2018 MNPD Vehicle Stops: Comparative Methodologies for Evaluating Implicit Bias

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Nashville and Davidson County

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Introduction

In 2000, The Tennessee General Assembly created a pilot program in which 44 Tennessee law enforcement agencies volunteered to collect detailed information for vehicle stops, including race, ethnicity, and gender of driver. In 2001, the Metropolitan Nashville Police Department (MNPD) began collecting this information for vehicle stops initiated in Metro Nashville. Although the State of Tennessee has since discontinued the program and does not require law enforcement agencies to collect the additional information, MNPD has elected to continue the practice.

A primary purpose for collecting vehicle stop data is to analyze whether officers are engaging a disproportionate amount of drivers according to the demographic breakdown of Davidson County's population.

The data collection instrument is *MNPD Form 252 – Vehicle Stops Data Form*, a modified state form that includes MNPD-specific data entries, such as address of stop, complaint number, ticket number, residency of the driver, officer employee identification number, and driver's license number. All Metropolitan Nashville Police Department officers are required to complete *MNPD Form 252 – Vehicle Stops Data Form* whenever a vehicle is stopped. This includes moving traffic violations, vehicle equipment violations, and for investigative reasons. Each record denotes if a citation is issued, an arrest is made, or a search is conducted. The officer initiating the stop must use their personal observation to determine race and ethnicity of the driver.

The US Department of Justice has identified standards for federal law enforcement officers when conducting vehicle stops stating that, "Federal law enforcement officers may not use race, ethnicity, gender, national origin, religion, sexual orientation, or gender identity to any degree, except that officers may rely on the listed characteristics in a specific suspect description" (US Department of Justice, 2014). The Metropolitan Nashville Police Department has demonstrated an open commitment to unbiased policing. The Department recognized the need to collect vehicle stop information well before the State of Tennessee initiated a pilot test program. It was coincidental that MNPD was able to take part in the 2001 pilot test. MNPD has long committed to building trust and credibility for police in the community.

The Metropolitan Nashville Police Department, Strategic Development Division produces weekly reports that list the number of vehicle stops, citations, and arrests made for each Precinct and Detail. This report attempts to go beyond basic counts by examining relationships between vehicle stop data and other factors (police workload, crime, crashes, licensed drivers, etc.).

Purpose

To address the methodology used and results from the analysis of the Metropolitan Nashville Police Department's (MNPD) evaluation of the 2018 Motor Vehicle Stop Data Collection Program. This assessment emphasized an analysis of Black, White, and Hispanic licensed drivers in Davidson County.

Executive Summary

Law enforcement agencies across the country continue to be challenged to establish viable and reliable methods to explain why disproportionate amounts of vehicle stops of racial/ethnic minorities occur within a jurisdiction.

While a single best way to analyze motor vehicle stop data has yet to be established, special care has been taken to assure that individual motorists and officers can not be identified in this study—the dataset is only analyzed in the aggregate. The purpose of the study is to assess whether the department as a whole is acting professionally—not identify or isolate the conduct of individual officers.

Empirical data collected for motor vehicle stops yield inconclusive results, do not determine causation, and can be easily misinterpreted. Although a higher percent of Black than White drivers were stopped when compared to Davidson County population estimates, causation cannot be fully explained. A more appropriate benchmark for the determination of racial bias should be used rather than population estimates. An analysis of 2018 stops compared to crashes show that discrepancies by race still exist, but are not as dramatic.

A Geographic Information System (GIS) was used to evaluate spatial relationships of the motor vehicle stop data. Use of a uniform grid (equal area per grid cell) with addresses of licensed drivers proved to be more valid than using U.S. Bureau of Census boundaries and population. The grid method compared the locations of vehicle stops, crime, and police workload against home addresses of Tennessee licensed drivers.

Using this data, the Pearson correlation coefficient was analyzed for several different sets of variables. The Pearson coefficient (Pearson's *r*) is a measure of the correlation between two variables, resulting in a value between -1 and +1 (for explanation, see page 8). It is a widely used statistic for measuring the strength of linear dependence between two variables.

The following VERY STRONG correlations were observed for the 2018 data:

- Officer activity time and incident locations (violent and property);
- Officer activity time and where drivers are stopped;
- Stop locations by race of driver compared to crash locations by race of driver.

Data Analysis and Results

Vehicle stop data is collected via *MNPD Form 252*, from either the hard copy form or the InPursuit eForm application in RMS. Data tables are stored on a SQL server. In 2018, officers conducted 204,400 vehicle stops in Davidson County—75,438 Black motorists, 118,913 White motorists, and 13,163 Hispanic motorists. Although the following race categories were not evaluated in this study, there were 2,834 Asian/Pacific Islanders, 42 American Indian/Alaskans, and 7,173 "Other" motorists stopped while operating a motor vehicle. 19.2% of the drivers stopped were issued citations, and 8.0% of vehicle stops resulted in an arrest (physical and/or citation arrest). Arrests made as a result of a vehicle stop (16,432) represented 27.5% of all arrests (59,659) made in Davidson County in 2018. This is a slight percentage increase from 2017, when arrests made as a result of a vehicle stop (18,066) represented 25.9% of all Davidson County arrests (69,641). This high count of chargeable offenses resulting from traffic stops supports the efficacy of the traffic stop as an enforcement tool—irrespective of citation issuance vs. warning.

State of Tennessee licensed driver data for Davidson County residents were compared to the vehicle stop information. The MNPD Crime Analysis Section used SPSS statistical software and ArcView Geographic Information System (GIS) mapping software to gain a clearer understanding of the comparative relationships.

Limitations and Assumptions

- Census data only represents the race and ethnicity of residents within the jurisdiction by census tract and census block and is not an accurate representation of the driver demographics in an area.
- Driver license race information was regarded as a more valid measure than census population information, but does not account for hot spot law enforcement initiatives.
- The movement of licensed drivers after license issuance may impact the validity of the data.
- Information on licensed drivers who reside outside of the area being studied, or do not have a valid driver license who are driving on local roads is unknown.
- It is impractical for a Police Department with such a large jurisdiction as Nashville (525 square miles) to conduct observational-type surveys on race and ethnicity of drivers on all of the major roads within the county. In addition, it is extremely difficult to determine the race/ethnicity of drivers based solely on an observer's perception of a moving motor vehicle's driver.
- More police are deployed in areas with high Calls for Service volume.
- Biannual workload assessments are performed to determine the optimum allocation of Patrol Zone Officers. The primary type of information used to perform the analysis is minutes of officer activity by location. The overall trend demonstrates that patrol zones (beats) are smaller towards the inner city and larger in the more rural areas near the county line. Thus, more officers are deployed towards the inner city, based on demand for police services.

Vehicle Stops to Population

Davidson County's demographic characteristics change significantly during the 10-year gap between decennial censuses. Therefore, population estimates from the 2017 American Community Survey (ACS) 1-year sample dataset are used in this analysis. Population estimates of individuals age 16 and over were used as a population base.

Table 1. 2017 American Community Survey Population Estimates (One-Year Estimate)

	Black	***White***	***Hispanic***	***Estimated Total Population***
All Ages	185,187	447,669	71,072	691,243
16 Years & Up	145,580	372,869	45,998	560,583

Source: ACS 2017 (1-Year Sample) Tables DP05, B20005, B20005A, B20005B, and B20005I.

One might expect traffic stops to be distributed proportionately among the various race/ethnicity categories. However, the following findings were observed:

Vehicle stops for Black drivers accounted for 36.9% of all stops, vehicle stops for White drivers accounted for 58.2% of all stops, and vehicle stops for drivers with a Hispanic Ethnicity accounted for 6.4% of all stops.

Black drivers accounted for 26.0% of the driving population, White drivers accounted for 66.5% of the driving population, and Hispanic drivers accounted for 8.2% of the driving population.

