7%	30.8%	0.0%	0.0%	0.0%	50.0%	37.0%
<i>Contraband (Tickets + Arrests)</i>							
2014-16	11	2	0	0	0	0	1
2015-17	16	3	0	0	0	0	1
2016-18	18	5	0	0	0	1	1
2017-19	10	3	0	0	0	1	1
2014-16 (% of Searches)	52.4%	66.7%	0.0%	0.0%	0.0%	0.0%	5.0%
2015-17 (% of Searches)	44.4%	42.9%	0.0%	0.0%	0.0%	0.0%	2.0%
2016-18 (% of Searches)	40.0%	41.7%	0.0%	0.0%	0.0%	50.0%	2.2%
2017-19 (% of Searches)	27.8%	23.1%	0.0%	0.0%	0.0%	50.0%	1.9%
<i>Contraband (Arrests only)</i>							
2014-16	7	1	0	0	0	0	8
2015-17	9	2	0	0	0	0	11
2016-18	11	3	0	0	0	1	15
2017-19	5	2	0	0	0	1	8
2014-16 (% of Searches)	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%	33.3%
2015-17 (% of Searches)	25.0%	28.6%	0.0%	0.0%	0.0%	0.0%	25.6%
2016-18 (% of Searches)	24.4%	25.0%	0.0%	0.0%	0.0%	50.0%	24.6%
2017-19 (% of Searches)	13.9%	15.4%	0.0%	0.0%	0.0%	50.0%	14.8%

Note. All data exclude externally generated stops.

Table A.2b. Trends in Total Stops by Year

All Years	White	Black	Asian	Hispanic	Native American	Unknown	Total
<b>Total Traffic Stops</b>							
<i>Including externally generated stops</i>							
2014	1,284	33	16	8	0	192	1,533
2015	3,351	67	34	27	0	604	4,083
2016	2,111	48	18	17	0	117	2,311
2017	4,858	164	67	58	2	35	5,814
2018	3,106	124	41	49	1	132	3,453
2019	3,306	142	28	35	1	132	3,644
<i>Excluding externally generated stops</i>							
2014	1,281	33	16	8	0	192	1,530
2015	3,251	62	33	26	0	603	3,975
2016	2,091	46	18	17	0	117	2,289
2017	4,848	161	67	58	2	35	5,171
2018	3,092	124	41	49	1	131	3,438
2019	3,299	142	28	35	1	132	3,637
<i>Annual Percentage Change</i>							
2014 to 2015	153.8%	87.9%	106.3%	225.0%	NA	214.1%	159.8%
2015 to 2016	-35.7%	-25.8%	-45.5%	-34.6%	NA	-80.6%	-42.4%
2016 to 2017	131.9%	250.0%	272.2%	241.2%	NA	-70.1%	125.9%
2017 to 2018	-36.2%	-23.0%	-38.8%	-15.5%	-50.0%	274.3%	-33.5%
2018 to 2019	6.7%	14.5%	-31.7%	-28.6%	0.0%	0.8%	5.8%
<i>Stops per 10,000 residents</i>							
2014	2,331	2,973	899				
2015	5,915	5,586	1,854				
2016	3,805	4,144	1,011				
2017	8,821	14,505	3,764				
2018	5,626	11,171	2,303				
2019	6,003	12,793	1,573				

### Appendix A.3. Data Quality and Methodology

The Brattleboro Police Department (BPD) traffic stop data used in this study consists of 20,590 rows, spanning nine years (2014-2019). Each row corresponds to a single outcome resulting from a traffic stop. There can be multiple outcomes of a stop, and as a result, there were 20,040 stops over this time period. Date and time of stops are not required by legislation, although some agencies have chosen to provide date and time. Because date and time are useful for many types of analysis, the existence and quality of that field of data is reported in this section as well.

