

In the Matter of the Study of State Police Stop Activity at the Southern end of the New Jersey Turnpike

We were retained by the ACLU of New Jersey to determine whether the New Jersey State Police (NJSP) was targeting Black motorists in making stops on the New Jersey Turnpike (NJT). More specifically, we were asked to concentrate on the section of the NJT patrolled by the Moorestown Station. To make this determination it was necessary to obtain or develop two datasets. The first of these was the percentage of Black motorists who were violating traffic laws on the NJSP between Exits 1 and 7A and the second was the race of motorists who were stopped by the NJSP on the NJT on this same section of the NJT.

To develop the first of these datasets there were two surveys of the NJT carried out during August and September, 2005. Both were of those motorists violating traffic laws and thus subject to being stopped. The first survey of violators was modeled after the violator's survey that was relied upon by the Court in *New Jersey v. Soto et al*¹. The survey vehicle drove at a constant 4 miles an hour above the speed limit. Surveyors noted any vehicle that passed them as a violator and any vehicle that they passed as a non-violator, unless they saw another violation in the few moments that the vehicle was in view. The surveyors were instructed to observe the speed limit and to maintain a speed of 4 mph above the speed limit when any reductions in the speed limit occurred for reasons of construction, traffic congestion and weather. Under reduced speed limit conditions, they were instructed to drive at 4 miles an hour over the limit, if possible, for the length of the section of the roadway that had a reduced speed limit posted. Further,

¹ *State v. Pedro Soto*, A734A. 2d 350 (N.J. Super. Ct. Law Div. 1996).

they were instructed to include automobiles, pick-up trucks, SUVs, mini-vans, vans and recreational vehicles.

The survey vehicle made 25 trips on the southern end of the NJT from Exits 1 to 7A. Each trip, which took approximately three hours, consisted of a complete coverage of all turnpike areas between those two exits, including the west spur to the Pennsylvania Turnpike at Exit 6. The days and times of day that the surveyors were on the road were randomly selected, as were the exits from which each survey trip began and the direction in which the survey vehicle started the trip. The survey was conducted between August 16th and August 28th, 2005. During each of the 25 trips, one person drove and one person noted and recorded the race/ethnicity of the driver, whether the vehicle was a violator or not and also noted each exit on the data sheet as it was passed.

The second violator's survey, the Radar Survey, was one that recorded the speed of vehicles driving on the NJ Turnpike between Exits 1 and 7A. The observer drove a Toyota Tundra with a Genesis II Select Directional radar from Decatur Electronics mounted in the vehicle. The observer was a former police officer who was certified by the manufacturer on the radar unit. The unit was calibrated in test runs on the New Jersey Turnpike in both northerly and southerly directions and on a daily basis prior to the beginning of survey runs. The survey vehicle, which proceeded for one complete loop of the Turnpike patrolled by the Moorestown Station was driven at the posted speed limit. That is, if the speed limit was 65, and normally for this section of it Turnpike it is 65, that was the speed the vehicle was driven. However, if the speed limit dropped below 65 for construction, weather or congestion, the survey vehicle adhered to the reduced speed limit. There were 40 sessions between August 27th to September 23rd, 2005, with each

one conducted on randomly selected days and time of day. Each session started and ended at a randomly selected Exit and proceeded in a randomly selected direction. The surveyor had the radar unit mounted in the survey vehicle and recorded the speed, race of driver and state of registration for each vehicle encountered.

NJSP Stops

The only data available to us for police stops comes from the first eleven “Semiannual Reports of Aggregate Data Submitted Pursuant to the Consent Decree Entered Into By the United States of America and the State of New Jersey”². As these are aggregate data, they do not allow us to determine where on the Turnpike and when during the reporting period the stops were made, which of the stops may have been made by troopers on regular road patrol and which may have been made by troopers on special details, all of which may be important to the analysis. For example, in a study presented in Soto³ of traffic tickets, the percentages of Black motorists stopped by two specialized units, the Radar Unit (now disbanded) and the Tactical Patrol unit were lower than were the percentages of Black motorists stopped by general road patrol troopers. In addition, there was a higher percentage of Blacks stopped between Exits 1 and 3 of the Turnpike than at exits further north in the patrol area of the Moorestown Station.

At this point we do not know which special units of the NJSP exist. However, as of 2001 there were extant Tactical Patrol Units (TPUs) that were “to enforce Title 39

² These data are published by the State of New Jersey Department of Law and Public Safety Office of the Attorney General.