Using driving population (residents age 16 and over) as a benchmark:

- Black drivers were stopped 10.9 percentage points higher than the benchmark;
- White drivers were stopped 8.3 percentage points lower than the benchmark;
- Hispanic drivers were stopped 1.8 percentage points lower than the benchmark.

Table 2. Vehicle Stop to Population Comparison, by Race / Ethnicity of Driver

Race / Ethnicity	***Stops (Percent of Total Drivers)***	***2017 Population Estimate Age 16+***	***Percentage Point Difference***
Black Drivers	36.9%	26.0%	10.9%
White Drivers	58.2%	66.5%	-8.3%
Hispanic Drivers	6.4%	8.2%	-1.8%

Benchmarking

In determining the presence of racial bias in vehicle stops, the population of drivers stopped is often compared against a measured population—a process known as "benchmarking." For a benchmark test to correctly estimate whether Black, White, and Hispanic drivers are treated alike, the denominator that is chosen must accurately reflect the appropriate risk set (Neil and Winship, 2019). Often, the denominator is a population estimate obtained from US Census or driver's license data. However, many limitations exist with using Census / DL data as a benchmark. Census / DL counts do not accurately portray the actual driving population or how driving patterns change throughout the day. Commuting patterns dramatically impact volume and the demographics of drivers using Davidson County roadways. Furthermore, Census / DL benchmarking does not account for the driving activity of out-of-county residents or racial differences in driving behavior (Ridgeway and MacDonald, 2010).

Alpert (2004) suggests that using drivers involved in crashes as a benchmark "could act as a relatively inexpensive and readily available denominator for research on topics where a baseline of drivers is needed, including research on racial profiling." MNPD collects crash data through the Tennessee Integrated Traffic Analysis Network (TITAN), which showed that 69,414 drivers were involved in Davidson County crashes in 2018. In the TITAN system, driver race and ethnicity is optional and was only collected for 63.1% of the 2018 drivers. Records missing race were excluded from the analysis. For the remaining crash records, White drivers represented 64.1% of total drivers, Black drivers represented 33.6% of total drivers, and Hispanic drivers represented 6.1% of total drivers.

Using drivers involved in crashes as a benchmark:

- Black drivers were stopped 3.3 percentage points higher than the benchmark;
- White drivers were stopped 6.0 percentage points lower than the benchmark;
- Hispanic drivers were stopped 0.3 percentage points higher than the benchmark.

Table 3. Vehicle Stop to Crash Comparison, by Race / Ethnicity of Driver

Race / Ethnicity	*Stops (Percent of Total Drivers)*	*Crashes (Percent of Total Drivers)*	*Percentage Point Difference*
Black Drivers	36.9%	33.6%	3.3%
White Drivers	58.2%	64.1%	-6.0%
Hispanic Drivers	6.4%	6.1%	0.3%

White drivers were issued citations at a higher rate (21.0%) than Black and Hispanic drivers (15.6% and 19.5%, respectively).

Black drivers were searched at a higher rate (5.3%) than White and Hispanic drivers (2.1% and 4.3%, respectively). 2.1% of Black drivers gave consent to search compared to 1.7% of Hispanic drivers and 1.0% of White drivers. 2.5% of Black drivers and Hispanic drivers were searched incident-to-arrest compared to 1.2% of White drivers. The rate for search due to evidence in plain view was 0.8% for Black drivers, 0.5% for Hispanic drivers, and 0.3% for White drivers.

Hispanic drivers were arrested at a higher rate than White and Black drivers. 24.3% of vehicle stops for Hispanic drivers resulted in arrest (physical arrest or misdemeanor citation arrest), compared to 11.5% for Black drivers and 5.7% for White drivers.

An examination of arrest charges shows that a majority of arrests resulting from a vehicle stop included a driver's license-related violation. 60.4% of vehicle stops involving the arrest of a Hispanic driver included a violation of the provisions of TCA Title 55, Chapter 50 (offenses include: *TCA 55-50-301* driving without a license, and *TCA 55-50-504 (a)* driving on a suspended, canceled, or revoked license). 53.4% of vehicle stops involving the arrest of a non-Hispanic driver included a violation of TCA Title 55, Chapter 50.

Table 4. Percentage of Drivers Who Were Issued Citations, Searched, or Arrested

	Vehicle Stops	***Percent of Stops Issued Traffic Citations***	***Percent of Stops Searched***	***Percent of Stops Arrested***
Black Drivers	75,438	15.6%	5.3%	11.5%
White Drivers	118,913	21.0%	2.1%	5.7%
Hispanic Drivers	13,163	19.5%	4.3%	24.3%
County Total	204,400	19.2%	3.3%	8.0%

Geographic Information Systems (GIS) Analysis

The MNPD Crime Analysis Section used Geographic Information System (GIS) software to map densities of vehicle stop, crime, population, and police workload information. Through an automated geocoding process, the geographic locations of vehicle stops were plotted in the GIS. 94.3% of the vehicle stop locations were successfully matched to a location on the map. This match rate is considered to be very good and is made possible because the address data originates from MNPD's Computer Aided Dispatch system, which verifies addresses as records are created by officers in the field.

Police patrol personnel are allocated to areas based on the demand for police services, with consideration taken for the severity of each offense type. The demand for police services is greater towards the inner city. Furthermore, additional police resources in the form of Crime Suppression Officers, DUI Task Force, Flex Officers, Walking & Bike Officers, and Special Events Officers are routinely assigned in and around the inner city area. There are generally more police field officers available in the inner city than towards the county line. A map of patrol zone/beat officer boundaries can be found in the **Appendix.**

Additionally, the geographic distribution of licensed driver residences remains diverse across Davidson County. The demographic characteristics of areas where higher concentrations of police officers are deployed are significantly different than areas containing lower concentrations of officers.

Vehicle stop, crime, crash, driver license, and police workload information were assessed using uniform grids. This methodology was preferred over a method incorporating census tracts, because each grid cell encompassed an equal area (1.6 square miles in this analysis). A z-score was assigned to each grid cell in each dataset, allowing for density analysis, which provides a straightforward approach to understanding the information quickly. The addresses of Black, White, and Hispanic Tennessee licensed drivers were geocoded and aggregated by grid cell. U.S. Census Bureau demographic information could not be accurately interpreted to grids, since these counts are summarized at the county level.

Grid maps are included in the **Appendix**. The maps show that higher concentrations of vehicle stops occur in the inner city area, as well as higher concentrations of minutes of officer activity, number of officers at incidents, and index crimes as defined by Uniform Crime Report guidelines. Summarized by race/ethnicity, each licensed driver population significantly differs from the others.

Correlation Coefficients

The MNPD Crime Analysis Section used SPSS statistical software to calculate bivariate correlation coefficients (Pearson's *r*) for several sets of variables—assessments of the linear relationship between vehicle stop information against police workload, crime, crashes, etc. The Pearson coefficient is a measure of the linear dependence of two variables, resulting in a value between +1 and −1.

Pearson correlation coefficients were calculated to determine *r* values and were found to be significant at the 0.01 (2 tailed) level. When the *r* value equals 0, there is no relationship between the two variables. The closer the *r* value gets to 1 or -1, the greater the relationship between the two variables. **Table 5** shows seven levels of magnitude for interpreting the Pearson Correlation Coefficient, ranging from *WEAK* to *VERY STRONG*. Only correlation between data variables could be demonstrated; causation cannot be proved.