#### A. Missing or Unknown Data Values by Field

Table A.3 shows the counts and percentages of missing or unknown data values. Missing data is when the officer fails to record data on a particular field. Unknown is where the officer records “unknown” as a value in a field. In either case, we lack data on that variable and thus we group missing and unknown together in assessing the quality of the data BPD supplies.

Table A.3. Fields with Missing or Unknown Values

Stop Years	Stops	Stop ID	Stop Date/Time	Age	Race	Gender	Stop Reason	Search Reason	Contra-band	Stop Outcome	Reported Accidents	Race in Reported Accidents
<b>Count of Blank or Unknown Rows</b>												
2014	1,530	6	0	4	192	2	4	2	2	2	838	96
2015	3,975	1	0	12	603	10	16	11	11	11	920	275
2016	2,289	4	0	6	117	1	3	75	75	76	869	296
2017	5,171	5,171	0	13	35	4	6	3	3	6	911	143
2018	3,438	3,438	0	57	131	4	123	114	114	94	769	82
2019	3,637	172	0	7	132	22	33	4	4	38	699	42
All Years	20,040	8,792	0	99	1,210	43	185	209	209	227	5,819	956
<b>Percentage of Blank or Unknown Rows</b>												
2014	1,530	0.4%	0.0%	0.3%	12.6%	0.1%	0.3%	0.1%	0.1%	0.1%	838	11.5%
2015	3,975	0.0%	0.0%	0.3%	15.2%	0.3%	0.4%	0.3%	0.3%	0.3%	920	29.9%
2016	2,289	0.2%	0.0%	0.3%	5.1%	0.0%	0.1%	3.3%	3.3%	3.3%	869	34.1%
2017	5,171	100.0%	0.0%	0.3%	0.7%	0.1%	0.1%	0.1%	0.1%	0.1%	911	15.7%
2018	3,438	100.0%	0.0%	1.7%	3.8%	0.1%	3.6%	3.3%	3.3%	2.7%	769	10.7%
2019	3,637	4.7%	0.0%	0.2%	3.6%	0.6%	0.9%	0.1%	0.1%	1.0%	699	6.0%
All Years	20,040	43.9%	0.0%	0.5%	6.0%	0.2%	0.9%	1.0%	1.0%	1.1%	5,819	16.4%

Note: Data exclude externally generated stops.

The definitions for missing or unknown values by field are:

- Age – Blank or 0
- Race – Blank, “Business”, “Unknown - U” or “Other – U”
- Gender – Blank, Business, NA or “Transgendered - T”
- Stop Reason – Blank or “O = Other violation”
- Search Reason – Blank
- Search Outcome – Blank
- Stop Result – Blank.

Analysis of the BPD data shows that required field values are sometimes missing or incorrect. Except for the optional Date/Time field, the number of fields with problem values has been reduced starting in 2017. Missing or unknown values for driver race have been the most common. This is concerning since race is the key variable of interest in traffic stop data. Although missing race data has declined since 2014, even in 2019, race is missing in 3.6% of all rows of data. About 6% of accident reports had missing race data in 2019. This category of data is not required by the legislation but it is important as a benchmark for assessing racial share of stops and agencies should consider placing more emphasis on ensuring accident reports are complete.

Table A.3b shows the number and percentage of BPD traffic stop reports with at least one field with a missing/unknown value.

Table A.3b. Stops With at Least One Missing/Unknown Data Value

Stop Years	Total Stops	Stops Missing Value(s)	% of Stops Missing Value(s)
2014	1,530	199	13.0%
2015	3,975	625	15.7%
2016	2,289	189	8.3%
2017	5,171	59	1.1%
2018	3,438	278	8.1%
2019	3,637	205	5.6%
All Years	20,040	1,555	7.8%

Table A.3c provides data on the relationship between missing or unknown values and race of driver. We would expect data to be missing at the same rates across racial groups. It is therefore concerning that stop reason is missing at a higher rate for Black and Asian drivers than other groups.

