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The John F. Finn Institute
for Public Safety, Inc.

Stops by Syracuse Police, 2006-2009

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The John F. Finn Institute for Public Safety, Inc., is an independent, not-for-profit and non-partisan corporation, whose work is dedicated to the development of criminal justice strategies, programs, and practices that are effective, lawful, and procedurally fair, through the application of social science findings and methods. The Institute conducts social research on matters of public safety and security – crime, public disorder, and the management of criminal justice agencies and partnerships – in collaboration with municipal, county, state, and federal criminal justice agencies, and for their direct benefit. The findings of the Institute's research are also disseminated through other media to criminal justice professionals, academicians, elected public officials, and other interested parties, so that those findings may contribute to a broader body of knowledge about criminal justice and to the practical application of those findings in other settings.

The Finn Institute was established in 2007, building on a set of collaborative projects and relationships with criminal justice agencies dating to 1998. The first of those projects, for which we partnered with the Albany Police Department (APD), was initiated by John Finn, who was at that time the sergeant who commanded the APD's Juvenile Unit. Later promoted to lieutenant and assigned to the department's Administrative Services Bureau, he spearheaded efforts to implement problem-oriented policing, and to develop an institutional capability for analysis that would support problem-solving. The APD's capacity for applying social science methods and results thereupon expanded exponentially, based on Lt. Finn's appreciation for the value of research, his keen aptitude for analysis, and his vision of policing, which entailed the formulation of proactive, data-driven, and – as needed – unconventional strategies to address problems of public safety. Lt. Finn was fatally shot in the line of duty in 2003. The Institute that bears his name honors his life and career by fostering the more effective use of research and analysis within criminal justice agencies, just as Lt. Finn did in the APD.

Introduction

For the past decade, elected and appointed officials in many states and countless cities have expressed concerns about racially biased policing, or racial profiling. The principal concern is that police use citizens' race as the partial or complete basis for the discretionary application of their authority, particularly in making traffic stops, but also in making other stops and in post-stop decisions as well (e.g., to conduct a search or frisk). Although attention to potential racial bias in policing dates historically to at least the 1960s, it was given renewed impetus by litigation in Maryland and New Jersey in the 1990s, which successfully claimed that state police targeted racial minorities for traffic stops. Contemporary concern has in many places taken the form of the collection and analysis of data on stops by police, as it has in Syracuse, where local legislation mandated data collection in 2001.

Earlier this year, we volunteered to analyze the Syracuse Police Department's data on stops. Here we report our results. First we describe the nature of the stops – the reasons for the stops, as officers recorded them, the spatial and temporal distributions of the stops (that is, where in the city they occur and at what times of the day), the characteristics of the people who are stopped (that is, their race, sex, and age), and for the most recent year, the assignments of the officers who made the stops (to the traffic division, Crime Reduction Teams, or other units)

Then we present analysis that is designed to provide clues about whether the stops reflect a racial bias. This is of course the primary goal of any such analysis, but drawing inferences about the source(s) of any racial disparities from data of this kind confronts monumental analytic challenges. Such clues would, ideally, emerge from a comparison of the characteristics of the people stopped by the police with the characteristics of the people who could have been legitimately stopped by the police; discrepancies between the former and the latter may suggest that police stops were influenced by factors other than the behavior of the citizens involved. Unfortunately, however, information on the latter population, which represents a suitable "benchmark," is practically impossible to come by; this is the benchmarking problem in analyses of racial bias in police stops.

We therefore adopt an analytic strategy, described further below, which was formulated by Greg Ridgeway of the RAND Corporation and applied in analyses of this kind in both Oakland and Cincinnati. The basic idea is to use changes in natural lighting to establish a benchmark, on the assumption that after dark, police officers suffer a degraded ability to detect motorists' race; the pattern of stops during darkness represents the presumptively more race-neutral benchmark, against which the pattern of stops during daytime can be compared. This has been dubbed the "veil of darkness" method. The comparison is limited to stops that occur "near the boundary of daylight and darkness," in what has been called the "inter-twilight" period, lest the analysis confound officers' decisions to stop with changes in the composition of the driving population across the hours of the day.[1]

Stops by Syracuse Police

Information about stops by Syracuse police is drawn from two sources: Form 67s, which are completed by Syracuse police when they have enforcement-related contacts with citizens that do not eventuate in an arrest, and arrest reports for "on-view" arrests (i.e., arrests made in incidents that officers initiated, rather than responding to a citizen request). The Form 67s include much of the information that is needed for analysis of the kind performed here, though they lack some information about searches, particularly the reason for the search. Moreover, a

[1] See especially Jeffrey Grogger and Greg Ridgeway, Testing for Racial Profiling in Traffic Stops from Behind a Veil of Darkness," *Journal of the American Statistical Association* 101 (2006): 878-887. Also see Oakland Police Department, *Promoting Cooperative Strategies to Reduce Racial Profiling: A Technical Guide* (Oakland: Author, 2004), pp. 40-43.

search is by policy always conducted incident to an arrest, but the arrest records do not indicate whether any search was a prelude to an arrest and, if so, the reason for that search. Hence we have examined stops but not post-stop decisions.