Table 5. Pearson Correlation Coefficient Magnitude

Correlation Coefficient (r* value*) Range			***Interpretation***
0.000	-	0.299	Weak Positive Correlation
0.300	-	0.499	Moderate Positive Correlation
0.500	-	0.549	High Positive Correlation
0.550	-	0.649	Very High Positive Correlation
0.650	-	0.749	Moderately Strong Positive Correlation
0.750	-	0.849	Strong Positive Correlation
0.850	-	1.000	Very Strong Positive Correlation

The correlation coefficients allow us to make more precise interpretations of the relationships of the density grids displayed on the density maps. In essence, there was sufficient evidence to conclude the following:

VERY STRONG positive correlation (r = 0.897) between where drivers crash and where drivers are stopped.
VERY STRONG positive correlation (r = 0.920) between where Black drivers crash and where Black drivers are stopped.
VERY STRONG positive correlation (r = 0.871) between where White drivers crash and where White drivers are stopped.
VERY STRONG positive correlation (r = 0.911) between where Hispanic drivers crash and where Hispanic drivers are stopped.

Correlations between the locations where W/B/H drivers live and where W/B/H drivers are stopped are weaker:

STRONG positive correlation (r = 0.756) between where Black drivers live and where Black drivers are stopped.
VERY HIGH positive correlation (r = 0.617) between where White drivers live and where White drivers are stopped.
STRONG positive correlation (r = 0.827) between where Hispanic drivers live and where Hispanic drivers are stopped.

These observations suggest that officers prioritize conducting stops in high-crash areas, over areas in which a particular race / ethnicity resides.

VERY STRONG positive correlations exist between police workload and locations where violent and property incidents are reported by victims:

VERY STRONG positive correlation (p = 0.948) between where violent incidents are reported and number of officers at incidents.
VERY STRONG positive correlation (p = 0.962) between where property incidents are reported and number of officers at incidents.
VERY STRONG positive correlation (p = 0.945) between where drivers are stopped and number of officers at incidents.
VERY STRONG positive correlation (p = 0.951) between where violent incidents are reported and officer activity time at incidents.
VERY STRONG positive correlation (p = 0.958) between where property incidents are reported and officer activity time at incidents.
VERY STRONG positive correlation (p = 0.932) between where drivers are stopped and officer activity time at incidents.

These observations strongly suggest that officers engage in an increased amount of activity in areas where crime incidents are more frequently reported.

However, focused traffic enforcement in high-crime and high-crash areas may result in consequences, including correlations such as:

STRONG positive correlation (p = 0.794) between where Black drivers live and number of officers at incidents.
STRONG positive correlation (p = 0.801) between where Black drivers live and officer activity time at incidents.
HIGH positive correlation (p = 0.543) between where White drivers live and number of officers at incidents.
HIGH positive correlation (p = 0.533) between where White drivers live and officer activity time at incidents.
MODERATE positive correlation (p = 0.438) between where Hispanic drivers live and number of officers at incidents.
MODERATE positive correlation (p = 0.453) between where Hispanic drivers live and officer activity time at incidents.

Table 6. The Bivariate Correlation Coefficients of Vehicle Stops to Police Workload by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
Number of Officers at Incidents	Vehicle Stops (Black)	**0.939**	**Very Strong Positive Correlation**
	Citations Issued from Stops (Black)	0.844	Strong Positive Correlation
	Arrests Made from Stops (Black)	**0.897**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (Black)	**0.891**	**Very Strong Positive Correlation**
	Vehicle Stops (White)	**0.890**	**Very Strong Positive Correlation**
	Citations Issued from Stops (White)	0.822	Strong Positive Correlation
	Arrests Made from Stops (White)	0.816	Strong Positive Correlation
	Searches from Vehicle Stops (White)	0.845	Strong Positive Correlation
	Vehicle Stops (Hispanic)	0.702	Moderately Strong Positive Correlation
	Citations Issued from Stops (Hispanic)	0.591	Very High Positive Correlation
	Arrests Made from Stops (Hispanic)	0.608	Very High Positive Correlation
	Searches from Vehicle Stops (Hispanic)	0.564	Very High Positive Correlation
Minutes of Officer Activity at Incident Locations	Vehicle Stops (Black)	**0.929**	**Very Strong Positive Correlation**
	Citations Issued from Stops (Black)	0.845	Strong Positive Correlation
	Arrests Made from Stops (Black)	**0.889**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (Black)	**0.884**	**Very Strong Positive Correlation**
	Vehicle Stops (White)	**0.873**	**Very Strong Positive Correlation**
	Citations Issued from Stops (White)	0.818	Strong Positive Correlation
	Arrests Made from Stops (White)	0.812	Strong Positive Correlation
	Searches from Vehicle Stops (White)	0.836	Strong Positive Correlation
	Vehicle Stops (Hispanic)	0.707	Moderately Strong Positive Correlation
	Citations Issued from Stops (Hispanic)	0.597	Very High Positive Correlation
	Arrests Made from Stops (Hispanic)	0.615	Very High Positive Correlation
	Searches from Vehicle Stops (Hispanic)	0.573	Very High Positive Correlation

Table 7. The Bivariate Correlation Coefficients of Vehicle Stops to Crime by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
Violent Part One Incidents	Vehicle Stops (Black)	**0.908**	**Very Strong Positive Correlation**
	Citations Issued from Stops (Black)	0.785	Strong Positive Correlation
	Arrests Made from Stops (Black)	**0.879**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (Black)	**0.889**	**Very Strong Positive Correlation**
	Vehicle Stops (White)	0.765	Strong Positive Correlation
	Citations Issued from Stops (White)	0.721	Moderately Strong Positive Correlation
	Arrests Made from Stops (White)	0.769	Strong Positive Correlation
	Searches from Vehicle Stops (White)	0.757	Strong Positive Correlation
	Vehicle Stops (Hispanic)	0.711	Moderately Strong Positive Correlation
	Citations Issued from Stops (Hispanic)	0.560	Very High Positive Correlation
	Arrests Made from Stops (Hispanic)	0.638	Very High Positive Correlation
	Searches from Vehicle Stops (Hispanic)	0.584	Very High Positive Correlation
Property Part One Incidents	Vehicle Stops (Black)	**0.889**	**Very Strong Positive Correlation**
	Citations Issued from Stops (Black)	0.790	Strong Positive Correlation
	Arrests Made from Stops (Black)	0.840	Strong Positive Correlation
	Searches from Vehicle Stops (Black)	0.832	Strong Positive Correlation
	Vehicle Stops (White)	**0.871**	**Very Strong Positive Correlation**
	Citations Issued from Stops (White)	0.776	Strong Positive Correlation
	Arrests Made from Stops (White)	0.792	Strong Positive Correlation
	Searches from Vehicle Stops (White)	0.830	Strong Positive Correlation
	Vehicle Stops (Hispanic)	0.683	Moderately Strong Positive Correlation
	Citations Issued from Stops (Hispanic)	0.557	Very High Positive Correlation
	Arrests Made from Stops (Hispanic)	0.587	Very High Positive Correlation
	Searches from Vehicle Stops (Hispanic)	0.560	Very High Positive Correlation
Drug Incidents	Vehicle Stops (Black)	**0.934**	**Very Strong Positive Correlation**
	Citations Issued from Stops (Black)	0.849	Strong Positive Correlation
	Arrests Made from Stops (Black)	**0.917**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (Black)	**0.916**	**Very Strong Positive Correlation**
	Vehicle Stops (White)	0.839	Strong Positive Correlation
	Citations Issued from Stops (White)	0.820	Strong Positive Correlation
	Arrests Made from Stops (White)	0.754	Strong Positive Correlation
	Searches from Vehicle Stops (White)	0.778	Strong Positive Correlation
	Vehicle Stops (Hispanic)	0.641	Very High Positive Correlation
	Citations Issued from Stops (Hispanic)	0.565	Very High Positive Correlation
	Arrests Made from Stops (Hispanic)	0.541	High Positive Correlation
	Searches from Vehicle Stops (Hispanic)	0.500	High Positive Correlation