Table A.3c. Missing or Unknown Values by Race

	White	Black	Asian	Hispanic	Unknown
<b>Count of Blank or Unknown Rows</b>					
Total Stops (excl. EGS)	17,862	568	203	193	1,210
Unknown Stop Reason	154	15	5	1	9
Unknown Stop Outcome	194	7	3	1	22
Unknown if Search occurred	179	9	3	1	16
Unknown if Contraband found subsequent to a search	0	0	0	0	0
Unknown Outcome if contraband found	0	0	0	0	0
<b>Percentage of Blank or Unknown Rows</b>					
Unknown Stop Reason as % of all stops	0.9%	2.6%	2.5%	0.5%	0.7%
Unknown Stop Outcome as % of all outcomes	1.1%	1.2%	1.5%	0.5%	1.8%
Unknown if Search occurred as % of all stops	1.0%	1.6%	1.5%	0.5%	1.3%
Unknown if Contraband found as % of all searches	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown Outcome if contraband found as % of all searches	0.0%	0.0%	0.0%	0.0%	0.0%

## B. Stop IDs

Most Vermont traffic stop data files contain only one stop outcome per row (where an outcome can be one arrest, one ticket, one warning, etc.). However, a single traffic stop can have multiple outcomes. For example, it is possible for a single stop to result in multiple tickets being issued, or other combinations such as a ticket and a warning, and so forth. It is important to be able to collect multiple outcomes into stops to avoid overcounting as well as to recognize stops where more than one ticket is issued. Identifying multiple outcomes for a stop can be a challenge. Some datasets provide stop IDs that enable this association. When stop IDs are present, each one of a stop's outcomes will have the same stop ID and so can be associated and analyzed together. When stop IDs are absent, a heuristic approach is used to attempt to group together outcomes. This technique associates outcomes using a combination of fields with matching values. Typically, the following set of fields is used to identify incidents: agency, date/time, age, gender, and race.

For the six years of data available from Brattleboro, the Stop IDs provided were not directly usable to tie together multiple outcomes for stops. However, the dates, times and other fields were available to derive Stop IDs (Table A.3d).

Table A.3d. Brattleboro Stop IDs

Year	Usable Stop ID	Could Derive Stop IDs	Stop Count	Row Count
2014	No	Yes	1533	1544
2015	No	Yes	4083	4085
2016	No	Yes	2311	2316
2017	No	Yes	5184	5191
2018	No	Yes	3453	3458
2019	Partial	Yes	3644	3996

Table A.4. Variable Definitions

Variable	Formula
<b>Total Traffic Stops</b>	
Including externally generated stops	Count of all stops
Excluding externally generated stops	Count of all stops except where stop reason is “externally generated stop”
<b>Reasons For Stops</b>	
<i>Safety Stops</i>	Count of all stops where stop reason is “moving violation” or “suspicion of DWI”
Moving Violation	Count of all stops where stop reason is “moving violation”
Suspicion of DWI	Count of all stops where stop reason is “suspicion of DWI”
<i>Investigatory/Pretextual Stops</i>	Count of all stops where stop reason is “investigatory stop” or “vehicle equipment”
Investigatory Stop	Count of all stops where stop reason is “investigatory stop”
Vehicle Equipment	Count of all stops where stop reason is “vehicle equipment”
Externally Generated Stop	Count of all stops where stop reason is “externally generated stop”
<i>Multiple Reasons - Moving Violation &amp; Suspicion of DWI</i>	Count of all stops where stop reasons include both “moving violation” and “suspicion of DWI”
<i>Multiple Reasons - Moving Violation &amp; Vehicle Equipment</i>	Count of all stops where stop reasons include both “moving violation” and “vehicle equipment”
<i>Multiple Reasons - Suspicion of DWI &amp; Vehicle Equipment</i>	Count of all stops where stop reasons include both “suspicion of DWI” and “vehicle equipment”
<i>Unknown Stop Reason</i>	Count of all stops where stop reason is “unknown”
<b>Outcomes (excl. EGS)</b>	
Ticket	Count of all stops where at least one ticket was issued.
Warning	Count of all stops where at least one warning was issued.
No action taken	Count of all stops where no action was taken was issued.
Arrest for violation	Count of all stops where there was an arrest for violation.
Arrest for warrant	Count of all stops where there was an arrest for warrant.
<b>Searches</b>	
<i>Total stops with no search</i>	Count of all stops where search reason was “no search”
No Search & Contraband & Arrest for violation	Count of all stops where search reason was “no search” and stop search outcome was “contraband” and there was an arrest for violation
No Search & Contraband & No Arrest	Count of all stops where search reason was “no search” and stop search outcome was “contraband” and there was not an arrest for violation
No Search (all others)	Count of all stops where search reason was “no search” and stop search outcome was not “contraband”
<i>Total Stops with Unknown Search</i>	Count of all stops where search reason was “unknown”
<i>Total Stops with Search</i>	Count of all stops where search reason was one of “probable cause,” “reasonable suspicion,” or “warrant”
<i>Search with Probable Cause (PC)</i>	Count of all stops where search reason was “probable cause”
Stops with PC Searches, No contraband	Count of all stops where search reason was “probable cause” and search outcome was “no contraband” or “no search”