³ *State v. Pedro Soto*, A734A. 2d 350 (N.J. Super. Ct. Law Div. 1996).

statutes, motor vehicle violations, and criminal statutes. They assist disabled motorists; they conduct HOV details, high occupancy details. They conduct aggressive driver details. They conduct express bus lane details for the George Washington Bridge and the Lincoln Tunnel. They conduct escorts of VIPs...”⁴ Also, Lt. Scripture testified that there was a Truck Unit, whose main assignment is inspecting and weighing commercial vehicles, although these troopers can write citations for non truck vehicles, but seldom do so. The third type of unit that Lt. Scripture testified about was the Construction Unit, whose troopers maintain safety of the construction site. During the Soto litigation, there was testimony that the Tactical Patrol unit stopped a lower percentage of Black motorists than did Road Patrol troopers and we do not know what percentage of Black motorists the Construction Unit stopped.

During the time period covered by the eleven semiannual reports available to us, January 1, 2000 to April 30, 2005, the Moorestown Station reports that 30.8% of the motorists stopped by their troopers were Blacks. It would take a breakdown of the aggregate statistics to determine what proportion of stops by the General Road Patrol Troopers are of Blacks and whether higher proportions of Black motorists are being stopped on the more southerly portions of the Turnpike.

⁴ Testimony of Lt. Heidi Scripture, Task Force Officer on the New Jersey Turnpike for the New Jersey State Police, October 25, 2001.

Table 1. Number and Percentage of Black Motorists Stopped by the NJSP by Station on the New Jersey Turnpike (from 2000 to 2005).

| Report Number | Station Name | Station Total Black Number | Station Total Black % | Station Total |
|---------------|--------------|----------------------------|-----------------------|---------------|
| 1 | Moorestown | 2278 | 29.3 | 7,787 |
| 2 | Moorestown | 3614 | 31.6 | 11,448 |
| 3 | Moorestown | 3440 | 29.7 | 11,589 |
| 4 | Moorestown | 3424 | 32.3 | 10,604 |
| 5 | Moorestown | 3382 | 30.4 | 11,129 |
| 6 | Moorestown | 3054 | 30.5 | 10,022 |
| 7 | Moorestown | 2748 | 29.8 | 9,231 |
| 8 | Moorestown | 2743 | 31.7 | 8,645 |
| 9 | Moorestown | 3370 | 30.1 | 11,188 |
| 10 | Moorestown | 3295 | 32.1 | 10,268 |
| 11 | Moorestown | 4132 | 30.8 | 13,411 |
| | | 35,480 | 30.8 | 115,322 |

Results

The purpose of the study is to examine whether, and to what extent, cars driven by Blacks are stopped at the disproportionately high rates on the southern end of the New Jersey Turnpike. Table 1 shows that from 2000 to 2005, the proportion of Blacks stopped on the southern end of NJT (Moorestown Station) was 30.8%. Also the most recent data is (as it happens) 30.8%. Therefore, we accept the 30.8% number as representative of the racial breakdown of the stops on this section of the NJT.

We have two studies that provide data to compare to the Moorestown Station data, the Vehicle Survey and the Radar Study.

In the vehicle survey the proportion of vehicles driven by Blacks that passed the survey vehicle or were observed to be committing some other violation was 19.0%. The speed of violators was not measured in the vehicle survey.

In the radar survey that captured the speed of each vehicle, 18.5% of the cars that passed the survey vehicle were driven by Blacks. However, neither figure reflects speed

bias in reporting⁵. Speed bias can be adjusted for only the radar survey because we know the speed of the violator only in that case. We recommend that the weighted figures found below be utilized for analysis of the radar study.

The instructions to the observer in the radar study was to drive at the speed limit. Other cars going at the speed limit would not be observed, since they would not pass the observer's car. Cars going only slightly above the speed limit would be less likely to pass the observer than would cars going substantially above the speed limit. Thus, the probability of being observed depends on the speed of the violators, which is what is meant by speed bias. (This kind of bias shows up in other contexts, and is sometimes known as size-biased sampling. For example, in estimating the extend of undiscovered oil, it is reasonable to suppose that larger fields have a higher probability of already being discovered). The appropriate weighting is derived in Appendix A, and is $T / (S - T)$ where T is the speed of the observer (which varies with the speed limit) and S is the measured speed of the violator. Thus, cars for which $S - T$ is large (i.e. cars driving much faster than the speed limit) are down-weighted relative to slower cars driving over the speed limit. This down weighting of the fastest cars appropriately reflects their greater probability of being observed.

We compare the 30.8 % number for the Moorestown Station with two numbers derived from the radar study. The first looks at the (weighted) proportion of Blacks among all violators. In the analysis of all violators, the (weighted) proportion of Blacks is .17676 with a standard deviation of .004718. An analysis based on this criterion has been criticized in some quarters because it does not distinguish egregious violators from those

⁵ Terrin, N. & Kadane, J.D. (1998). Counting cars in a legal case involving differential enforcement. *Chance*, **11**, 3:25-27.

driving only slightly above the speed limit. To address this concern we do a separate analysis of egregious violators, those driving at least 15 miles per hour above the speed limit. In the analysis of egregious violators, the proportion of Blacks is .1916 with a standard deviation of .01208.