Table 8. The Bivariate Correlation Coefficients of Vehicle Stops to Suspects by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
Black Suspects Described By Victim in Incident Reports	Vehicle Stops (Black)	**0.897**	**Very Strong Positive Correlation**
	Citations Issued from Stops (Black)	0.775	Strong Positive Correlation
	Arrests Made from Stops (Black)	**0.868**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (Black)	**0.874**	**Very Strong Positive Correlation**
	Licensed Drivers (Black)	0.758	Strong Positive Correlation
	Vehicle Stops (White)	0.774	Strong Positive Correlation
	Vehicle Stops (Hispanic)	0.600	Very High Positive Correlation
White Suspects Described By Victim in Incident Reports	Vehicle Stops (White)	0.722	Moderately Strong Positive Correlation
	Citations Issued from Stops (White)	0.617	Very High Positive Correlation
	Arrests Made from Stops (White)	0.809	Strong Positive Correlation
	Searches from Vehicle Stops (White)	0.794	Strong Positive Correlation
	Licensed Drivers (White)	0.561	Very High Positive Correlation
	Vehicle Stops (Black)	0.654	Moderately Strong Positive Correlation
	Vehicle Stops (Hispanic)	0.777	Strong Positive Correlation
Hispanic Suspects Described By Victim in Incident Reports	Vehicle Stops (Hispanic)	0.788	Strong Positive Correlation
	Citations Issued from Stops (Hispanic)	0.520	High Positive Correlation
	Arrests Made from Stops (Hispanic)	0.789	Strong Positive Correlation
	Searches from Vehicle Stops (Hispanic)	0.783	Strong Positive Correlation
	Licensed Drivers (Hispanic)	**0.851**	**Very Strong Positive Correlation**
	Vehicle Stops (White)	0.402	Moderate Positive Correlation
	Vehicle Stops (Black)	0.368	Moderate Positive Correlation

Table 9. The Bivariate Correlation Coefficients of Police Workload to Licensed Drivers by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
DL Address Black Licensed Drivers	Violent Part One Incidents	0.833	Strong Positive Correlation
	Property Part One Incidents	0.759	Strong Positive Correlation
	Drug Incidents	0.720	Moderately Strong Positive Correlation
	Number of Officers at Incidents	0.794	Strong Positive Correlation
	Minutes of Officer Activity	0.801	Strong Positive Correlation
DL Address White Licensed Drivers	Violent Part One Incidents	0.419	Moderate Positive Correlation
	Property Part One Incidents	0.587	Very High Positive Correlation
	Drug Incidents	0.393	Moderate Positive Correlation
	Number of Officers at Incidents	0.543	High Positive Correlation
	Minutes of Officer Activity	0.533	High Positive Correlation
DL Address Hispanic Licensed Drivers	Violent Part One Incidents	0.520	High Positive Correlation
	Property Part One Incidents	0.442	Moderate Positive Correlation
	Drug Incidents	0.337	Moderate Positive Correlation
	Number of Officers at Incidents	0.438	Moderate Positive Correlation
	Minutes of Officer Activity	0.453	Moderate Positive Correlation

Table 10. The Bivariate Correlation Coefficients of Vehicle Stops to Police Workload by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
Number of Officers at Incidents	Vehicle Stops (All Stops)	**0.945**	**Very Strong Positive Correlation**
	Citations Issued from Stops (All Stops)	0.842	Strong Positive Correlation
	Arrests Made from Stops (All Stops)	**0.924**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (All Stops)	**0.931**	**Very Strong Positive Correlation**
	Violent Part One Incidents	**0.948**	**Very Strong Positive Correlation**
	Property Part One Incidents	**0.962**	**Very Strong Positive Correlation**
Minutes of Officer Activity at Incident Locations	Vehicle Stops (All Stops)	**0.932**	**Very Strong Positive Correlation**
	Citations Issued from Stops (All Stops)	0.840	Strong Positive Correlation
	Arrests Made from Stops (All Stops)	**0.917**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (All Stops)	**0.924**	**Very Strong Positive Correlation**
	Violent Part One Incidents	**0.951**	**Very Strong Positive Correlation**
	Property Part One Incidents	**0.958**	**Very Strong Positive Correlation**

Table 11. The Bivariate Correlation Coefficients of Vehicle Stops to Crime by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
Violent Part One Incidents	Vehicle Stops (All Stops)	**0.861**	**Very Strong Positive Correlation**
	Citations Issued from Stops (All Stops)	0.755	Strong Positive Correlation
	Arrests Made from Stops (All Stops)	**0.894**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (All Stops)	**0.903**	**Very Strong Positive Correlation**
Property Part One Incidents	Vehicle Stops (All Stops)	**0.912**	**Very Strong Positive Correlation**
	Citations Issued from Stops (All Stops)	0.792	Strong Positive Correlation
	Arrests Made from Stops (All Stops)	**0.876**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (All Stops)	**0.883**	**Very Strong Positive Correlation**

Table 12. The Bivariate Correlation Coefficients of Licensed Driver Addresses to Vehicle Stops, Citations, Arrests, and Searches by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
DL Address Black Licensed Drivers	Vehicle Stops (Black)	0.756	Strong Positive Correlation
	Citations Issued from Stops (Black)	0.572	Very High Positive Correlation
	Arrests Made from Stops (Black)	0.728	Moderately Strong Positive Correlation
	Searches from Vehicle Stops (Black)	0.744	Moderately Strong Positive Correlation
DL Address White Licensed Drivers	Vehicle Stops (White)	0.617	Very High Positive Correlation
	Citations Issued from Stops (White)	0.465	Moderate Positive Correlation
	Arrests Made from Stops (White)	0.544	High Positive Correlation
	Searches from Vehicle Stops (White)	0.549	High Positive Correlation
DL Address Hispanic Licensed Drivers	Vehicle Stops (Hispanic)	0.827	Strong Positive Correlation
	Citations Issued from Stops (Hispanic)	0.442	Moderate Positive Correlation
	Arrests Made from Stops (Hispanic)	**0.855**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (Hispanic)	0.808	Strong Positive Correlation

Table 13. The Bivariate Correlation Coefficients of Licensed Driver Addresses to Vehicle Stops by Race by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
DL Address Black Licensed Drivers	Vehicle Stops (Black)	0.756	Strong Positive Correlation
	Vehicle Stops (White)	0.589	Very High Positive Correlation
	Vehicle Stops (Hispanic)	0.631	Very High Positive Correlation
DL Address White Licensed Drivers	Vehicle Stops (Black)	0.413	Moderate Positive Correlation
	Vehicle Stops (White)	0.617	Very High Positive Correlation
	Vehicle Stops (Hispanic)	0.487	Moderate Positive Correlation
DL Address Hispanic Licensed Drivers	Vehicle Stops (Black)	0.344	Moderate Positive Correlation
	Vehicle Stops (White)	0.380	Moderate Positive Correlation
	Vehicle Stops (Hispanic)	0.827	Strong Positive Correlation

Table 14. The Bivariate Correlation Coefficients of Suspects (All Races) to Vehicle Stops by Grid

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
Suspects (All Races) Described By Victim in Incident Reports	Vehicle Stops (Black)	**0.883**	**Very Strong Positive Correlation**
	Citations Issued from Stops (Black)	0.776	Strong Positive Correlation
	Arrests Made from Stops (Black)	0.843	Strong Positive Correlation
	Searches from Vehicle Stops (Black)	0.839	Strong Positive Correlation
	Vehicle Stops (White)	0.813	Strong Positive Correlation
	Citations Issued from Stops (White)	0.734	Moderately Strong Positive Correlation
	Arrests Made from Stops (White)	0.786	Strong Positive Correlation
	Searches from Vehicle Stops (White)	0.807	Strong Positive Correlation
	Vehicle Stops (Hispanic)	0.702	Moderately Strong Positive Correlation
	Citations Issued from Stops (Hispanic)	0.551	Very High Positive Correlation
	Arrests Made from Stops (Hispanic)	0.620	Very High Positive Correlation
	Searches from Vehicle Stops (Hispanic)	0.591	Very High Positive Correlation
	Vehicle Stops (All)	**0.877**	**Very Strong Positive Correlation**
	Citations Issued from Stops (All)	0.760	Strong Positive Correlation
	Arrests Made from Stops (All)	**0.877**	**Very Strong Positive Correlation**
	Searches from Vehicle Stops (All)	**0.881**	**Very Strong Positive Correlation**

