IN THE COMMONWEALTH COURT OF PENNSYLVANIA

Viviette Applewhite; Wilola Shinholster Lee; Gloria Cuttino; Nadine Marsh; Bea Bookler; Joyce Block; Devra Mirel ("Asher") Schor; the League of Women Voters of Pennsylvania, National Association for the Advancement of Colored People, Pennsylvania State Conference; Homeless Advocacy Project,	)	
Petitioners,	)	Docket No. 330 MD 12
v.	)	
The Commonwealth of Pennsylvania; Thomas W. Corbett, in his capacity as Governor; and Carol Aichele, in her capacity as Secretary of the Commonwealth,	)	
Respondents.	)	

PETITIONERS' DISCLOSURE OF EXPERT REPORTS

Pursuant to the Court's May 28, 2013 Scheduling Order and the Pennsylvania Rules of Civil Procedure, Petitioners hereby submit expert reports as follows:

1. Bernard R. Siskin, Ph.D.
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   Please see Exhibit 1 for Dr. Siskin Expert Report.

2. David A. Marker, Ph.D.
   Westat
   1600 Research Blvd
   Rockville, MD 20850

   Please see Exhibit 2 for Dr. Marker's Expert Report

3. Lorraine C. Minnite, Ph.D.
   Department of Public Policy & Administration
   Rutgers University
   401 Cooper Street
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   Please see Exhibit 3 for Dr. Minnite's Expert Report.

4. Diana C. Mutz, Ph.D.
   Samuel A. Stouffer Professor of Political Science and Communication
   University of Pennsylvania
   208 South 37th street
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   Please see Exhibit 4 for Professor Mutz's Expert Report.

Petitioners reserve the right to modify, supplement or amend the foregoing expert reports as Respondents continue to produce responsive documents and may change their positions and propose new actions in response to these expert reports. Petitioners also reserve the right to submit rebuttal testimony from each of these experts to any arguments, testimony, expert reports, evidence or questioning presented by Respondents.

Dated: July 1, 2013

Respectfully submitted,

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IN THE COMMONWEALTH COURT OF PENNSYLVANIA

Viviette Applewhite; Wilola Shinholster Lee; Gloria Cuttino; Nadine Marsh; Bea Bookler; Joyce Block; Devra Mirel ("Asher") Schor; the League of Women Voters of Pennsylvania; National Association for the Advancement of Colored People, Pennsylvania State Conference; Homeless Advocacy Project, Petitioners, v. The Commonwealth of Pennsylvania; Thomas W. Corbett, in his capacity as Governor; Carol Aichele, in her capacity as Secretary of the Commonwealth Respondents	Docket No. 330 MD 12

CERTIFICATE OF SERVICE

I certify that I am this 1st day of July 2013, serving the foregoing Petitioners' Disclosure of Expert Reports, upon the persons and in the manner indicated below, which service satisfies the requirement of Pa. R.A.P. 121.

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Dated: July 1, 2013

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Applewhite, et al. v. Commonwealth of Pennsylvania, et al.
No. 330 MD 2012

EXHIBIT 1

Petitioners' Disclosure of Expert Reports

REPORT

in the matter of

Applewhite v. Commonwealth of Pennsylvania

By

Bernard R. Siskin, Ph.D.
Director

BLDS, LLC
Philadelphia, PA

July 2013

REPORT
in the matter of
Applewhite v. Commonwealth of Pennsylvania

Bernard R. Siskin, Ph.D.

I. OVERVIEW

In the November 2013 election, Pennsylvania voters may be required to present valid photo ID in order to cast a regular in-person ballot. The question arises as to how many registered voters in the Commonwealth of Pennsylvania ("PA," "Pennsylvania," or "Commonwealth") currently lack such valid photo ID. Counsel for Petitioners in this matter have asked me to determine the number of currently Registered Voters who lack an acceptable voter ID issued by the Pennsylvania Department of Transportation ("PennDOT") or Pennsylvania Department of State ("DOS").

I was supplied by Respondents with three computerized data files:

1. The Pennsylvania Voter Registration file ("SURE Database") was received on May 6, 2013, and contained the names, birthdates, last four digits of Social Security Number ("SSN"), addresses, and license numbers of all registered voters in Pennsylvania.
2. The PA Department of Motor Vehicles file ("PennDOT Database") was received on May 30, 2013, and contained the names, birthdates, last four digits of SSN, addresses, license numbers, and license expiration dates of all persons with

Pennsylvania driver's licenses, non-driver photo identification cards, and DOS ID issued for voting purposes.[1]

3. A Full Voter Export ("FVE") file was received on May 24, 2013, and contained a non-confidential subset of the variables from the SURE database file that were suitable for export.

From these data, I was asked by Counsel to determine (a) the number of Active or Inactive[2] Registered Voters ("Registered Voters") in the SURE Database who could not be found in the PennDOT Database (i.e., "non-matches"),[3] and (b) the number of Registered Voters with a Pennsylvania driver's license or non-driver photo identification card (collectively, "PennDOT ID") that would be acceptable for voting purposes in the November 2013 election but for having an expiration date prior to November 5, 2012, one year before the November 5, 2013 election.[4]

I understand that there are alternative forms of acceptable photo identification such as a military ID, another form of U.S.- or Commonwealth-issued ID, an ID from an accredited Pennsylvania public or private institution of higher learning, an ID from a Pennsylvania care

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[1] On May 6, 2013, I received a version of this file without expiration dates or DOS ID information.

[2] It is my understanding that the Active and Inactive Voter designation is irrelevant to whether a voter can vote on election day. All Active and Inactive Voters are considered validly Registered Voters and can go to the polls on election day and vote in Pennsylvania. Moreover, my review of the SURE database confirms that thousands of previously Inactive Voters voted in November 2012 and thus will be deemed Active Voters in future elections. Thus, all references to Registered Voters in this Report necessarily include Active and Inactive Voters. As explained below, I excluded those Registered Voters in the SURE database who could not actually vote on election day.

[3] My analysis is based on the SURE Database file that I received from the Commonwealth. That file, which was current as of May 6, 2013, will not contain data for persons who register to vote after May 6, 2013 (e.g., those persons who will turn 18 after May 6, 2013, and will thus become eligible to vote in November 2013). Therefore, I could not attempt to match such individuals to the PennDOT Database.

[4] I understand that a PennDOT ID can be used for voting up to one year after it expires. Because the DOS ID was issued beginning in August 2012 and is valid for 10 years, the DOS ID is irrelevant to my analysis of expiration dates on a PennDOT ID.

facility, or an employee ID issued by a Commonwealth municipality or county (assuming that ID satisfies the Photo ID Law's expiration date and name conformity requirements). This Report only addresses whether voters in the SURE Database have valid ID for voting purposes as reflected in the PennDOT Database.