The SPD has four complete years' of data on stops, from 2006 through 2009.[2] We have confined our focus to vehicle stops, given our presumption that the veil-of-darkness method does not apply plausibly to pedestrian stops. Table 1 shows the numbers of vehicle stops, by year and overall, for which information was derived from each of these two sources. The numbers of on-view arrests that were recorded as vehicle stops declined substantially and sharply between 2007 and 2008, because during the summer of 2007, the Onondaga County 911 Center discontinued its use of the source code that identifies traffic stops.[3] We have, consequently, made use of some additional information about the arrests that characterizes the nature of the incident. From among the codes in this information field, we identified three that we believe are reliably indicative of a vehicle stop: "stop"; "suspicious vehicle"; and "DWI." We treat as a vehicle stop any on-view arrest that was entered as a "traffic stop" in the source field, or as one of these three incident types.

With stops thusly defined, we can enumerate the approximately 50,000 vehicle stops made by Syracuse police in the four years examined here. We suppose that we have undercounted stops among the arrests in 2008 and 2009, but we believe that by including arrests with other incident-type codes, we would likely capture not only additional vehicle stops but also arrests that did not stem from vehicle stops, thereby introducing a different kind of distortion into the analysis.[4]

Table 1. Source of Information about Vehicle Stops

Source of information	2006		2007		2008		2009		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Form 67	9663	77.9	8788	80.6	11365	93.4	14147	94.4	43963	87.1
Arrest report	2736	22.1	2120	19.4	804	6.6	833	5.6	6493	12.9
Total	12399		10908		12169		14980		50456	

Reasons for Vehicle Stops

Table 2 displays the reasons for the stops, as officers recorded them, by year. At least three-quarters of the stops were made for traffic violations, and the proportion is probably higher still, assuming that a fraction of the stops ending in arrests began as stops for traffic violations and through investigation (e.g., warrant checks or searches) officers established probable cause for arrest.

[2] These data included some duplicate records of individual events, which were removed prior to our analysis. In addition, we note here that for some stops the data on time or place were invalid, and as a consequence, these stops were eliminated from analysis that required data on time and place.

[3] Personal communication with Captain Richard Trudell, March 5, 2010.

[4] We would also note, more generally, that many on-view arrests are not "stops" of the sort that arouse concern about racial profiling. The literature does not offer a widely-accepted definition of a stop, but in general, stops are based either on an officer's observation of a traffic or other minor violation, or on reasonable suspicion. Officer-initiated arrests based on probable cause – e.g., pursuant to an investigation – do not fit the description of a stop. See, e.g., the NYPD policy governing the completion of stop, question, and frisk (UF250) forms: "arrests that occur directly from a level-4 encounter … [in which an officer has probable cause to believe that an individual was involved in a crime] should not be documented on a UF250." Greg Ridgeway, *Analysis of Racial Disparities in the New York Police Department's Stop, Question, and Frisk Practices* (Santa Monica: RAND Corporation, 2007), p. 2.

Table 3 shows the reasons for stops made by traffic officers, Crime Reduction Team (CRT) officers, and all other officers, respectively, in 2009.[5] Approximately 55 percent of the stops were made by officers assigned to the traffic division, and all but very small fractions of the stops made by traffic officers were, as expected, for traffic violations. A larger proportion of the stops made by CRT officers end in arrest or are of suspicious vehicles or people; given the nature of these officers' assignments, this too is as expected. We infer that other officers (mainly patrol officers) also make, proportionally, fewer stops merely for traffic violations than traffic division officers do, and compared with CRT officers, a smaller fraction of these stops resulted in arrest.

Table 2. Reasons for Vehicle Stops

Reason for Stops	2006		2007		2008		2009		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Traffic violation	9240	74.5	8399	77.0	10829	89.0	13616	90.9	42084	83.4
unknown on-view arrest	2736	22.1	2120	19.4	804	6.6	833	5.6	6493	12.9
Suspicious person/ vehicle	199	1.6	257	2.4	342	2.8	353	2.4	1151	2.3
Sex offender check / Sex Offense	1		3		2		2		8	
Other	223	1.8	129	1.2	192	1.6	176	1.2	720	1.4
Total	12399		10908		12169		14980		50456	

Table 3. Reasons for Vehicle Stops, by Officer Assignment, 2009

Reason for Stops	Traffic		CRT		Other		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
Traffic violation	7922	95.7	1149	85.3	4545	84.8	13616	90.9
unknown – on-view arrest	333	4.0	149	11.1	351	6.5	833	5.6
Suspicious person / vehicle	8	0.1	20	1.5	325	6.1	353	2.4
Sex offender check/ Sex offense	1		0		1		2	
Other	10	0.1	29	2.2	137	2.6	176	1.2
Total	8274		1347		5359		14980	

Stops by Time of Day

Table 4 shows the distribution of stops across times of the day.[6] We would of course expect that the numbers of vehicle stops would fluctuate with both the volume of vehicular traffic and the deployment of police, and so it is no surprise that stops are most numerous during the afternoon commuting hours and the evening hours. Moreover, stops during the afternoon inter-twilight period represent about one-third of the vehicle stops, each year and overall, providing a

[5] We examine only 2009 because the retrieval of information on officers' assignments is labor-intensive.
[6] Two stops with uninterpretable times were eliminated.

substantial analytical base for the veil-of-darkness analysis. The inter-twilight period is marked by the earliest time at which civil twilight ends during the year (in Syracuse, that is 5:02 p.m. in December) and the latest time at which civil twilight ends (in Syracuse, 9:23 p.m. in June). This is the time period of the day within which darkness and daylight vary across the year: after sunrise and before 5:02 p.m. it is always daylight, and after 9:23 p.m. and before sunrise, it is always dark, but between 5:02 and 9:23 it is sometimes daylight and sometimes dark. Hence it is the vehicle stops made during these hours that afford the opportunity to compare stops made under different conditions of visibility but with presumably similar patterns of vehicular traffic. (Vehicle stops during the morning inter-twilight period – approximately 5 a.m. to 7 a.m. in Syracuse – are far less numerous, and we do not include them in our veil-of-darkness analysis.)