Table 15. The Bivariate Correlation Coefficients of Vehicle Stop Driver Race to Crash Driver Race

Variable 1	*Variable 2*	*Correlation Coefficient (r)*	*Relationship*
Vehicle Stops (Black)	Black Licensed Drivers	0.756	Strong Positive Correlation
	White Drivers on Crash Reports	0.802	Strong Positive Correlation
	Black Drivers on Crash Reports	**0.920**	**Very Strong Positive Correlation**
	Hispanic Drivers on Crash Reports	0.599	Very High Positive Correlation
	All Drivers on Crash Reports	**0.858**	**Very Strong Positive Correlation**
Vehicle Stops (White)	White Licensed Drivers	0.617	Very High Positive Correlation
	White Drivers on Crash Reports	**0.871**	**Very Strong Positive Correlation**
	Black Drivers on Crash Reports	0.807	Strong Positive Correlation
	Hispanic Drivers on Crash Reports	0.634	Very High Positive Correlation
	All Drivers on Crash Reports	**0.865**	**Very Strong Positive Correlation**
Vehicle Stops (Hispanic)	Hispanic Licensed Drivers	0.827	Strong Positive Correlation
	White Drivers on Crash Reports	0.717	Moderately Strong Positive Correlation
	Black Drivers on Crash Reports	0.657	Moderately Strong Positive Correlation
	Hispanic Drivers on Crash Reports	**0.911**	**Very Strong Positive Correlation**
	All Drivers on Crash Reports	0.701	Moderately Strong Positive Correlation
Vehicle Stops (All Races)	All Licensed Drivers (DL Address)	0.649	Very High Positive Correlation
	White Drivers on Crash Reports	**0.876**	**Very Strong Positive Correlation**
	Black Drivers on Crash Reports	**0.888**	**Very Strong Positive Correlation**
	Hispanic Drivers on Crash Reports	0.655	Moderately Strong Positive Correlation
	All Drivers on Crash Reports	**0.897**	**Very Strong Positive Correlation**

Conclusions

The US Department of Justice approves of law enforcement efforts targeted at high crime areas properly supported by reliable, empirical data. "So long as they are not motivated by racial animus, officers can properly decide to enforce all laws aggressively (in high crime areas), including less serious quality of life ordinances" (US Department of Justice, 2014). The approaches described in this document attempt to establish a reliable method for determining if a disproportionate amount of vehicle stops of racial/ethnic minorities occur in Davidson County.

Caution must be exercised when comparing demographic breakdowns of vehicle stops against population counts. Drivers involved in crashes may serve as a more appropriate risk set for benchmarking. Racial discrepancies are still observed, but are not as dramatic, when comparing stopped drivers against crash drivers.

Using US Census ACS data (residents age 16 and over) as a benchmark:

- Black drivers were stopped 10.9 percentage points higher than the benchmark;
- White drivers were stopped 8.3 percentage points lower than the benchmark;
- Hispanic drivers were stopped 1.8 percentage points lower than the benchmark.

Using drivers involved in crashes as a benchmark:

- Black drivers were stopped 3.3 percentage points higher than the benchmark;
- White drivers were stopped 6.0 percentage points lower than the benchmark;
- Hispanic drivers were stopped 0.3 percentage points higher than the benchmark.

By examining correlation coefficients of vehicle stops to police workload, incident, suspect, and crash data, empirical differences can be better clarified. VERY STRONG correlations were observed for the following relationships:

- Crash locations and where drivers are stopped.
- Black driver crash locations and where Black drivers are stopped.
- White driver crash locations and where White drivers are stopped.
- Hispanic driver crash locations and where Hispanic drivers are stopped.
- Officer activity time at incidents and where violent incidents are reported.
- Officer activity time at incidents and where property incident are reported.
- Officer activity time at incidents and where drivers are stopped.

Hotspot police initiatives provide more opportunity for officers to engage with members of communities within areas that have a higher volume of crime incidents and officer activity. MNPD police resources are deployed at a higher rate in locations where crimes are more frequently reported. These relationships may explain why a disproportionate amount of Black drivers were stopped.

Works Cited

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Neil, Roland and Winship, Christopher. Methodological Challenges and Opportunities in Testing for Racial Discrimination in Policing. *Annual Review of Criminology*, Vol. 2:73–98, 2019.

Ridgeway, Greg, and MacDonald, John. Methods for Assessing Racially Biased Policing. In *Race, Ethnicity, and Policing: New and Essential Readings*, eds. Stephen Rice and Michael White, 180–204. New York: NYU Press, 2010.

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Appendix

2018 Motor Vehicle Stop Summary

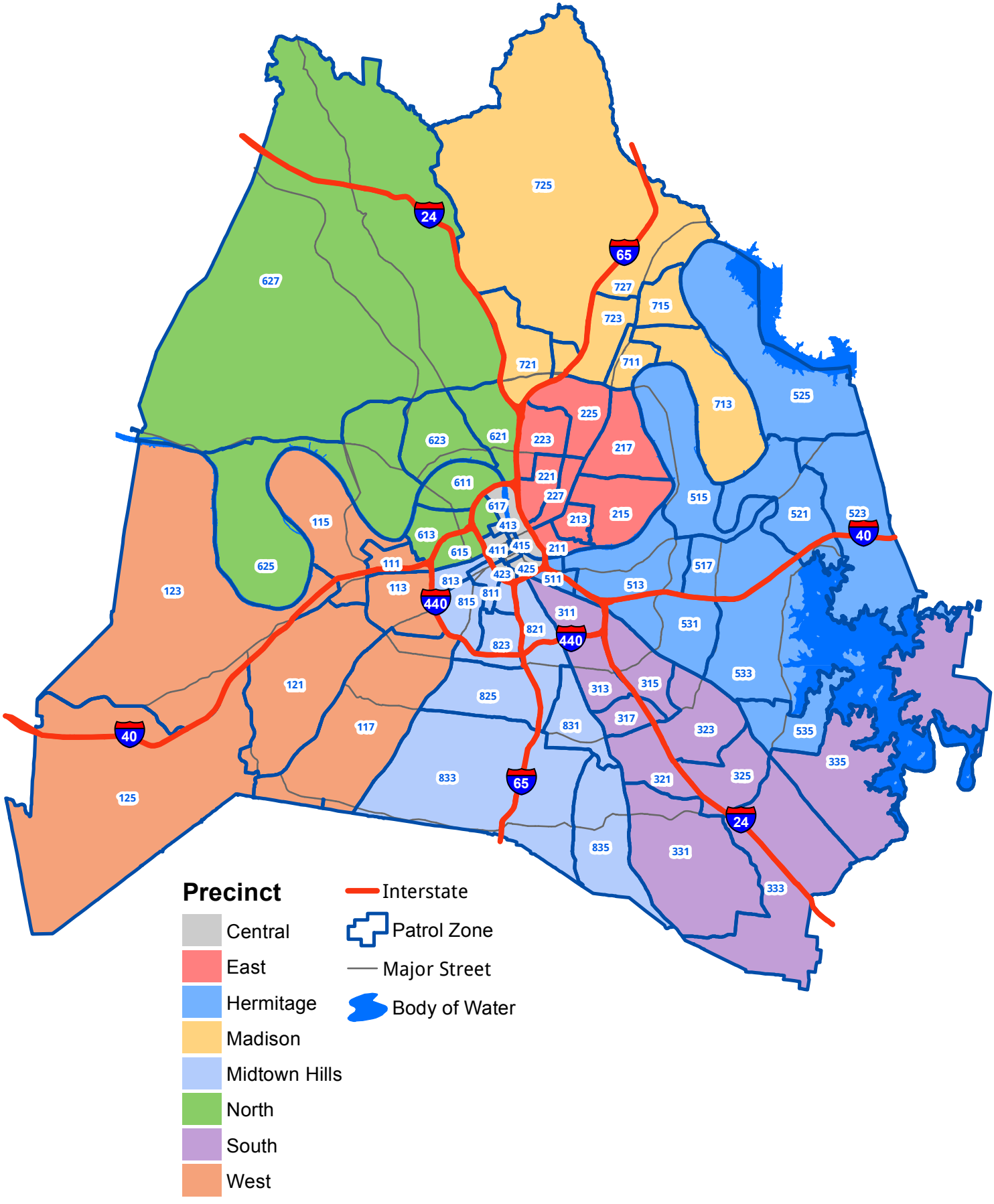
All Stops	204,400	
All Stops, Driver Issued Citation	39,197	19.2%
All Stops, Driver Arrested*	16,432	8.0%
All Stops, Driver Searched	6,722	3.3%
All Stops, Driver Warned**	151,291	74.0%
White Stops	118,913	
White Stops, Driver Issued Citation	24,953	21.0%
White Stops, Driver Arrested*	6,819	5.7%
White Stops, Driver Searched	2,489	2.1%
White Stops, Driver Warned**	88,216	74.2%
Black Stops	75,438	
Black Stops, Driver Issued Citation	11,732	15.6%
Black Stops, Driver Arrested*	8,655	11.5%
Black Stops, Driver Searched	4,030	5.3%
Black Stops, Driver Warned**	56,185	74.5%
Hispanic Stops	75,438	
Hispanic Stops, Driver Issued Citation	11,732	15.6%
Hispanic Stops, Driver Arrested*	8,655	11.5%
Hispanic Stops, Driver Searched	4030	5.3%
Hispanic Stops, Driver Warned**	56,185	74.5%