Section III of this Report discusses in detail the steps used in my matching efforts. In summary, I matched Registered Voters in the SURE Database to individuals in the PennDOT Database in successive steps, each using a different combination of the following matching criteria: (1) date of birth, (2) last four digits of SSN, (3) license number, (4) name, and (5) address. In total, I used 12 steps to try to identify matches. To be conservative, some of the steps I used were designed to treat certain individuals as matches even though names and other information in the file did not match. As a result, some of the matches I identified likely are false matches. Likewise, given inherent limitations in the data, certain non-matches I identified likely did match. On balance, the false matches likely outnumber the false non-matches. Although there is clearly an error rate on either side and it is impossible to provide a calculation that is precisely accurate down to the last voter, I am highly confident that the numbers I present as non-matches constitutes a reliable estimate of the number of Registered Voters in the SURE Database who do not have a valid PennDOT or DOS ID for voting in the November 2013 election. These data show that hundreds of thousands of Registered Voters lack PennDOT or DOS ID that will be valid for voting in November 2013.

Specifically, of the 8,231,753 Registered Voters in the SURE Database, I identified 251,879 (3.1% of all Registered Voters) who were not in the PennDOT Database at all, which means those Registered Voters likely do not have -- and indeed never have had -- a PennDOT or DOS ID. In addition, I identified another 417,502 Registered Voters (5.1%) who are in the

PennDOT Database but have a PennDOT ID that expired prior to November 5, 2012 (i.e., more than one year prior to the November 5, 2013, election), and therefore do not have a DOT ID acceptable for voting in the upcoming November 2013 election. I determined that these individuals also do not have a DOS ID. Thus, a total of 669,381 Registered Voters (8.1%) lack a valid PennDOT or DOS ID for voting in the November 5, 2013, election.

Some Registered Voters who were issued a PennDOT ID subsequently have moved out of Pennsylvania and have obtained an ID issued by another state. When PA is made aware of this (e.g., because the other state so informs PA), I understand that PennDOT reclassifies the PennDOT ID as "OOS" (Out of State) in the PennDOT Database. I identified those Registered Voters who possess an expired PennDOT ID and were classified in the PennDOT Database as OOS ("OOS Registered Voters" and "OOS ID," respectively). Table 1 shows that there are 157,966 such OOS Registered Voters. Table 1 also shows that 152,128 of the OOS Registered Voters did not vote in the November 2012 election. It is reasonable to expect that many of these Registered Voters with OOS ID have relocated out of PA and no longer constitute eligible voters in Pennsylvania, but that the SURE Database has not been updated to reflect this. Although some of these individuals may subsequently have moved back to PA without obtaining a new PennDOT ID (e.g., because they are too elderly to drive) and others may be students who have obtained an out-of-state license but remain eligible to vote in PA, I conservatively treated all Registered Voters with expired PennDOT ID designated OOS as not eligible to vote in PA, and I excluded them from my subsequent analyses. Subtracting these 157,966 OOS Registered Voters from the total 669,381 Registered Voters without a valid PennDOT or DOS ID, I identified 511,415 non-OOS Registered Voters (6.2%) without valid PennDOT or DOS ID to vote in the November 2013 election.

In addition to analyzing Registered Voters without valid ID, I also analyzed the subgroup of Registered Voters without valid ID who voted in the November 2012 election ("November 2012 Voters"). Of the 5,742,557 Registered Voters in the SURE Database who voted in the November 2012 election, 143,046 November 2012 Voters (2.5% of all November 2012 Voters) lacked valid PennDOT or DOS ID as of May 6, 2013. Of these, 115,778 voted in person in the November 2012 election, 24,339 voted by absentee ballot, and 2,929 voted by provisional ballot. These November 2012 Voter data are included in Table 1 and are reflected in the "A" tables of my other analyses.

I have analyzed the results of my matching efforts for both Registered Voters and November 2012 Voters by subgroup characteristics: race and ethnicity, party of registration, age, and sex/gender. These analyses, shown in Tables 2-5, reveal highly statistically significant differences based on race and ethnicity, party, age, and sex/gender for both Registered Voters and November 2012 Voters.

I further analyzed the geographic characteristics of the Registered Voters and November 2012 Voters who lack valid PennDOT or DOS ID. I found that there are Registered Voters and November 2012 Voters who lack valid PennDOT or DOS ID in every county in Pennsylvania, including 7,683 Registered Voters without valid ID in the 9 counties that lack any PennDOT facility and 44,709 Registered Voters without valid ID in the 23 counties in which a PennDOT facility is open only one or two days per week. These data are presented in Table 6. In Tables 7-8, I present statistics related to the average driving distance and the average driving time that Registered Voters or November 2012 Voters without valid PennDOT or DOS ID would have to spend traveling between their houses and the closest PennDOT Driver License Center ("DLC")

issuing PennDOT or DOS ID.[5] In Table 9, I also present statistics related to the time that Registered Voters or November 2012 Voters living in Philadelphia or Pittsburgh would need to spend on public transportation to commute to and from the closest DLC.

All opinions in this report are expressed to a reasonable degree of scientific certainty, are based on at least a "more likely than not" standard, and are based on generally accepted and reliable statistical and database methodologies. I reserve the right to modify, supplement, or amend this Report as my study continues and in response to evidence, testimony or rebuttal expert reports, and testimony or questions offered by Respondents in this matter.

II. QUALIFICATIONS

I, Bernard R. Siskin, Ph.D., am the principal investigator on this matter.[6] I am a Director of BLDS, LLC, a specialty consulting firm. Prior to joining BLDS, I was a Director at the specialty consulting firms LECG, LLC, the Center for Forensic Economic Studies, Inc., and National Economic Research Associates. Prior to that, I was a tenured faculty member at Temple University in Philadelphia, where, for five years, I was Chairman of the Department of Statistics. I received my Ph.D. in Statistics with a minor in Econometrics from the Wharton School of Business at the University of Pennsylvania in 1970. I have authored four books, three book chapters, four research monographs, and numerous papers on statistical methodology, including articles on the role of statistics in the analysis of employment discrimination issues. Since receiving my Ph.D., I have specialized in the application of statistics to the analysis of

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[5] Although I understand that Respondents' Counsel have recently suggested that certain voters may be able to apply for ID by mail and may be able to go to a PennDOT facility other than a DLC, I used the nearest DLC as the destination for Registered Voters without valid PennDOT or DOS ID because it is my understanding that the Commonwealth has consistently told voters they must go to a DLC to obtain free ID for voting.

[6] I am being compensated for my work on this matter at a rate of $475 per hour with a cap of $30,000 for BLDS's work analyzing the data and generating this Report.

evidence of discrimination in the employment, education, lending, and jury selection contexts. I have been appointed as a neutral expert for various federal and state courts, and I was the statistical expert for the Third Circuit Court of Appeals Task Force on Race and Gender. I have been retained by numerous governmental and private organizations, including but not limited to the Equal Employment Opportunity Commission, the United States Justice Department, the National Aeronautic and Space Agency, the Federal Bureau of Investigation, the Central Intelligence Agency, and various states and municipalities as well as numerous Fortune 500 corporations. I have consulted for and testified on behalf of both plaintiffs and defendants in litigation. My resume is attached in Appendix B.

III. MATCHING OF VOTER RECORDS IN THE SURE DATABASE WITH THE PENNDOT DATABASE

On May 6, 2013, I received a database from DOS containing 13,878,135 records. From this population, I selected valid voter records (defined by a Row Status of "True") for Active and Inactive Voters as defined by DOS. The resulting population of 8,231,753 records represents the population from the SURE Database of individuals who will be permitted to vote in the November 2013 election if they have valid ID.[7] Under the Photo ID Law, valid ID includes, but is not limited to, (i) a PennDOT driver's license, (ii) a non-driver photo ID card issued by PennDOT, or (iii) a DOS ID. PennDOT ID must contain an expiration date of November 5, 2012, or later (i.e., one year prior to the November 5, 2013, election) in order to qualify as valid ID to vote in the November 2013 election.