Table 4. Vehicle Stops by Time of Day

Time of Day	2006		2007		2008		2009		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
7 a.m. – 10:59 a.m.	1037	8.4	939	8.6	1186	9.7	1000	6.7	4162	8.2
11 a.m. – 2:59 p.m.	1302	10.5	1150	10.5	1480	12.2	1766	11.8	5698	11.3
3 p.m. – 6:59 p.m.	3811	30.7	3049	28.0	2781	22.9	3458	23.1	13099	26.0
7 p.m. – 10:59 p.m.	3633	29.3	2768	25.4	3366	27.7	4582	30.6	14349	28.4
11 p.m. – 2:59 a.m.	2145	17.3	2376	21.8	2816	23.1	3550	23.7	10887	21.6
3 a.m. – 6:59 a.m.	470	3.8	626	5.7	540	4.4	623	4.2	2259	4.5
Total	12398		10908		12169		14979		50454	
Inter-twilight	4755	38.4	3527	32.3	3908	32.1	5064	33.8	17254	34.2

To some degree the numbers and the mix of vehicle stops varies across the hours of the day with the deployment of different units. CRT officers make virtually all of their stops between 3 p.m. and 3 a.m., with 80 percent of them between 3 p.m. and 11 p.m., although CRT stops represent only 15.3 percent of all of the vehicle stops. Most of the vehicle stops by traffic officers are made between 3 p.m. and 3 a.m. Between 3 a.m. and 3 p.m., the majority of vehicle stops – 52 percent – are made by officers who are not assigned to one of these specialized units. Stops in the inter-twilight period are disproportionately made by traffic and CRT officers, compared with other times of the day.

Table 5. Vehicle Stops by Time of Day and Officer Assignment, 2009

Time of Day – 2009	Traffic		CRT		Other		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
7 a.m. – 10:59 a.m.	398	4.8	0	0	602	11.2	1000	6.7
11 a.m. – 2:59 p.m.	1161	14.0	25	1.9	580	10.8	1766	11.8
3 p.m. – 6:59 p.m.	2032	24.6	327	24.3	1099	20.5	3458	23.1
7 p.m. – 10:59 p.m.	2969	35.9	749	55.6	864	16.1	4582	30.6
11 p.m. – 2:59 a.m.	1662	20.1	246	18.3	1642	30.6	3550	23.7
3 a.m. – 6:59 a.m.	51	0.6	0	0	572	10.7	623	4.2
Total	8273		1347		5359		14979	
Inter-twilight	3055	36.9	774	57.5	1235	23.0	5064	33.8

The Spatial Distribution of Vehicle Stops

Vehicle stops are widely distributed spatially, but they are more densely concentrated in the central parts of the city, and especially along major traffic arterials, such as Erie Blvd. and Salina Street. The map in Figure 1, below, displays the spatial distribution of vehicle stops: the more darkly shaded the area, the more densely concentrated the stops are in that area.

In Figure 2, below, the spatial distribution is disaggregated by officers' assignments, which exhibit differences that are consistent with their respective missions. Stops by CRT officers are more concentrated spatially, and in areas that tend to have higher rates of crime. Stops by officers assigned to traffic are more widely dispersed, and tend to be especially congruent with major traffic arterials. Stops by officers with neither of these assignments are also rather widely dispersed but appear to cluster more in higher-crime areas than the traffic officers' stops do, which may reflect deployment patterns.

People Who are Stopped

The occupants of the stopped vehicles are comprised of roughly equivalent proportions of African-Americans and whites, overall and year by year; see Table 6. (We included in these tabulations everyone involved in a stop, and not only the drivers, because arrest data do not allow us to differentiate drivers from passengers.) Somewhat more than two-thirds are men. One-quarter to two-fifths fall into the age categories shown in the table.