Notes:

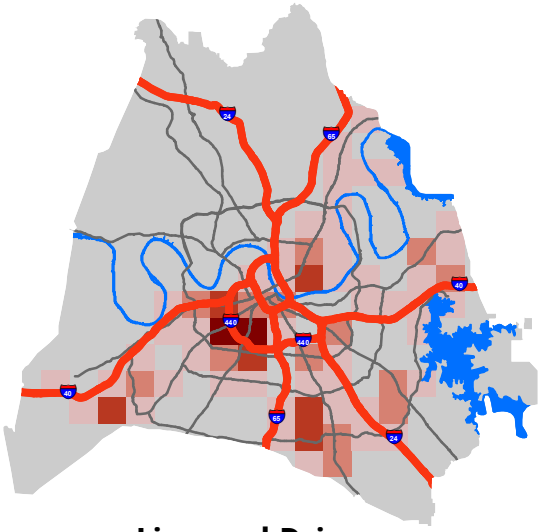
* - 54.7% of driver arrests include a charge violating of the provisions of TCA Title 55, Chapter 50 (offenses include: TCA 55-50-301 driving without a license, and TCA 55-50-504 (a) driving on a suspended, canceled, or revoked license).

** - "Driver Warned" refers to all vehicle stops in which the driver was not cited or arrested. For MNPD vehicle stops, this is typically a verbal warning.

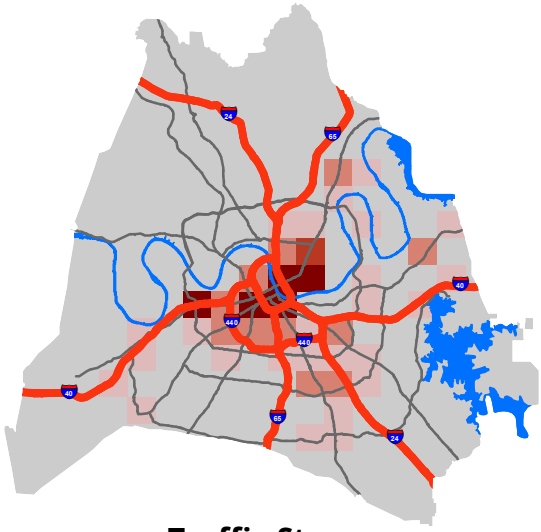
MNPD Police Patrol Boundaries and Patrol Zones



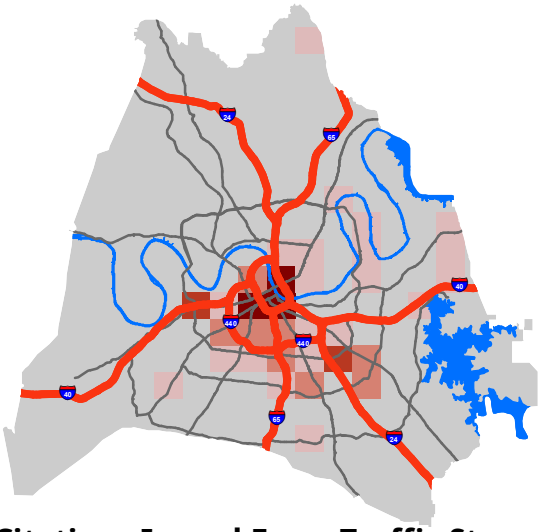
Grid Density Maps of Vehicle Stops with White Drivers



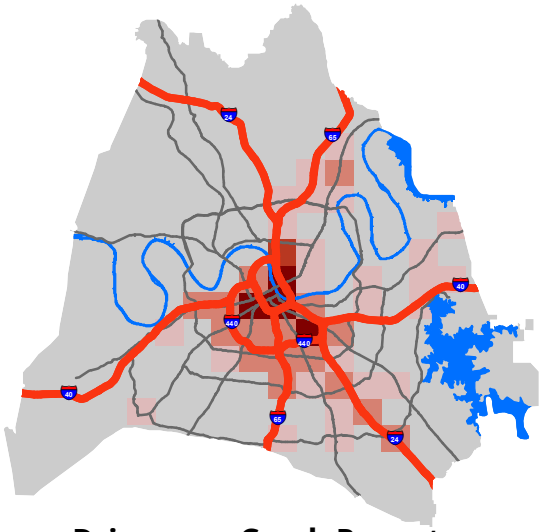
Licensed Drivers (White)



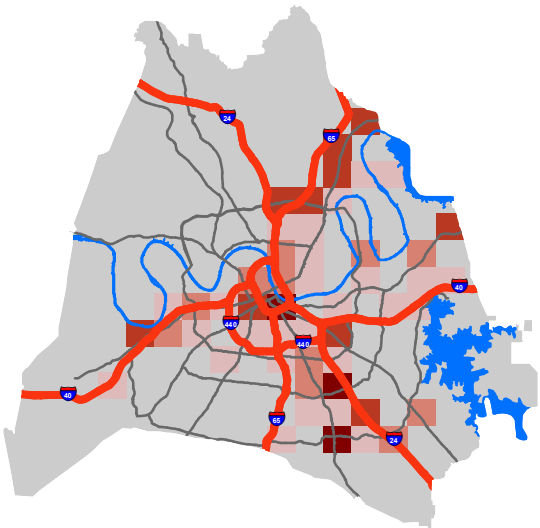
Traffic Stops (White)



Citations Issued From Traffic Stops (White)



Drivers on Crash Reports (White)