Variable	Formula
Stops with PC Searches, Unknown contraband	Count of all stops where search reason was “probable cause” and search outcome was “unknown”
Stops with PC Searches, Contraband	Count of all stops where search reason was “probable cause” and search outcome was “contraband”
<i>Outcomes of PC Search</i>	
Stops with PC Searches, Contraband & Warning, No Action or Unknown*	Count of all stops where search reason was “probable cause” and search outcome was “contraband” and one or more of the following outcomes were recorded: “warning,” “no action,” or “unknown” but no tickets or arrests
Stops with PC Searches, Contraband and Ticket*	Count of all stops where search reason was “probable cause” and search outcome was “contraband” and one or more tickets were issued but no arrest
Stops with PC Searches, Contraband and Arrest*	Count of all stops where search reason was “probable cause” and search outcome was “contraband” and one or more arrests were made (for Violation or Warrant)
Search with Reasonable Suspicion (RS)	Count of all stops where search reason was “reasonable suspicion”
Stops with RS Searches, No contraband	Count of all stops where search reason was “reasonable suspicion” and search outcome was “no contraband” or “no search”
Stops with RS Searches, Unknown contraband	Count of all stops where search reason was “reasonable suspicion” and search outcome was “unknown”
Stops with RS Searches, Contraband	Count of all stops where search reason was “reasonable suspicion” and search outcome was “contraband”
<i>Outcomes of RS Search</i>	
Stops with RS Searches, Contraband & Warning, No Action or Unknown	Count of all stops where search reason was “reasonable suspicion” and search outcome was “contraband” and one or more of the following outcomes were recorded: “warning,” “no action,” or “unknown” but no tickets or arrests
Stops with RS Searches, Contraband & Ticket*	Count of all stops where search reason was “reasonable suspicion” and search outcome was “contraband” and one or more tickets were issued but no arrest
Stops with RS Searches, Contraband & Arrest*	Count of all stops where search reason was “reasonable suspicion” and search outcome was “contraband” and one or more arrests were made (for Violation or Warrant)
Search with Warrant	Count of all stops where search reason was “warrant”.
Stops with Warrant Searches, No contraband	Count of all stops where search reason was “warrant” and search outcome was “no contraband” or “no search”
Stops with Warrant Searches, Unknown contraband	Count of all stops where search reason was “warrant” and search outcome was “unknown”
Stops with Warrant Searches, Contraband	Count of all stops where search reason was “warrant” and search outcome was “contraband”
<i>Outcomes of Warrant Search</i>	
<i>Stops with Warrant Searches, Contraband &amp; Warning, No Action or Unknown</i>	Count of all stops where search reason was “warrant” and search outcome was “contraband” and one or more of the following outcomes were recorded: “warning,” “no action,” or “unknown” but no tickets or arrests
Stops with Warrant Searches, Contraband & Ticket*	Count of all stops where search reason was “warrant” and search outcome was “contraband” and one or more tickets were issued but no arrest