Table 6. Characteristics of People Stopped

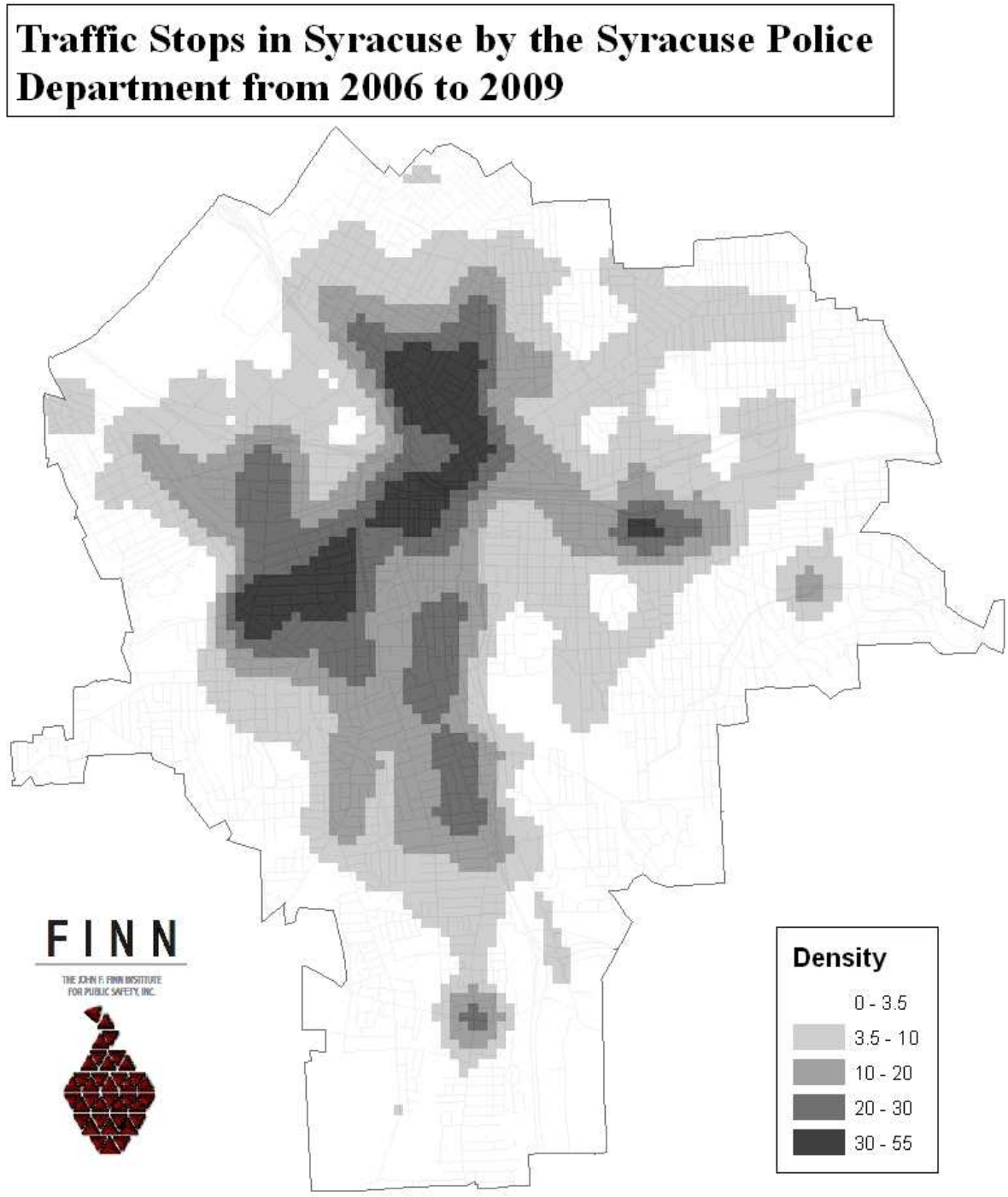
Characteristics	2006		2007		2008		2009		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
African-American	6841	47.9	6095	48.5	6799	46.5	8710	48.2	28445	47.8
White	7026	49.2	6061	48.2	7323	50.1	8706	48.1	29116	48.9
Male	10261	71.8	8937	71.1	10158	69.5	12597	69.6	41953	70.4
16 – 24 years old	5701	39.9	4848	38.6	5234	35.8	6539	36.1	22322	37.5
25 – 35 years old	4190	29.3	3764	30.0	4352	29.8	5402	29.9	17708	29.7
36 – 55 years old	3392	23.8	3146	25.0	3892	26.6	5029	27.8	15459	26.0
Total	14282		12567		14615		18089		59553	

The composition of the stopped population differs some for officers with different assignments. The people stopped by traffic division officers are disproportionately white, with a somewhat smaller proportion of men, and a more even distribution of ages. The people stopped by CRT officers, presumably in higher-crime areas with a greater residential representation of minorities, are disproportionately African-American, male, and young; this is what one would expect given their unit's mission.