[7] Voters who registered after the SURE Database was exported and provided to me obviously are not captured by my analyses. Newly registered voters without valid PennDOT or DOS ID would cause my findings to increase.

In order to identify the number of Registered Voters who do not have valid PennDOT or DOS ID to vote in the November 2013 election, I matched the records in the SURE Database to those in the PennDOT Database. Specifically, I identified those Registered Voters in the SURE Database who also were in the PennDOT Database. I used the information provided in the SURE Database and the PennDOT Database to develop matching criteria based on (1) last name, (2) first name, (3) middle name, (4) date of birth, (5) last four digits of SSN, (6) license number, (7) license expiration date, and (8) address. Although date of birth and address on a Registered Voter's PennDOT ID are not required to match the information in the SURE Database in order for that individual to vote in the November 2013 election, I used date of birth and address as part of my matching criteria to help me determine whether the individual in the PennDOT Database and the Registered Voter in the SURE database were the same person. In addition, my matching efforts did not attempt to make the type of judgments poll workers will have to make about whether names substantially conform between an ID and the poll book; if the data suggested that the Registered Voter in the SURE Database was the same person in the PennDOT Database, I treated that individual as a match even though poll workers may not allow that person to vote in the November 2013 election.[8]

As summarized in Appendix A-1, I used 12 different, successive matching steps:

1. In Step 1, Registered Voters matched individuals in the PennDOT Database if I could match a license number associated with an expiration date on or after November 5, 2012, as well as the first name and last name of the individual. In

[8] I was conservative in my matching efforts and used techniques that likely created a number of false matches. Therefore, my results likely underestimate those Registered Voters who will be deemed to lack valid PennDOT ID on November 5, 2013.

this step, I allowed for name truncation (e.g., "Rob" for "Robert"). I matched 6,844,529 Registered Voters (83.1% of all Registered Voters) in this first step.

2. Step 2 in the process matched Registered Voters to individuals in the PennDOT Database for whom I could match first name and last name (exactly or with truncation), exact date of birth, and SSN.[9] I matched 475,728 additional Registered Voters (5.8%) in this step.
3. Step 3 matched Registered Voters whose license numbers exactly matched in both the SURE and PennDOT Databases with no other criteria considered. This step gave me an additional 224,273 matches (2.7% of Registered Voters).

After this step, I had matched 91.6% of all Registered Voters, which is comparable to the matching efforts conducted by the Commonwealth in the Summer of 2012. I then continued with nine additional matching steps. In Steps 4 through 6, I took address into consideration. Addresses in two different databases may differ in minor ways. For example, the address in one database may list an apartment as "Apt. # XX" while the address in another database may lack an apartment indicator entirely or may list the apartment as "Apt. XX" without the number sign. Additionally, one database may list an address as "2 Knock N Knoll Cir" while another database may lists the address as "2 Knock & Knoll Circle." To aid in the matching process, I first mapped the latitude and longitude of each address of record in the SURE and PennDOT Databases. I then used these geographic coordinates to match addresses. Mapping addresses by

[9] I attempted to match SSN if the corresponding fields in both the SURE and PennDOT Databases were populated with valid four-digit numbers. Some of the SSN fields were blank, contained the value "NONE," or otherwise did not contain valid last four digits of their SSN, and therefore could not be matched under this criterion. In total, I found 748,931 Registered Voters in the SURE Database without valid last four digits of their SSN.

latitude and longitude specifically pinpoints the geographic coordinates associated with the location of the voter's address.

4. Steps 4 through 6 matched Registered Voters in the SURE Database with individuals in the PennDOT Database for whom I could match first name and last name (exactly or with truncation), exact date of birth, and latitude and longitude of the address of record successively within 5 miles, 10 miles, and within the same county. These steps yielded matches for an additional (i) 184,228, (ii) 333, and (iii) 1,337 Registered Voters, respectively (collectively, 2.3% of Registered Voters).

5. In Step 7, I relaxed the name-matching criteria to include situations where the first names and last names of Registered Voters sounded the same phonetically and were close with respect to spelling compared to the names of individuals in the PennDOT Database. This is known as Fuzzy String matching.[10] The following examples are situations where I was able to find a name match using Fuzzy String matching:

   O'Brien and OBrien
   Jeffrey and Jeffery
   La Rue and LaRue

   In addition to Fuzzy String matching, Step 7 required that SSN and exact date of birth matched, and it required that the latitude and longitude of addresses in the

[10] To incorporate Fuzzy String matching, I used a Soundex condition, which applies a phonetic match requirement. I also used a Damerau-Levenhstein distance measure, which classifies two names as a match if the number of insertions, deletions, and transpositions of letters required to establish the match is less than or equal to one-fourth of the characters (*see* Damerau F. "A Technique For Computer Detection And Correction Of Spelling Errors." *Communications of the ACM* 7(3):171-176 (1964). *See also* Levenshtein VI. "Binary Codes Capable Of Correcting Deletions, Insertions, And Reversals." *Soviet Physics Doklady* 10:707-710 (1966)).

SURE and PennDOT Databases be within 5 miles of each other. Step 7 provided an additional 51,392 matches (0.6% of Registered Voters).

6. Steps 8, 9, and 10 were the same as Step 7 except that the geographic match was relaxed to be within 10 miles, within the same county, and without geographical restriction. These steps yielded matches for an additional (i) 207, (ii) 946, and (iii) 31,613 Registered Voters, respectively (collectively, 0.4% of Registered Voters).

7. In Step 11, I classified Registered Voters as matching individuals in the PennDOT Database if first name and last name (exactly, with truncation, or using Fuzzy String matching), SSN, and zip code matched, and if date of birth matched with respect to the year and either the month or the day. The following examples are situations where I was able to find a birth date match using this last criterion:

   02/03/1970 and 02/13/1970
   02/03/1970 and 03/03/1970

   I identified an additional 136,091 Registered Voter matches (1.7% of Registered Voters) from this step.

8. Finally, in Step 12, I classified as matches those Registered Voters whose SSN and date of birth matched those of individuals in the PennDOT Database, without consideration of name or address. I identified an additional 29,190 matches (0.4% of Registered Voters) at this step.[11]

[11] This step largely ignored the substantial name conformity requirement of the Photo ID Law. As discussed below and in Appendix C, this step resulted in numerous false matches when a sample of the entries in the SURE and PennDOT Databases were compared manually.

Overall, the 12 steps described above identified 7,979,874 matches out of the 8,231,753 Registered Voters (96.9%) in the SURE Database. Thus, the above 12 steps were unable to identify matches for 251,879 of the 8,231,753 Registered Voters (3.1%).

A number of additional Registered Voters in the SURE Database matched individuals in the PennDOT Database, but because these individuals have PennDOT ID with expiration dates prior to November 5, 2012, their ID will not be valid for voting in the November 5, 2013, election. Appendix A-2 provides the number of Registered Voters whose licenses have an expiration date prior to November 5, 2012, for each of the 12 steps presented in Appendix A-1. Overall, an additional 417,502 Registered Voters (5.1%) have a PennDOT ID that expired prior to November 5, 2012.