Variable	Formula
Stops with Warrant Searches, Contraband & Arrest*	Count of all stops where search reason was “warrant” and search outcome was “contraband” and one or more arrests were made
<b>Racial Shares of Stops</b>	
Including externally generated stops	Number of stops for a race divided by number of stops for all races
Excluding externally generated stops	Number of non-EGS for a race divided by number of non-EGS for all races
Racial share of stops (ACS)	Percentage of area residents of a particular race as determined by the American Community Survey (ACS) five-year estimates for 2013-2017 (See <a href="https://www.census.gov/programs-surveys/acs">https://www.census.gov/programs-surveys/acs</a> )
Racial share of stops (DMV accident data)	Percentage of area drivers of a particular race as determined by Vermont DMV Accident data for 2013-18.
Disparity Index (using ACS)	For a particular race, the Disparity Index (ACS) is the % of non-EGS for that race divided by the % of area residents for that race based on the ACS 5-year estimates from 2013-2017.
Disparity Index (using DMV Accident data)	For a particular race, the Disparity Index (DMV) is the % of non-EGS stops for that race by the % of area drivers for that race based on Vermont DMV accident data for 2013-2018.
<b>Stop Reason as % of All Stops</b>	
<i>Safety Stops</i>	% of all stops where stop reason is “moving violation” or “suspicion of DWI”
Moving Violation	% of all stops where stop reason is “moving violation”
Suspicion of DWI	% of all stops where stop reason is “suspicion of DWI”
<i>Investigatory/ Pretextual Stops</i>	% of all stops where stop reason is “investigatory stop” or “vehicle equipment”
Investigatory Stops	% of all stops where stop reason is “investigatory stop”
Vehicle Equipment	% of all stops where stop reason is “vehicle equipment”
<i>Externally Generated Stops</i>	% of all stops where stop reason is “externally generated stop”
<i>Multiple Reasons</i>	% of all stops where there are multiple stop reasons in the following combinations: “moving violation” and “suspicion of DWI” or “moving violation” and “vehicle equipment” or “suspicion of DWI” and “vehicle equipment”
<i>Unknown Reason</i>	% of all stops where stop reason is “unknown”
<b>Outcome Rates as a % of All Stops</b>	
<i>Warning Rate</i>	% of non-EGS stops where at least one warning was issued
<i>Ticket Rate</i>	% of non-EGS stops where at least one ticket was issued
<i>Arrest for Violation Rate</i>	% of non-EGS stops where there was an arrest for violation
<i>Arrest for Warrant Rate</i>	% of non-EGS stops where there was an arrest for warrant
<i>No Action Rate</i>	% of non-EGS stops where there was no action taken
<i>Search Rates</i>	
<i>Search rate (excl. searches on warrant)</i>	% of non-EGS stops where the search reason was “probable cause” or “reasonable suspicion”

Variable	Formula
<i>Search rate (incl. searches on warrant)</i>	% of non-EGS stops where the search reason was “probable cause,” “reasonable suspicion,” or “warrant search”
<i>Hit rates (as a % of PC, RS, &amp; Warrant Searches)</i>	
<i>Hit rates (incl. all outcomes)</i>	% of non-EGS stops where the search reason was “probable cause,” “reasonable suspicion,” or “warrant” and contraband was found
<i>Hit rates (excl. warnings as outcomes)</i>	% of non-EGS where the search reason was “probable cause,” “reasonable suspicion,” or “warrant” and contraband was found, and the stop resulted in at least one ticket or arrest
<i>Hit rates (outcome = arrest)</i>	% of non-EGS stops where the search reason was “probable cause,” “reasonable suspicion,” or “warrant” and contraband was found, and the stop resulted in an arrest for violation or warrant