Table 7. Characteristics of People Stopped by Officer Assignment, 2009

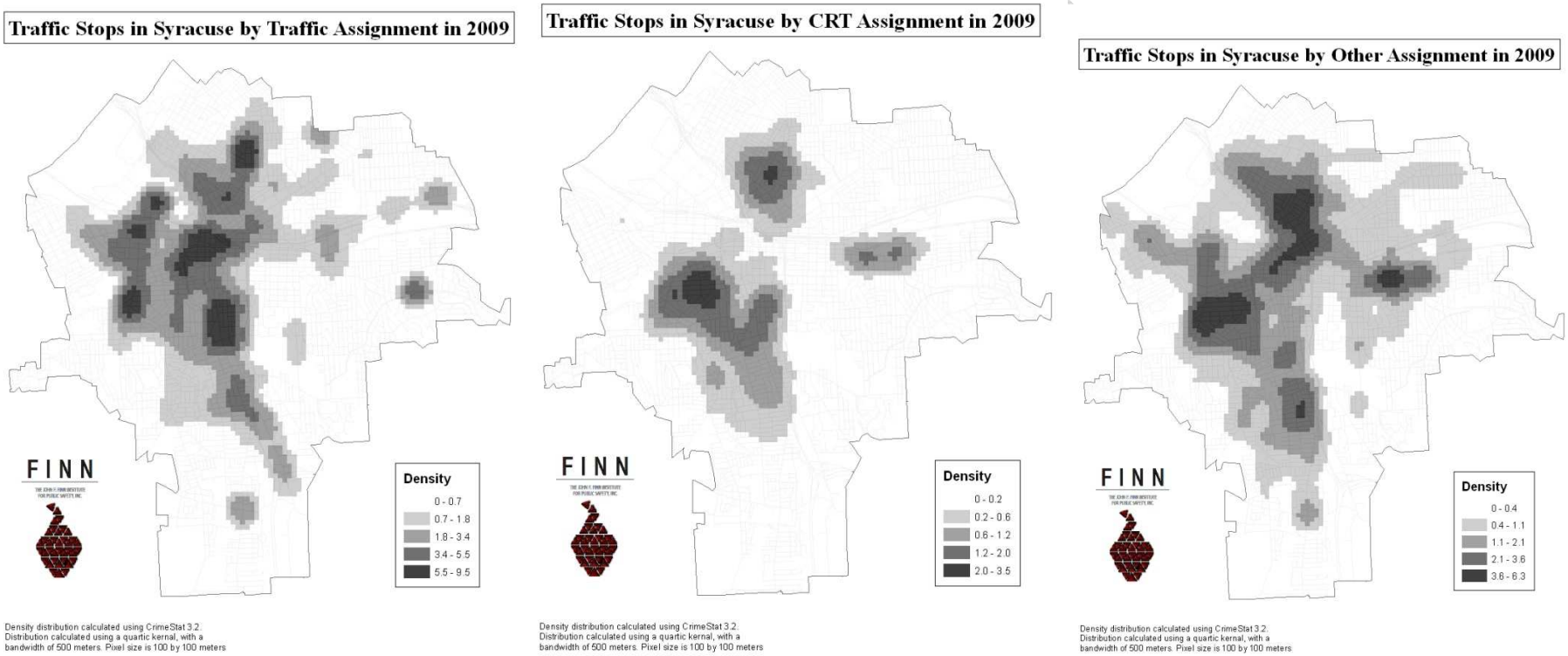
Characteristics – 2009	Traffic		CRT		Other		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
African-American	3411	38.9	1537	72.6	3762	52.3	8710	48.2
White	5011	57.1	553	26.1	6142	43.7	8706	48.1
Male	5852	66.7	1660	78.4	5085	70.6	12597	69.6
16 – 24 years old	2793	31.8	1045	49.4	2701	37.5	6539	36.1
25 – 35 years old	2686	30.6	663	31.3	2053	28.5	5402	29.9
36 – 55 years old	2693	30.7	371	17.5	1965	27.3	5029	27.8
Total	8774		2117		7198		18089	

Figure 1: Density Distribution of Stops By Syracuse Police Department



Density distribution calculated using CrimeStat 3.2. Distribution calculated using a quartic kernal, with a bandwidth of 500 meters. Pixel size is 100 by 100 meters

Figure 2: Density of Stops by Police Unit in Syracuse in 2009



Inter-twilight Stops

Our analytic focus, in testing for evidence of racial bias in stops, is on the stops made during the inter-twilight period, which in Syracuse is from 5:02 p.m. to 9:23 p.m. Stops made during this time frame may have been initiated in darkness, when we might reasonably expect that officers would be less readily able to detect the race of the motorists they stop, or during daylight, depending on the time of year. The driving population might change some over this period of time, as we discuss below, but not as much as the population would be expected to change across all of the hours of the day, and so to a degree, the focus on the inter-twilight period serves to control for officers' opportunities to make stops. Here we briefly describe these stops: the reasons for the stops, the assignments of the officers who make them, and the characteristics of the people who are stopped.

The reasons for stops during the inter-twilight period mirror those for stops more generally, as shown in Table 8: mainly traffic violations, so far as the data enable us to identify reasons. When the reasons for stops are disaggregated by officers' assignments, we likewise find that the stops during the inter-twilight period display a pattern that resembles that of stops more generally (see Table 9).

Table 8. Reasons for Inter-twilight Vehicle Stops

Reason for Stops	2006		2007		2008		2009		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Traffic violation	3317	69.8	2551	72.3	3590	91.9	4753	93.9	14211	82.4
unknown on-view arrest	1328	27.9	897	25.4	208	5.3	212	4.2	2645	15.3
Suspicious person/ vehicle	40	0.8	39	1.1	41	1.0	46	0.9	166	1.0
Sex offender check	0		0		0		0		0	
Other	70	1.5	40	1.1	69	1.8	53	1.0	232	1.3
Total	4755		3527		3908		5064		17254	

Table 9. Reasons for Inter-twilight Vehicle Stops, by Officer Assignment, 2009

Reason for Stops	Traffic		CRT		Other		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
Traffic violation	2999	98.2	666	86.0	1088	88.1	4753	93.9
Other unknown – on-view arrest	50	1.6	79	10.2	83	6.7	212	4.2
Suspicious person / vehicle	1	0.0	13	1.7	32	2.6	46	0.9
Sex offender check	0		0		0		0	
Other	5	0.2			32	2.6	53	1.0
Total	3055		774		1235		5064	

The people stopped during the inter-twilight period differ somewhat, as a group, from the larger population of those who are stopped. A slim majority of the people stopped in this period

are African-American, and compared with the stopped population as a whole, they are disproportionately African-American, as well as disproportionately younger and male.