Because computer databases are never 100% free of errors and automated matching procedures using names and addresses are imperfect, I conducted an audit of my classification of non-matches and matches. As described in more detail in Appendix C, I selected random samples of matched and non-matched Registered Voters to determine whether I manually could locate those Registered Voters in the PennDOT Database. While I classified as non-matches some Registered Voters who I was able to locate in the PennDOT Database using a manual search, approximately the same number of Registered Voters were found to have been falsely classified as matches when I tested three of the 12 steps. Thus, the errors committed in both directions approximately cancel each other out. Nevertheless, even if I assume that all of the estimated false matches were true matches and look only at the estimated 35,263 additional non-matches, I estimate with 95% confidence that my finding of 251,879 Registered Voter non-matches would be lowered by only 52,393 Registered Voters at most (*i.e.*, the upper band of the 95% confidential interval around the estimate of 35,263). This possible error rate does not

impact my finding of 259,536 Registered Voters with non-OOS ID that expired before November 5, 2012. In short, even accounting for a margin of error, my findings show that, with 95% confidence, there are hundreds of thousands of Registered Voters who lack a valid PennDOT or DOS ID for voting in November 2013.

IV. CLASSIFICATION OF VOTERS WITHOUT VALID ID BY RACE AND ETHNICITY, PARTY OF REGISTRATION, AGE GROUP, AND SEX/GENDER

As noted in Section I, I excluded from my subsequent analyses those 157,966 Registered Voters with expired PennDOT ID who were designated OOS in the PennDOT Database. I analyzed the remaining 511,415 Registered Voters lacking valid PennDOT or DOS ID based on specific subgroup characteristics.

A. Race and Ethnicity

I studied the proportion of voters without PennDOT or DOS ID compared to the total Registered Voter population by race and ethnicity. Since race and ethnicity are not recorded in either the SURE or PennDOT Databases, I estimated race and ethnicity by using the generally accepted and reliable Geocoding and Bayesian Improved Surname Geocoding ("BISG") methodologies. Both methodologies show similar and highly statistically significant differences for multiple racial and ethnic minorities among Registered Voters without valid PennDOT or DOS ID in Pennsylvania.

Geocoding involves mapping an individual's address to a census measure of the address's racial and ethnic population. This methodology has been used for years to estimate the racial and ethnic makeup of a population, and it is generally accepted as reliable in my field. Similarly,

I have provided testimony relying on geocoded estimates of race and ethnicity on multiple occasions.[12]

BISG has been shown in academic literature and in my experience to improve the accuracy of the Geocoding methodology by incorporating the known association of surnames with particular racial and ethnic groups into the classification process and thereby providing additional information about an individual's race and ethnicity over Geocoding alone. Briefly, BISG begins with an estimate of race and ethnicity based on an individual's surname, and it then revises that estimate using the information regarding the racial and ethnic composition of the census area in which the address is located. For additional information on BISG, see Elliott, M.N., Morrison, P.A., *et al.* "Using the Census Bureau's Surname List to Improve Estimates of Race/Ethnicity and Associated Disparities" in *Health Serv Outcomes Res Method* 9:69-83 (2009). BISG is now generally accepted to be reliable in my field. For example, the federal Consumer Financial Protection Bureau has adopted the BISG methodology when it needs to estimate race and ethnicity. I similarly have adopted BISG as my preferred methodology. Regardless, I provide my findings using both traditional Geocoding and BISG in Table 2.[13]

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[12] U.S. v. Ingmar Guandique (Death of Chandra Levy) [2009 CF1 9230], U.S. v. Jose Reyes, et al [No. 411, Docket 97-1072], and U.S. v. Rita Gluzman [Docket No. 97-1281].

[13] To further validate both methodologies, I compared the race and ethnicity composition of Registered Voters in Pennsylvania to the race and ethnicity composition reported by the U.S. Census Bureau for Pennsylvania in November 2012. As presented in Appendix D, among Registered Voters, the percentage of Non-Hispanic whites was 85.0%, the percentage of African Americans was 9.9%, and the percentage of Hispanics was 3.3%. My estimates using BISG found that 84.1% of Registered Voters in Pennsylvania are Non-Hispanic white, 10.6% are African American, and 2.9% are Hispanics. Similarly, my estimates using Geocoding alone found 82.8% are Non-Hispanic white, 10.9% are African American, and 3.7% are Hispanic. Both methodologies yield results that are reasonably close to those published by the U.S. Census Bureau and presented in Appendix D.

Table 2 shows the total number of Registered Voters, number of Registered Voters lacking valid PennDOT or DOS ID, and percentage of Registered Voters without valid PennDOT or DOS ID divided by race and ethnicity as calculated using each methodology. Both approaches reveal a statistically significantly greater proportion of Registered Voters without valid PennDOT or DOS ID among each of the known racial and ethnic groups than among the group of Non-Hispanic white Registered Voters. These disparities are highly statistically significant with *p*-values far lower than one in 750 trillion.[14] For example, the disparity between the 10.80% of African American Registered Voters who do not have valid PennDOT or DOS ID and the 5.49% of Non-Hispanic white Registered Voters who do not have valid PennDOT or DOS ID is 228 units of standard deviation; compared to Non-Hispanic white Registered Voters, all other racial and ethnic groups similarly have a highly statistically significantly greater

[14] Statistical significance addresses whether an observed difference indicates a real difference or can be attributed to chance variation alone. The absolute difference between what is observed and what is expected, assuming the demographic factor being studied is not related to the outcome, can be converted to "units of standard deviation." The greater the number of units of standard deviation, the less likely that a difference is attributable to chance alone. Statisticians often use a benchmark, or disparity, of two or three units of standard deviation to indicate statistical significance. A disparity of two units of standard deviation approximately corresponds to a probability of occurrence (i.e., *p*-value) of 0.05; a disparity of three units of standard deviation approximately corresponds to a probability of occurrence of 0.01. Statistical significance is largely determined by the magnitude of the difference observed and the sample size (i.e., number of observations). A given difference may not be statistically significant if the sample size is "small," but the same difference could be statistically significant if the sample size is "large." In this study, the population and sample sizes are extremely large (in the tens and hundreds of thousands). With such a very large number of observations, small differences will be statistically significant. In this Report, some units of standard deviation exceed 100 or even 200. In the field of statistics, it is generally accepted that when the number of units of standard deviation exceeds eight, the associated *p*-values are so small that a *p*-value cannot be computed. As a point of reference, eight units of standard deviation approximately corresponds to a probability of occurrence of one in 750 trillion. The user of these statistics has discretion to determine whether any particular statistically significant result is large enough to be of practical importance. In this case, practical importance refers to how many Registered Voters will not be allowed to vote. As discussed in this report, the subgroup data overwhelmingly show that many thousands of minority, Democrat, Female, and young and older Registered Voters face a higher risk of not being allowed to vote under the Photo ID Law.

percentage of Registered Voters without valid PennDOT or DOS ID. Table 2A presents comparable figures for November 2012 Voters. Again, each of the Non-Hispanic white racial and ethnic groups has a highly statistically significantly greater percentage of November 2012 Voters without valid PennDOT or DOS ID as compared to Non-Hispanic white November 2012 Voters.