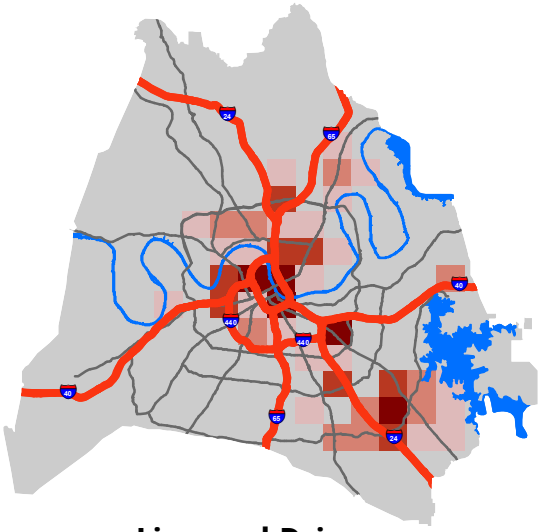
White Suspects Described by Victims

Standard Score (Z-Value)

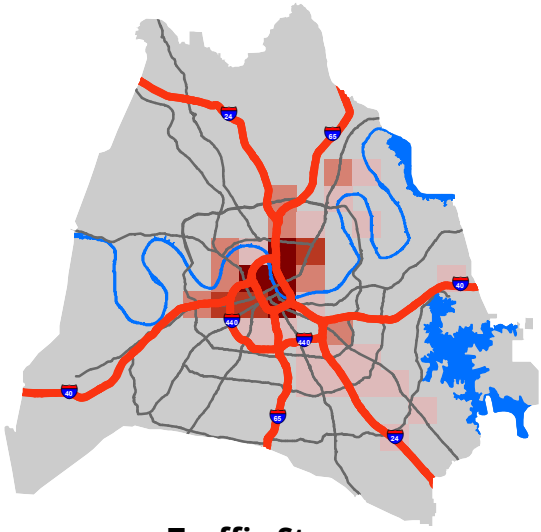
- Below 0.50
- 0.50 - 1.49
- 1.50 - 2.49
- 2.50 - 3.49
- 3.50 or Above

- Interstate
- Major Street
- Body of Water

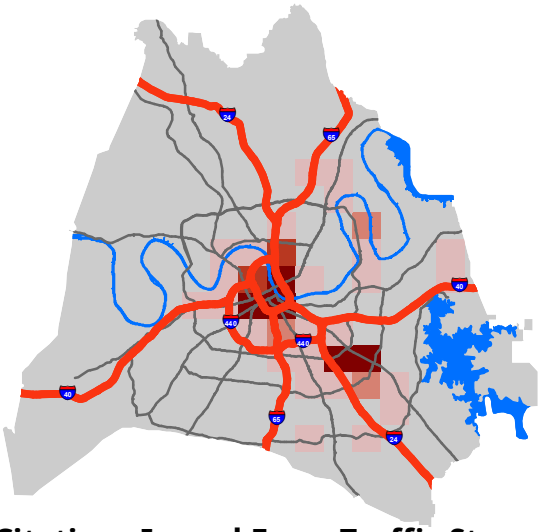
Grid Density Maps of Vehicle Stops with Black Drivers



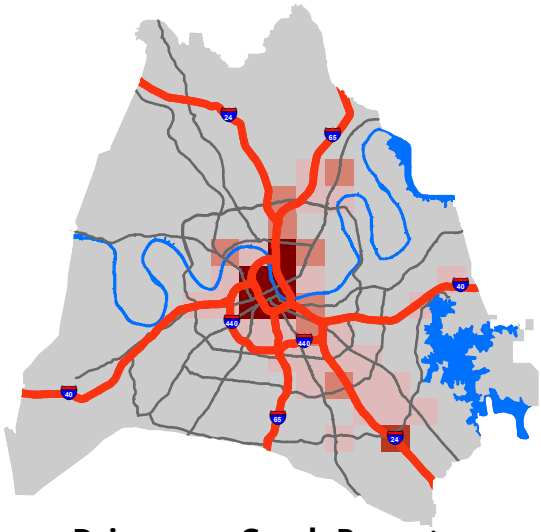
Licensed Drivers (Black)



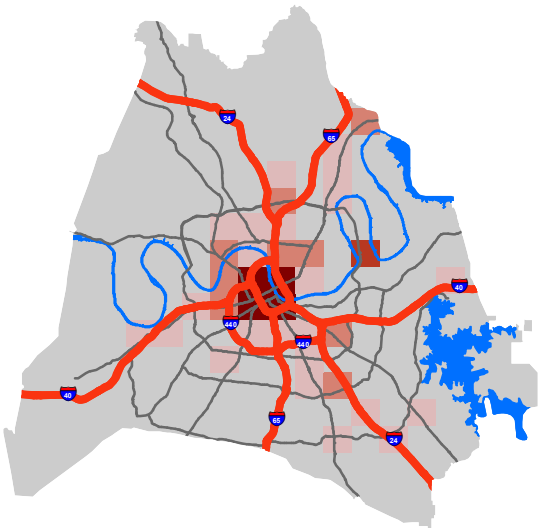
Traffic Stops (Black)



Citations Issued From Traffic Stops (Black)



Drivers on Crash Reports (Black)



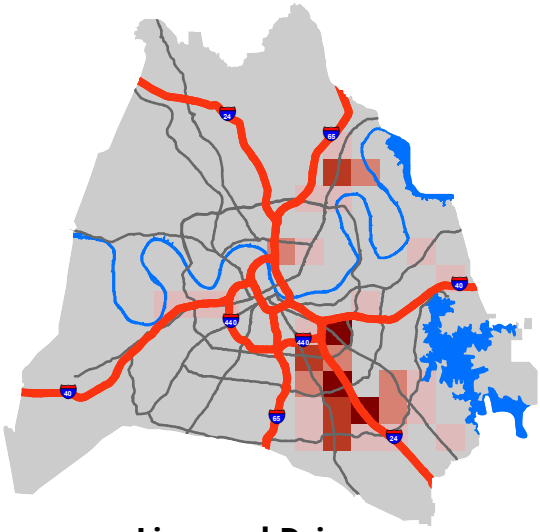
Black Suspects Described by Victims

Standard Score (Z-Value)

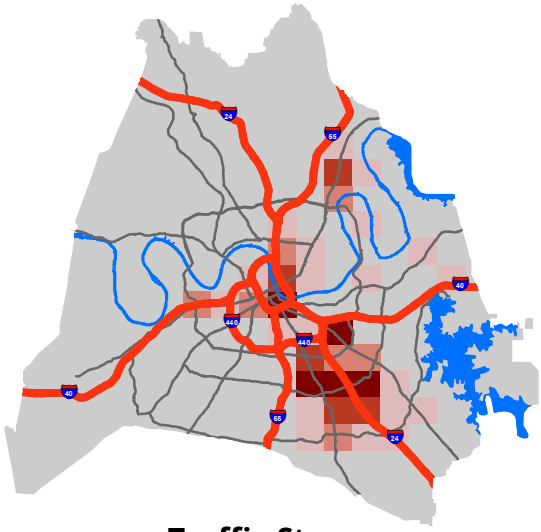
- Below 0.50
- 0.50 - 1.49
- 1.50 - 2.49
- 2.50 - 3.49
- 3.50 or Above

- Interstate
- Major Street
- Body of Water

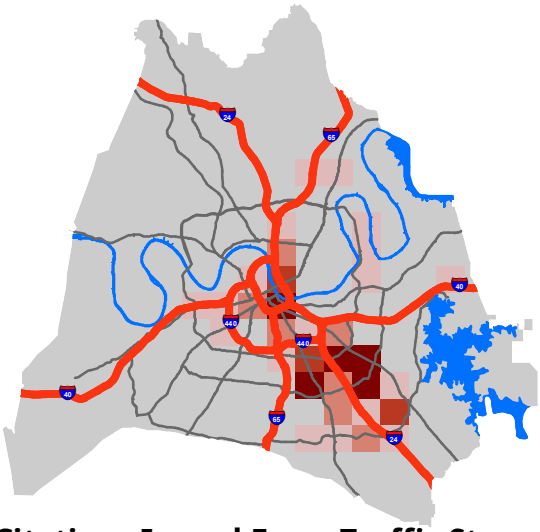
Grid Density Maps of Vehicle Stops with Hispanic Drivers