Table 10. Characteristics of People Stopped in Inter-twilight Period

Characteristics	2006		2007		2008		2009		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
African-American	2864	52.7	2126	52.9	2194	48.3	3135	51.8	10319	51.4
White	2433	44.8	1773	44.1	2201	48.4	2741	45.3	9148	45.6
Male	3961	72.9	2888	71.8	3114	68.5	4200	69.4	14163	70.6
16 – 24 years old	2234	41.1	1613	40.1	1572	34.6	2226	36.8	7645	38.1
25 – 35 years old	1700	31.3	1208	30.0	1441	31.7	1812	29.9	6161	30.7
36 – 55 years old	1172	21.6	969	24.1	1213	26.7	1661	27.4	5015	25.0
Total	5346		4022		4547		6053		20058	

Testing for Racial Bias in Stops

Some analyses of police stops compare the racial composition of those who are stopped with the racial composition of the residential population, even though it is typically acknowledged that the comparison is liable to be misleading. Police do not select motorists or pedestrians for stops from among the general population, but rather – when they are doing their job properly – from among those whose behavior gives police evidence of a traffic violation or at least reasonable suspicion for a stop, i.e., a population of violators or potential offenders. Insofar as the violator population is not necessarily a racial cross-section of the residential population, then racially blind decisions by police cannot be expected to yield stops whose subjects resemble, in the aggregate, the residential population. The prevalence and frequency of offending is not uniform across demographic groups, and moreover, the violator population includes people who are not residents, and so no credible analysis can be based on the assumption that traffic violations and other behavior that is the legitimate basis for a stop is randomly distributed across racial or other demographic categories. Some insight into the nature of the problem is afforded by a study conducted several years ago by the United Kingdom's Home Office. Their study compared the residential population with the population that uses public spaces, especially during the times and in the areas in which stops tend to be concentrated, that is, the "available" population. They concluded that:

> The research presented here shows, quite clearly, that measures of resident population give a poor indication of the populations actually available to be stopped or searched. …. Most significantly, within pockets of high stop and search activity, young men and people from minority ethnic backgrounds tended to be over-represented in the available population.[7]

Furthermore, police resources are typically allocated in proportion with the demand for police services, in the forms of crime rates and call-for-service volumes, and because such demand is also correlated with the size of minority populations, citizens' exposure to law enforcement is not even across racial groups, putting African-American violators at greater risk of detection, other things being equal.

A number of studies have conducted field research in an effort to form a benchmark for comparison that more plausibly captures the characteristics of the violator population, sampling times and places at which the race of passing motorists is tabulated, and even providing for the use of radar or "rolling surveys" to tabulate the race of violators. This approach provides a benchmark that is superior to Census data on the residential population, but it does not capture all of the legitimate reasons for police stops, and it may be better suited to highway traffic

[7] MVA and Joel Miller, *Profiling Populations Available for Stops and Searches*, Police Research Series Paper 131 (London: Home Office, 2000), p. vi.

enforcement than it is to city policing. But in any case, no such benchmark is currently available for Syracuse, and the field research necessary to establish such a benchmark is not inexpensive.

Consequently, for our analysis of police stops in Syracuse, we rely primarily on an approach to analyzing stops that was recently developed by the RAND Corporation in conducting analyses in Oakland, California, and subsequently applied in Cincinnati, Ohio. In Oakland, analysis provided for comparing the race of drivers stopped in daylight to that of drivers stopped after dark, within the inter-twilight period, overall and within short intervals of time.[8] A recent refinement of this approach, applied in Cincinnati, was to take advantage of the semi-annual changes to and from Daylight Savings Time (DST), which allows an analyst to still more effectively hold time of day constant – and with it, presumably, patterns of driving – as natural lighting abruptly shifts. Thus in his analysis of Cincinnati stops, Greg Ridgeway examines stops in the "inter-twilight period" (between 5:50 p.m. and 8:06 p.m. in Cincinnati) during the 30 days before and after the switch to or from DST.[9] Ridgeway also examined stops in the inter-twilight period across the entire year. We have replicated this kind of analysis in Syracuse, where the inter-twilight period is 5:02 p.m. until 9:23 p.m.

We have not analyzed post-stop outcomes, such as searches, arrests, and tickets, because the data on searches is incomplete. The Form 67s include information on whether a search or frisk was conducted, but Form 67s are not completed for stops that eventuate in arrests, and for those stops, we cannot ascertain whether a search preceded the arrest. Furthermore, inasmuch as searches are central to analysis that applies the "outcome test," we cannot perform such analysis. The "outcome test" is derived from "an equilibrium model of police-citizen behavior" formulated by a group of economists.[10] This approach is the subject of some controversy, however, and it is not widely accepted as a valid method for detecting racial bias in police behavior.[11] Stops are exercises of discretionary authority, and so too are post-stop decisions – to search, to cite, to arrest, and so forth. These decisions are shaped by a host of factors, such as the seriousness of the violation and the contrition of the violator.[12] At best, the approach applies only to discretionary searches; even the original authors acknowledge that "… the test is informative only about bias in searches, not in stops."[13]

The Veil of Darkness Analysis

The simplest application of the veil-of-darkness method is to compare two proportions: of those who are stopped during daylight, the proportion who are African-American; and of those who are stopped during darkness, the proportion who are African-American. If police are biased against African-Americans in making stops, then the former proportion will be larger than the latter. Figure 3 displays these proportions as a line graph. For each half-hour interval between 5 p.m. and 9:30 p.m., the blue line represents the percentage of stops in daylight that involved at least one black occupant, while the red line represents the percentage of stops in darkness

[8] See Oakland Police Department, *Promoting Cooperative Strategies to Reduce Racial Profiling: A Technical Guide, op cit.*, especially pp. 38-44.