B. Party of Registration

Table 3 breaks down the number of Registered Voters without valid PennDOT or DOS ID by party of registration. Among Registered Voters who registered as Democrat, 7.36% do not have valid PennDOT or DOS ID. Among Registered Voters who registered as Republican, 4.52% do not have valid ID. The difference in these percentages constitutes a disparity of 145.1 units of standard deviation and, therefore, is highly statistically significant. Table 3A presents comparable figures for November 2012 Voters. 3.01% of November 2012 Voters who registered Democrat compared to 1.62% of November 2012 Voters who registered Republican do not have valid PennDOT or DOS ID. This equates to a disparity of 99.8 units of standard deviation.

C. **Age Group**

Table 4 breaks down the number of Registered Voters without valid PennDOT or DOS ID to vote in the November 2013 election by age group. The proportion of Registered Voters ages 18-22 (e.g., college students) and ages 80-89 (e.g., the elderly who no longer drive) who do not have valid PennDOT or DOS ID exceeds 11% percent of the total population of Registered Voters in each of those age groups; the percentage of Registered Voters over age 90 who do not have valid PennDOT or DOS ID is 40.58%. The corresponding percentages for the intermediary age groups are 6.81% for Registered Voters ages 23-49, 3.21% for Registered Voters ages 50-69, and 4.62% for Registered Voters ages 70-79.

The corresponding percentages among November 2012 Voters as presented in Table 4A are 12.01% for Registered Voters ages 18-22, 5.62% for Registered Voters ages 80-89, and 22.38% for Registered Voters over age 90. The corresponding percentages for the intermediary age groups are 1.83% for Registered Voters ages 23-49, 1.25% for Registered Voters ages 50-69, and 2.20% for Registered Voters ages 70-79.

The statistical disparity among the percentage of Registered Voters and November 2012 Voters without PennDOT or DOS ID by age group exceeds 100 units of standard deviation. The statistical disparity in percentages between those aged 80 or older compared to those younger than 80 represents 351 units of standard deviation. The comparable statistical disparity for those aged 80 or older compared to those younger than 80 among November 2012 Voters represents 242 units of standard deviation.

D. Sex/Gender

Table 5 presents the number of Registered Voters without valid PennDOT or DOS ID by sex/gender. For this comparison, I separated the population into two groups -- matched Registered Voters with PennDOT ID that expired prior to November 5, 2012, and non-matched Registered Voters who do not have valid PennDOT or DOS ID. I did this because the PennDOT Database contains sex/gender designations but the SURE Database generally does not.

The top portion of Table 5 compares the percentage of male and female Registered Voters that I was able to match to the PennDOT Database but whose ID expired before November 5, 2012. Female Registered Voters comprise 52.58% of overall Registered Voters matched to a PennDOT ID and 54.80% of Registered Voters matched to a PennDOT ID that expired before November 5, 2012. Stated another way, 3.50% of the PennDOT IDs matched to a Female Registered Voter expired before November 5, 2012, compared to 3.20% of PennDOT

IDs matched to a Male Registered Voter. In absolute terms, this means that there are 142,212 Female Registered Voters matched to a PennDOT ID that is not valid for voting in November 2013 compared to 130,097 Female Registered Voters if Female Registered Voters had expired PennDOT ID at the same rate as Male Registered Voters. This observed difference is highly statistically significant (22.21 units of standard deviations), which is not surprising since females tend to live longer than males and thus are more likely to have an expired PennDOT ID.

The bottom portion of Table 5 compares the percentage of non-matched male and female Registered Voters -- i.e., Registered Voters with no PennDOT or DOS ID. Because the SURE Database generally does not include sex/gender identifiers, I assigned sex/gender to Registered Voters by using a survey conducted by the U.S. Census Bureau in 1990.[15] Using data from this Census survey, I computed the probability that a person with a given first name would be male or female. For example, if there were 1,000 persons named Michael and 990 were male, then the probability that a person named Michael is male is 0.990. I classified a Registered Voter as Male or Female if the associated probability was at least 0.90. Female Registered Voters comprise 55.64% of these Registered Voters without PennDOT or DOS ID, which represents a disparity equal to 29.05 units of standard deviations. This finding is not surprising since females tend to change their last names more frequently than males.

Table 5A presents comparable figures by gender/sex restricted to November 2012 Voters.

[15] U.S. Census Bureau. "Frequently Occurring Surnames from the 1990 Census." October 1995, Web. Sept 19, 2009. http://www.census.gov/genealogy/www/data/1990surnames/.

V. CLASSIFICATION OF VOTERS WITHOUT VALID ID BY GEOGRAPHIC CHARACTERISTICS

Registered Voters in Pennsylvania who do not have a valid PennDOT or DOS ID may be able to obtain one at a PennDOT DLC. I therefore looked at the characteristics of Registered Voters lacking valid PennDOT or DOS ID in relation to the nearest DLC.

A. County

I first tabulated the proportion of non-matched Registered Voters by county. Table 6 shows the total number of Registered Voters, number of Registered Voters without valid PennDOT or DOS ID, and percentage of Registered Voters without valid PennDOT or DOS ID for each of the counties in Pennsylvania. As discussed previously, overall, 6.4% of non-OOS Registered Voters in Pennsylvania do not have valid PennDOT or DOS ID for purposes of voting in the November 5, 2013, election. Union, Centre, and Philadelphia Counties have the greatest proportion of voters lacking PennDOT or DOS ID with 14.8%, 13.6%, and 12.7% of Registered Voters in each county lacking such ID, respectively.

I also was asked to provide separate statistics for two groups of counties:

- The nine counties without a PennDOT DLC -- Cameron, Clinton, Forest, Fulton, Juniata, Montour, Perry, Sullivan, and Union.
- The 23 counties with PennDOT DLCs that are open only one or two days per week --
    - counties open only one day each week include Columbia, Clarion, Wayne, Huntingdon, Carbon, Mifflin, Pike, Bradford, Susquehanna, Northumberland, Wyoming, Greene, and Tioga, and

- counties open only two days each week include Armstrong, Potter, Bedford, Westmoreland, McKean, Indiana, Jefferson, Venango, Elk, and Warren.[16]

These statistics are also presented in Table 6.

Table 6A is similar to Table 6, but it is limited to November 2012 Voters.

B. <u>Driving Distance and Time to Nearest DLC</u>

I next determined the driving distances for each of the 442,850 voters without valid ID for whom I could geographically map the latitude and longitude of the address of record. These latitudes and longitudes provide the information necessary for computing the driving distance and driving times between two addresses, and they routinely are used by Google Maps, MapQuest, and similar mapping programs in their calculations of driving routes, distances, and times. I geographically mapped the addresses of record by using Open Street Map and PG Routing software. I benchmarked my distance calculation against MapQuest and found that the Open Street Map distance calculations were, on average, 0.4 miles less than the MapQuest calculations. The distances I computed using Open Street Map were slightly more conservative than those from MapQuest since I computed distances using the shortest route between the Registered Voter's address and the nearest DLC.