Our findings are summarized in the following table:

| Table 2: Percent of Blacks Found | | | |
|---|-----------|--------------------------|---------|
| Source | Weighted? | Comparison Population | % Black |
| Vehicle Survey | No | All Traffic | 19.0% |
| Radar Study | No | All Traffic | 18.5% |
| Radar Study | Yes | All Traffic | 17.6% |
| Radar Study | Yes | Egregious Violators Only | 19.2% |

Note that these numbers are roughly consistent. The largest difference in % Black between the weighted egregious violators and the weighted all traffic is 1.6%.

Since both 17.6% for Blacks among all violators and 19.2% among egregious violators are both substantially below 30.8% of Blacks among stops, we see immediately that there is a potential problem. It appears that although Blacks are slightly more numerous among egregious violators than among all violators, the extent to which they are in no way explains the discrepancy between both numbers and the rate of Blacks among those stopped.

To understand what these proportions mean, we convert them to an odds ratio, as detailed in the Appendix B. The odds ratio is:

$$\frac{P\{\text{Stop} \mid \text{Black and Violator}\}}{P\{\text{Stop} \mid \text{Not Black and Violator}\}}$$

In a system in which race played no role in who was stopped among violators, the ratio would be 1. To the extent that it is greater than 1, the system disadvantages Blacks.

Appendix B shows that for all violators the estimated odds ratio is 2.08, which is $1.08/.067 = 16.1$ standard deviations above 1, while for egregious violators, the estimated odds are 1.87, which is $.87/.146 = 5.96$ standard deviations from 1. Thus in both cases there is very substantial evidence that Blacks have roughly twice the odds of being stopped as do others.

Those results indicate:

1. That Blacks are disproportionately stopped at southern end of turnpike.
2. Among egregious violators, Blacks are disproportionately stopped at southern end of turnpike.

Appendix A

Imagine a circular track of length M the observer car is going at speed T .

Suppose a speeding car, going at speed $S > T$ is placed at random on the track. What is the probability that the speeder will overtake the observer? Suppose that the observer starts at the same point P, and drives the entire track, which takes time M/T . If the speeder starts at distance X behind the observer, he will get to the point P for the second time (and thus catch the observer car, just barely), if $(X + M)/S = M/T$. So the relevant X 's are those less than or equal to U , where U satisfies $(U + M)/S = M/T$. Thus

$(U + M)T = MS$, or $UT = M(S - T)$, or $U/M = \frac{S - T}{T}$. Thus the probability of the

speeder overtaking the observer, i.e. being observed is $\frac{S - T}{T}$.

Using the principle that observations should be weighted by the reciprocal of the probability of observation, the weight of a speeder observed going at speed s when the

observer is going T is $\frac{T}{S - T} = \frac{1}{(S/T - 1)}$.

Appendix B:

Derivation of Formulas for Odds, and its Standard Deviation.

It is useful first to establish some notation. Let S be the event that a driver is stopped; V that the driver is a violator, B that the driver is Black, and \bar{B} that the driver is not Black. Then the quantity to be estimated is

$$\begin{aligned}\frac{P(S/BV)}{P(S/\bar{B}V)} &= \frac{P(SBV)/P(BV)}{P(S\bar{B}V)/P(\bar{B}V)} \\ &= \frac{P(B/SV)P(SV)/P(BV)}{P(\bar{B}/SV)P(SV)/P(\bar{B}V)} \\ &= \frac{P(B/SV)/P(BV)}{P(\bar{B}/SV)/P(\bar{B}V)} \\ &= \frac{.308/P(B/V)P(V)}{.692/P(\bar{B}/V)P(V)} \\ &= \frac{(.308)}{(.692)} \left(\frac{1-p}{p} \right)\end{aligned}$$

Where $p=P(B/V)$. Hence when $p=.176$, the estimated odds are 2.08. When $p=.192$ the estimated odds are 1.87.

In the first case, $\hat{p} = .177$ and the standard error of \hat{p} is .0047. In the second case, $\hat{p} = .192$ a standard error of \hat{p} of .012.

To convert these to standard errors of the odds ratio we use the delta⁶ method:

$$\begin{aligned}SD\left[\frac{.308(1-\hat{p})}{.692\hat{p}}\right] &= \left(\frac{.308}{.692}\right)SD\left(\frac{1-\hat{p}}{\hat{p}}\right) \\ &= \left(\frac{.308}{.692}\right)SD\left(\frac{1}{\hat{p}}-1\right) \\ &= \frac{.308}{.692}SD\left(\frac{1}{\hat{p}}\right) = \frac{.308}{.692} \cdot \frac{1}{\hat{p}^2}SD(\hat{p})\end{aligned}$$

When $\hat{p} = .177$, SD (odds ratio) = .067

When $\hat{p} = .192$, SD (odds ratio) = .146

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⁶ Billingsley, P. (1995) 3rd ed. *Probability and measure*. New York, N.Y. John Wiley & Sons. P. 359.