[9] Greg Ridgeway, *Cincinnati Police Department Traffic Stops: Applying RAND's Framework to Analyze Racial Disparities* (Santa Monica, CA: RAND Corporation, 2009).

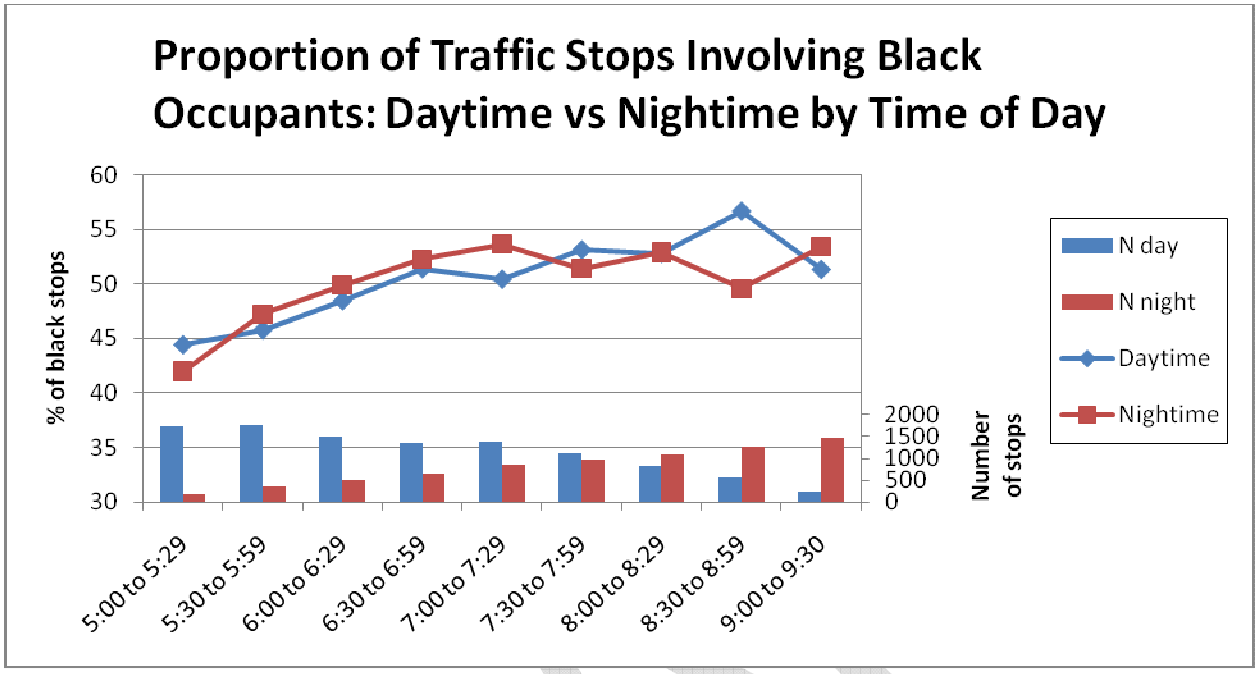
[10] John Knowles, Nichola Persico, and Petra Todd, "Racial Bias in Motor Vehicle Searches: Theory and Evidence," *Journal of Political Economy* 109 (2001): 203-229.

[11] See Robin S. Engel, "A Critique of the 'Outcome Test' in Racial Profiling Research," *Justice Quarterly* 25 (2008): 1-36; Nichola Persico and Petra E. Todd, "The Hit Rates Test for Racial Bias in Motor Vehicle Searches," *Justice Quarterly* 25 (2008): 37-53; Robin S. Engel and Rob Tillyer, "Searching for Equilibrium: The Tenuous Nature of the Outcome Test," *Justice Quarterly* 25 (2008): 54-71; Shamena Anwar and Hanming Fang, "An Alternative Test of Racial Prejudice in Motor Vehicle Searches: Theory and Evidence," *American Economic Review* 96 (2006): 127-151.

[12] See, e.g., Robert E. Worden, "Situational and Attitudinal Explanations of Police Behavior: A Theoretical Reappraisal and Empirical Assessment," *Law & Society Review* 23 (1989): 667-711.

[13] Persico and Todd, "The Hit Rates Test for Racial Bias in Motor Vehicle Searches," op cit., p. 42.

that involved at least one black occupant, with the scale of percentages on the left axis. The bar chart below the line graph displays the number of stops that occurred during each time interval in daylight (the blue bar) or darkness (the red bar). The scale for the bar chart is shown on the right axis.