The distance and time required for Registered Voters to travel between the nearest DLC and their homes varies widely by county. Distance statistics by county are presented in Table 7, which shows by county the median round-trip driving distance as well as the round-trip driving distance for the middle 50% (25^{th} to 75^{th} percentile) and middle 95% (2.5^{th} to 97.5^{th} percentile) of Registered Voters without valid PennDOT or DOS ID.

[16] My source for this information is the "Stipulation Regarding PennDOT Web Searches" (Jul. 25, 2012).

Overall, the median round-trip driving distance to the nearest DLC for Registered Voters without valid PennDOT or DOS ID is 9.96 miles. Focusing on the nine counties which have no DLC, the median driving distance is 36.63 miles; in those counties with DLCs open only one or two days each week, the median driving distance is 18.53 miles. As expected, voters in these counties have longer commutes to the DLC: almost four times longer in counties without a DLC than the overall median, and almost two times longer in counties with DLCs open only one or two days a week than the overall median. Table 7A presents similar statistics but is limited to November 2012 Voters.

I also estimated the driving time that it would take for Registered Voters without valid PennDOT or DOS ID to travel between their homes and the nearest DLC. I selected a random sample of 15,000 Registered Voters without valid PennDOT or DOS ID. I randomly selected Registered Voters without a valid PennDOT or DOS ID for the sample in proportion to their county's representation among the total population of Registered Voters without valid ID. Using MapQuest's travel time function, I then determined the driving time from their homes to the nearest DLC. The bottom portion of Table 8 contains a number of statistics describing the round-trip driving time of Registered Voters without PennDOT or DOS ID from their homes to the nearest DLC. For example, the average round-trip driving time to the nearest DLC is 25.02 minutes, while the average round-trip driving time for the middle 95% of Registered Voters without valid ID ranges from 5.07 to 71.07 minutes. Table 8 also reveals that the proportion of Registered Voters who have a round-trip driving time of 30 minutes or longer is 28.7%, while 11.5% of Registered Voters without PennDOT or DOS ID have a round-trip driving time of 45 minutes or longer. Table 8A provides comparable data, but it is limited to November 2012 Voters without valid ID.

Table 8 also contains statistics describing the round-trip driving distance of Registered Voters without PennDOT or DOS ID from their homes to the nearest DLC. For example, among Registered Voters without valid PennDOT or DOS ID, the average round-trip driving distance to the nearest DLC is 14.11 miles, while the average round-trip driving distance for the middle 95% ranges from 1.76 to 47.63 miles. The proportion of Registered Voters who have a round-trip driving distance of 20 or more miles is 21.9%, while 10.5% of Registered Voters without PennDOT or DOS ID have a round-trip driving distance of 30 or more miles. Table 8A provides comparable data limited to November 2012 Voters without valid ID. For example, among November 2012 voters without PennDOT or DOS ID, the average round-trip driving distance to the nearest DLC is 13.53 miles, while the average round-trip driving distance for the middle 95% ranges from 1.75 to 46.61 miles. The proportion of November 2012 Voters who have a round-trip distance of 20 or more miles to the nearest DLC is 20.0%, while 9.0% of November 2012 Voters without PennDOT or DOS ID have a round-trip distance of 30 or more miles.

C. Commuting Time to Nearest DLC by Public Transportation in Philadelphia and Pittsburgh

Registered Voters in the two major Pennsylvania urban areas of Philadelphia and Pittsburgh who cannot get a ride to the nearest DLC may be able to travel to a DLC by public transportation. Thus, I made a separate estimate of the average public transportation travel time for Registered Voters without valid PennDOT or DOS ID to commute from their homes in Philadelphia or Pittsburgh to the nearest DLC. I did this using the mass transit option in Google Maps, which calculated the commuting time from the Registered Voter's address of record to the nearest DLC using available bus, subway, and rail schedules as well as estimates for walking time.

For this analysis, I selected a random sample of 2,000 Registered Voters from Philadelphia and Pittsburgh who do not have valid PennDOT or DOS ID. I randomly selected Registered Voters without a valid PennDOT or DOS ID for the sample in proportion to their representation among the total population of Registered Voters without valid ID in Philadelphia and Pittsburgh. Table 9 contains a number of statistics describing the round-trip commuting time of Registered Voters without PennDOT or DOS ID from their homes to the nearest DLC. For example, among Registered Voters without valid ID in Philadelphia and Pittsburgh, the average round-trip commuting time to the nearest DLC is 51.82 minutes, while the average round-trip commuting time for the middle 95% ranges from 14.78 to 120.23 minutes. The proportion of Registered Voters in Philadelphia and Pittsburgh without valid ID who have a round-trip commuting time of 60 minutes or longer is 28.1%. Table 9A provides comparable data limited to November 2012 Voters in Philadelphia and Pittsburgh without PennDOT or DOS ID. For example, among November 2012 voters without PennDOT or DOS ID, the average round-trip commuting time to the nearest DLC is 50.27 minutes, while the average round-trip commuting time for the middle 95% ranges from 14.20 to 117.26 minutes. The proportion of Registered Voters in Philadelphia and Pittsburgh without valid ID who have a round-trip commuting time of 60 minutes or longer is 25.0%.

VI. SPECIFIC REGISTERED VOTERS WITHOUT VALID PENNDOT OR DOS ID

Petitioners' Counsel asked that I use the public Full Voter Export file to provide them with a list of voters who may lack valid PennDOT or DOS ID. I subsequently was asked to confirm whether the following Registered Voters, who may testify at trial, lack valid PennDOT or DOS ID: Mina Pripstein, Mary Toadvin, Catherine Howell, Patricia Norton, Marion Baker, Theresa Kukowski, Margaret Pennington, and David Proctor. Based on my matching efforts, I have

conveyed that information to Petitioners' counsel. To assure compliance with the protective order, I have not included those results here, but understand that Petitioners' counsel will convey that information orally to counsel for Respondents.

VII. SOFTWARE USED AND OTHER TECHNICAL DETAILS

Appendix E contains a list of the software programs that I used to conduct the matching and statistical analyses presented in this Report. This software is publically available. The SURE Database and PennDOT Database files are subject to Court order precluding BLDS from disclosing them to any third party or transmitting the data outside of BLDS's physical security perimeter. All derivative and intermediate files I created from these databases are also subject to Court order preventing disclosure or transmitting outside of BLDS. Both the SURE and PennDOT Databases are available from Respondents. Using those files and the matching procedures I have described in detail in this report and the appendices, my matching results can be substantially recreated by Respondents. Similar random samples from those results can be selected by Respondents using the same methodologies and publicly available software to validate the results based on my random samples. My subgroup analyses can also be substantially replicated using the standard methodologies I describe in this report.

The public Full Voter Export file I received is not covered by Court order but was not utilized in the analyses described above; it was utilized only to provide reports to Petitioners' counsel consistent with the Court order. This database is also available from Respondents.

VIII. CONCLUSIONS

In conclusion, after comparing the SURE Database and the PennDOT Database using my 12 step matching procedure, I identified 251,879 Registered Voters (3.1%) who do not have, and

appear never to have had, PennDOT or DOS ID. In addition, I identified another 417,502 Registered Voters (5.1%) who do not have valid PennDOT or DOS ID for voting in the upcoming November 2013 election because their PennDOT IDs expired prior to November 5, 2012. Thus, I identified a total of 669,381 Registered Voters who lack valid PennDOT or DOS ID in order to vote in the November 2013 election. After accounting for Registered Voters listed by PennDOT as being OOS, I was left with 511,415 Registered Voters (6.2 %) who lack a PennDOT or DOS ID acceptable for voting in the November 2013 election. Even after accounting for a reasonable margin of error and inherent imperfections in matching two databases, these findings show with very high confidence that hundreds of thousands of Pennsylvania Registered Voters lack acceptable PennDOT or DOS ID for voting in the November 2013 election.