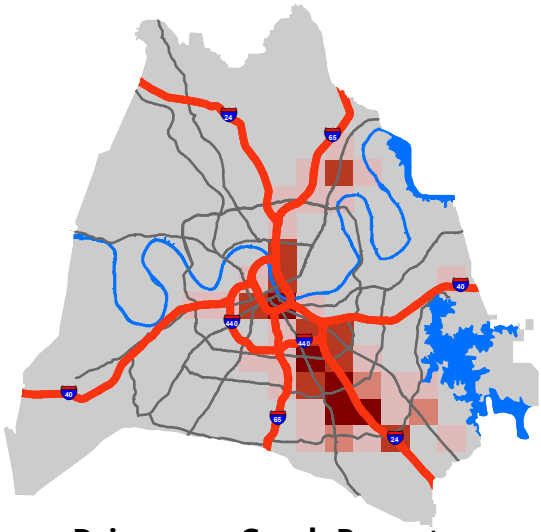
Licensed Drivers (Hispanic)



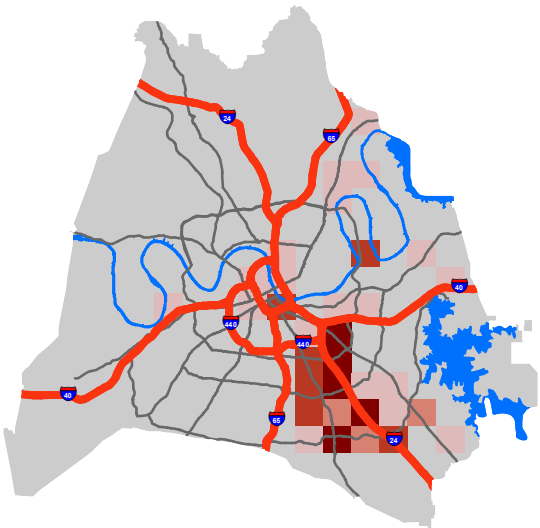
Traffic Stops (Hispanic)



Citations Issued From Traffic Stops (Hispanic)



Drivers on Crash Reports (Hispanic)



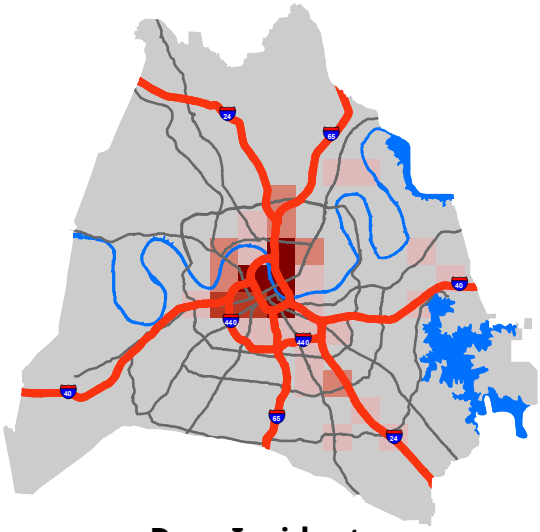
Hispanic Suspects Described by Victims

Standard Score (Z-Value)

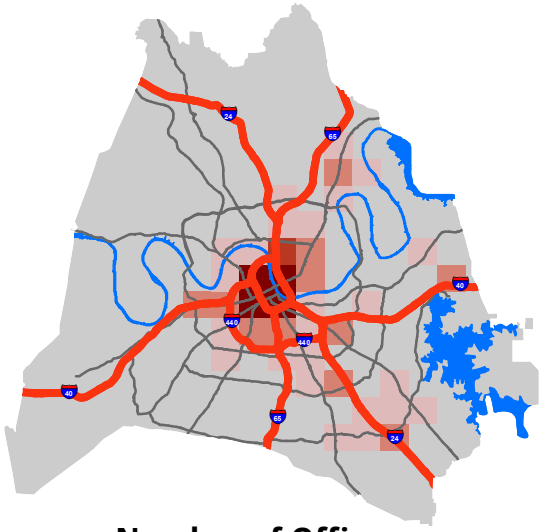
- Below 0.50
- 0.50 - 1.49
- 1.50 - 2.49
- 2.50 - 3.49
- 3.50 or Above

- Interstate
- Major Street
- Body of Water

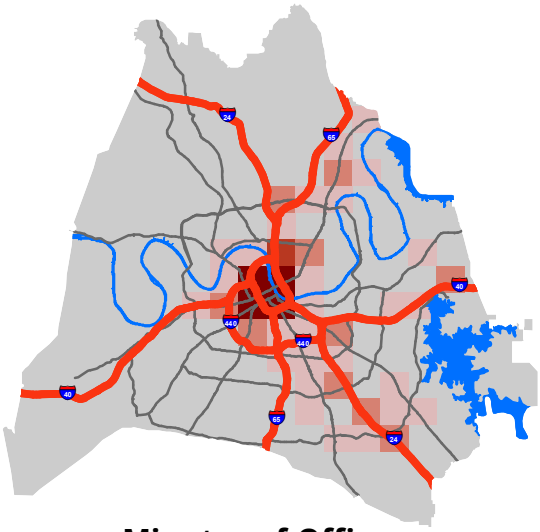
Grid Density Maps of Officer Activity and Part I Crimes



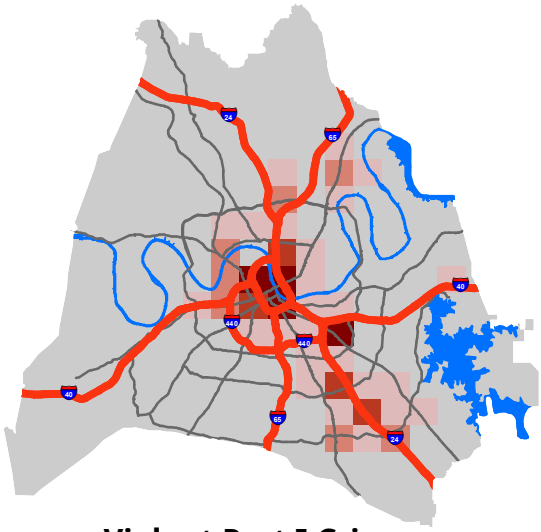
Drug Incidents



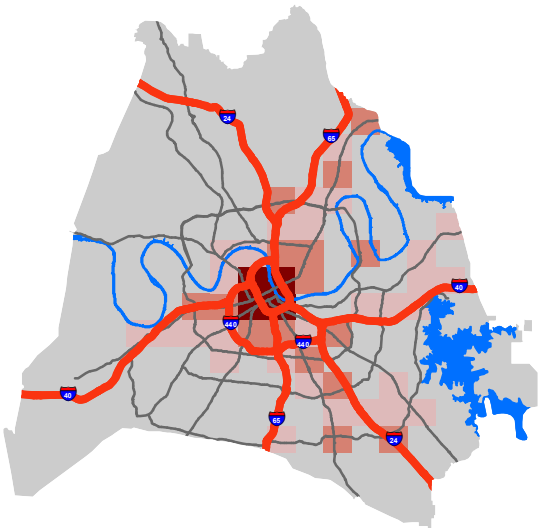
Number of Officers at Incidents



Minutes of Officer Activity



Violent Part I Crimes



Property Part I Crimes

Standard Score (Z-Value)

- Below 0.50
- 0.50 - 1.49
- 1.50 - 2.49
- 2.50 - 3.49
- 3.50 or Above

- Interstate
- Major Street
- Body of Water