Two facts are immediately apparent from the line graph. First, the proportion of stops involving a black occupant varies some across the inter-twilight period, increasing from 5:00 until about 7:00, and then holding roughly steady. We attribute this pattern mainly to a changing composition of the driving population, though it could be partly a function of police deployment.[14] Second, and more importantly, the proportions of stops involving black occupants during daylight and darkness, respectively, are in the main quite similar during each clock-time interval, with the possible exception of the 8:30-8:59 interval, when 50 percent of the nighttime stops, and 57 percent of the daytime stops, involved one or more African-Americans. The daytime-nighttime disparity in the 8:30-8:59 interval is consistent with a pattern of racial bias, but otherwise the disparities are small and several are in the opposite direction, leading us to infer that this one larger difference is a statistical anomaly.

A more analytically powerful – but less visually intuitive – approach is to statistically control for variation in time and place, so that we can better isolate the effect of daylight on the probability that an African-American will be stopped. We use the technique of logistic regression to hold clock time (in 15-minute intervals), day of week, and police beat constant. From the regression results we compute an odds ratio that indicates how many times more likely it is that daylight stops involved an African-American citizen, compared with nighttime stops. An odds ratio of 1 tells us that African-Americans were no more likely to be stopped during daylight than in darkness. An odds ratio greater than 1 is consistent with an inference of racial bias, signifying that African-Americans were more likely to be stopped during daylight than in darkness. An odds ratio of less than 1 signifies that African-Americans were less likely to be

[14] Such variation in the composition of the driving population would not be unique to Syracuse. See, e.g., William R. Smith, Donald Tomaskovic-Devey, Matthew T. Zingraff, H. Marcinda Mason, Patricia Y. Warren, and Cynthia Pfaff Wright, *The North Carolina Highway Traffic Study*, Report to the National Institute of Justice (Raleigh: North Carolina State University, 2003).

stopped during daylight than in darkness, a pattern contrary to the proposition that stops are racially biased. We conduct this analysis for each year and for all four years together, with the relevant results displayed in Table 11.[15]

Table 11: Comparison of the Odds of Black vs. Non-black Occupants Being Stopped between Daylight and Dark

Year	Odds Ratio	95% confidence interval	P value	Number of stops
All	0.963	0.894 – 1.037	0.319	17,172
2006	0.890	0.775 – 1.023	0.102	4,707
2007	0.969	0.822 – 1.142	0.703	3,494
2008	1.062	0.904 – 1.247	0.466	3,908
2009	1.023	0.886 – 1.023	0.753	5,063

None of the odds ratios for the individual years, nor that for the entire four-year period, indicate that African-Americans were more likely to be stopped during daylight than during darkness, when officers' ability to detect occupants' race is degraded. The overall odds ratio, and the odds ratios for two of the four years, are all less than 1, which is contrary to the proposition that police target African-Americans for stops, though none of them can be reliably distinguished from 1, which signifies an even chance of being stopped in daylight or dark. The odds ratios for the remaining two years are both slightly greater than 1, but again, neither can be reliably distinguished from 1 statistically. This analysis yields no evidence of racial bias in stops.

When we delimit the analysis to stops conducted in the 30 days before and after the switch to or from Daylight Savings Time, we find, for the most part, similar patterns, with one exception. Overall and for three of the four years, the odds ratios are all within a fairly tight statistical margin of 1, signifying no difference between day and night in the likelihood that an African-American would be stopped. In 2008, however, the odds ratio was substantially and statistically greater than 1, consistent with an inference of racial bias. We are aware of no police operations or other events that might have coincided with the transition from or to DST in 2008, and neither are the SPD command staff with whom we discussed this finding. It might be an anomaly; why such a pattern would emerge in one year and in none of the others, before and since, prompts us to doubt that this reflects a larger pattern of police behavior.

Table 12: Comparison of the Odds of Black vs. Non-black Occupants Being Stopped between Daylight and Dark, within 30 Days of DST

Year	Odds Ratio	95% confidence interval	P value	Number of stops
All	1.076	0.897 – 1.290	0.432	5,470
2006	1.012	0.761 – 1.346	0.934	1,606
2007	0.818	0.565 – 1.184	0.287	1,059
2008	1.541	1.075 – 2.211	0.019	1,210
2009	1.175	0.852 – 1.621	0.325	1,595

[15] We include measures of statistical significance, even though we analyze the entire population of stops and not only a sample, because stops are subject to a number of stochastic or random elements, including at any given time the "available" population on the street, the volume of calls for service, the numbers of police units on duty, and the deployment of "details" or special operations that might augment or detract from the time that police have at their disposal to engage in proactive police work.

Conclusions

We infer from the empirical evidence summarized here that Syracuse police, in general, have not exhibited racial bias in making vehicle stops. No analysis of data of the kind examined here can definitively establish that a racial bias influences officers' decisions to stop citizens, but the preponderantly null findings yielded by the veil-of-darkness analysis of Syracuse stops is, we believe, fairly strong evidence of racial neutrality by police. Firm conclusions are inevitably elusive, given the complexity of the decisions that officers make and the circumstances under which they make them, and given the inability of any analyst to establish valid benchmarks. In our judgment, the veil-of-darkness approach affords the most useful benchmark yet devised, and when it is applied to data on Syracuse stops, the results are for the most part consistent with the conclusion that Syracuse police have not been racially biased in making vehicle stops.