My analysis of the impact of the Photo ID Law on subgroups of Registered Voters reveals disparities in the percentage of Registered Voters without valid ID that are highly statistically significantly adverse based on the following comparisons:

- African Americans compared to non-Hispanic white Registered Voters;
- Hispanics compared to non-Hispanic white Registered Voters;
- Other minority races compared to non-Hispanic white Registered Voters;
- Democrat compared to Republican Registered Voters;
- Female compared to Male Registered Voters; and
- Younger (ages 18-22) and older (over age 80) Registered Voters compared to Registered Voters in other age groups.

Registered Voters in Pennsylvania who do not have acceptable ID for voting under the Photo ID Law may be able to obtain one at a DLC. I found that the median round-trip driving

distance for such voters lacking acceptable ID was 9.96 miles, the maximum was 142.77 miles, and the distance for the middle 95 percent of the population ranged from 1.76 miles to 47.63 miles. The Registered Voters in the 9 counties without a DLC have driving distances of almost 4 times the overall median, and voters living in counties where the DLC is only open 1 or 2 days a week have a driving distance of almost double the overall median.

Registered Voters in the two major Pennsylvania urban areas who cannot get a ride to the nearest DLC may be able to travel to a DLC by public transportation. I found that the average commuting time for these individuals to travel to and from the closest DLC is 51.82 minutes, the median is 46.30 minutes, the maximum is 222.50 minutes, and the range for 95 percent of the population is from 14.78 to 120.23 minutes. The proportion of non-matched voters who have a round trip travel time of 60 minutes or more is 28.1 percent.

I declare under penalty of perjury that the foregoing is true and accurate to the best of my knowledge and belief.

Dated July 1, 2013

Bernard R. Siskin, Ph.D.

TABLES

TABLE 1

OVERALL RESULTS: REGISTERED VOTERS IN THE SURE DATABASE COMPARED TO RECORDS OF PENNDOT AND DOS IDS

Total Registered Voters from the May 6, 2013, SURE Database: 8,231,753
Total November 2012 Voters from the May 6, 2013, SURE Database: 5,742,557

Non Out of State (Non "OOS")[1]

Non-Matched[2] to Any PennDOT Record (including DOS ID)

	Total	Percentage	Voted at Polls	Voted Absentee	Voted Provisionally	Did Not Vote In November 2012
Registered Voters	251,879	3.06%	N/A	N/A	N/A	162,126
November 2012 Voters	89,753	1.09%	79,322	8,197	2,234	

Matched to PennDOT Record Expired Before November 5, 2012

	Total	Percentage	Voted at Polls	Voted Absentee	Voted Provisionally	Did Not Vote In November 2012
Registered Voters	259,536	3.22%	N/A	N/A	N/A	206,243
November 2012 Voters	53,293	0.65%	36,456	16,142	695	

Total: Non-Matched + PennDOT Record Expired Before November 5, 2012

	Total	Percentage	Voted at Polls	Voted Absentee	Voted Provisionally	Did Not Vote In November 2012
Registered Voters	511,415	6.21%	N/A	N/A	N/A	368,369
November 2012 Voters	143,046	1.74%	115,778	24,339	2,929	

OOS

Matched to PennDOT Record Expired Before November 5, 2012

	Total	Percentage	Voted at Polls	Voted Absentee	Voted Provisionally	Did Not Vote In November 2012
Registered Voters	157,966	1.92%	N/A	N/A	N/A	152,128
November 2012 Voters	5,838	0.10%	4,220	1,529	89	

[1] OOS refers to PennDOT records marked "Out of State." This likely means an individual turned a PennDOT license into another state's Department of Motor Vehicles, which then notified PennDOT that the driver is now out of state. Although some of these individuals may move back in state and thus become eligible to vote again in Pennsylvania (and others may live only temporarily out of state as college students while maintaining eligibility to vote in Pennsylvania), I conservatively have treated all of these voters as no longer eligible to vote in Pennsylvania. The data shows that 4,220 OOS individuals voted in November 2012.

[2] Matches were defined broadly using multiple criteria described in Appendix A-1. Certain of these "matches" likely are not actually the same person (false matches) or will be judged not to have substantially conforming names by a poll workers. I treated these persons as if they have valid identification for voting purposes.

TABLE 2

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY RACE/ETHNICITY

ALL VOTER RECORDS

A. Using BISG

Race/Ethnicity	Registered Voters	Number without Valid ID	Percent of Registered Voters
White (Non-Hispanic)	6,559,368	360,231	5.49%
African American	826,239	89,265	10.80%
Hispanic	228,232	24,851	10.89%
Asian	125,004	13,964	11.17%
American Indian	7,934	648	8.17%
Multirace	52,835	4,507	8.53%
Total	7,799,612	493,466	6.33%

Statistical disparity in percentages between African American and White (non-Hispanic) is 228 units of standard deviation.
Statistical disparity in percentages between Hispanics and White (non-Hispanic) is 108 units of standard deviation.
Statistical disparity in percentages between Other Races[1] and White (non-Hispanic) is 114 units of standard deviation.

B. Using Geocoding

Race/Ethnicity	Registered Voters	Number without Valid ID	Percent of Registered Voters
White (Non-Hispanic)	6,458,161	359,509	5.57%
African American	846,959	89,483	10.57%
Hispanic	290,811	26,573	9.14%
Asian	133,819	12,482	9.33%
American Indian	8,892	692	7.78%
Multirace	60,974	4,727	7.75%
Total	7,799,616	493,466	6.33%

Statistical disparity in percentages between African American and White (non-Hispanic) is 210 units of standard deviation.
Statistical disparity in percentages between Hispanics and White (non-Hispanic) is 107 units of standard deviation.
Statistical disparity in percentages between Other Races[1] and White (non-Hispanic) is 184 units of standard deviation.

[1] Other Races are the Asian, American Indian, and Multirace categories.

Note

Excludes Unknown Races

TABLE 2A

REGISTERED VOTERS
ESTIMATED TO NOT HAVE VALID PENNDOT OR
DOS ID (EXCLUDES OOS ID)
BY RACE/ETHNICITY

RESTRICTED TO NOVEMBER 2012 VOTERS

A. Using BISG

Race/Ethnicity	November 2012 Voters	Number without Valid ID	Percent of November 2012 Voters
White (Non-Hispanic)	4,775,938	100,440	2.10%
African American	580,944	28,082	4.83%
Hispanic	129,629	4,792	3.70%
Asian	77,935	4,178	5.36%
American Indian	5,464	183	3.35%
Multirace	36,163	1,287	3.56%
Total	5,606,073	138,962	2.48%

Statistical disparity in percentages between African American and White (non-Hispanic) is 152 units of standard deviation.
Statistical disparity in percentages between Hispanics and White (non-Hispanic) is 38 units of standard deviation.
Statistical disparity in percentages between Other Races[1] and White (non-Hispanic) is 83 units of standard deviation.

B. Using Geocoding

Race/Ethnicity	November 2012 Voters	Number without Valid ID	Percent of November 2012 Voters
White (Non-Hispanic)	4,683,046	99,450	2.12%
African American	591,468	27,745	4.69%
Hispanic	186,019	6,281	3.38%
Asian	96,266	3,914	4.07%
American Indian	6,208	198	3.19%
Multirace	43,069	1,374	3.19%
Total	5,606,076	138,962	2.48%

Statistical disparity in percentages between African American and White (non-Hispanic) is 145 units of standard deviation.
Statistical disparity in percentages between Hispanics and White (non-Hispanic) is 34 units of standard deviation.
Statistical disparity in percentages between Other Races[1] and White (non-Hispanic) is 135 units of standard deviation.

[1] Other Races are the Asian, American Indian, and Multirace categories.

Note

Excludes Unknown Races

TABLE 3

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY PARTY OF REGISTRATION

ALL VOTER RECORDS

Party Registration	Registered Voters	Number without Valid ID	Percent of Registered Voters
Democrat	3,999,240	294,284	7.36%
Republican	2,958,497	133,762	4.52%
No Affiliation	584,862	55,506	9.49%
Others	435,358	26,821	6.16%
Total	7,977,957	510,373	6.40%

Statistical disparity in percentages between Democrat and Republican is 145.1 units of standard deviation.

Note

Excludes Unknown Party Registration.

TABLE 3A

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY PARTY OF REGISTRATION

RESTRICTED TO NOVEMBER 2012 VOTERS

Party Registration	November 2012 Voters	Number without Valid ID	Percent of November 2012 Voters
Democrat	2,833,092	85,307	3.01%
Republican	2,292,989	37,246	1.62%
No Affiliation	315,877	15,208	4.81%
Others	281,338	4,703	1.67%
Total	5,723,296	142,464	2.49%

Statistical disparity in percentages between Democrat and Republican is 99.8 units of standard deviation.

Note

Excludes Unknown Party Registration.

TABLE 4

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY AGE GROUP

ALL VOTER RECORDS

Age Group	Registered Voters	Number without Valid ID	Percent of Registered Voters
18-22	335,339	37,128	11.07%
23-49	3,494,335	238,102	6.81%
50-69	2,829,288	90,714	3.21%
70-79	733,808	33,893	4.62%
80-89	453,863	53,809	11.86%
90+	134,533	54,597	40.58%
Total	7,981,166	508,243	6.37%

The statistical disparity in percentages between each Age Group exceeds 100 units of standard deviation. The statistical disparity in percentages between Age Groups 80 and over and Age Groups younger than 80 represents 351 units of standard deviation.

Note

Excludes Unknown Age.

TABLE 4A

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY AGE GROUP

RESTRICTED TO NOVEMBER 2012 VOTERS

Age Group	November 2012 Voters	Number without Valid ID	Percent of November 2012 Voters
18-22	206,433	24,793	12.01%
23-49	2,215,159	40,471	1.83%
50-69	2,290,071	28,643	1.25%
70-79	612,083	13,450	2.20%
80-89	333,004	18,725	5.62%
90+	68,878	15,417	22.38%
Total	5,725,628	141,499	2.47%

The statistical disparity in percentages between each Age Group exceeds 100 units of standard deviation. The statistical disparity in percentages between Age Groups 80 and over and Age Groups younger than 80 represents 242 units of standard deviation.

Note

Excludes Unknown Age.

TABLE 5

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY SEX/GENDER

ALL VOTER RECORDS

MATCHED RECORDS, BUT EXPIRED BEFORE NOVEMBER 5, 2012

Sex/Gender	Registered Voters	Number with Expired ID	Percent of Registered Voters
Female	4,065,934	142,212	3.50%
Male	3,666,665	117,322	3.20%
Total	7,732,599	259,534	3.36%
Percent Female	52.58%	54.80%	

Statistical disparity in percentage between Female and Male is 22.21 units of standard deviation.

NON-MATCHED RECORD, INCLUDING DOS ID

Sex/Gender	Number without PennDOT or DOS ID
Female	124,943
Male	99,609
Total	224,552
Percent Female	55.64%

Statistical disparity in percentages between Female and Male is 29.05 units of standard deviation.

Note

Excludes Unknown Sex/Gender.

TABLE 5A

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY SEX/GENDER

RESTRICTED TO NOVEMBER 2012 VOTERS

MATCHED RECORDS, BUT EXPIRED BEFORE NOVEMBER 5, 2012

Sex/Gender	November 2012 Voters	Number with Expired ID	Percent of November 2012 Voters
Female	3,028,772	33,104	1.09%
Male	2,608,706	20,189	0.77%
Total	5,637,478	53,293	0.95%
Percent Female	53.73%	62.12%	

Statistical disparity in percentage between Female and Male is 38.67 units of standard deviation.

NON-MATCHED RECORD, INCLUDING DOS ID

Sex/Gender	Number without PennDOT or DOS ID
Female	46,581
Male	35,216
Total	81,797
Percent Female	56.95%

Statistical disparity in percentages between Female and Male is 18.45 units of standard deviation.

Note

Excludes Unknown Sex/Gender.

TABLE 6

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY COUNTY

ALL VOTER RECORDS

PA County	Registered Voters	Number without Valid ID	Percent of Registered Voters
Adams	58,113	2,392	4.1%
Allegheny	854,024	61,725	7.2%
Armstrong‡	40,333	1,206	3.0%
Beaver	106,974	3,989	3.7%
Bedford‡	31,442	1,627	5.2%
Berks	239,329	9,599	4.0%
Blair	81,858	7,792	9.5%
Bradford‡	37,420	2,888	7.7%
Bucks	414,023	14,583	3.5%
Butler	117,088	4,380	3.7%
Cambria	83,168	3,527	4.2%
Cameron†	3,472	379	10.9%
Carbon‡	37,408	1,437	3.8%
Centre	102,404	15,154	14.8%
Chester	318,482	14,608	4.6%
Clarion‡	22,428	808	3.6%
Clearfield	49,476	3,507	7.1%
Clinton†	22,068	1,687	7.6%
Columbia‡	38,062	2,104	5.5%
Crawford	51,139	3,020	5.9%
Cumberland	143,981	6,169	4.3%
Dauphin	169,701	7,573	4.5%
Delaware	373,299	25,827	6.9%
Elk‡	19,271	693	3.6%
Erie	171,223	10,010	5.8%
Fayette	78,682	4,499	5.7%
Forest†	3,227	128	4.0%
Franklin	84,564	2,946	3.5%
Fulton†	8,710	360	4.1%
Greene‡	21,613	870	4.0%
Huntingdon‡	27,877	2,290	8.2%

TABLE 6

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY COUNTY

ALL VOTER RECORDS

PA County	Registered Voters	Number without Valid ID	Percent of Registered Voters
Indiana‡	54,699	4,407	8.1%
Jefferson‡	27,656	1,859	6.7%
Juniata†	13,406	491	3.7%
Lackawanna	142,947	10,418	7.3%
Lancaster	299,653	13,369	4.5%
Lawrence	57,953	4,240	7.3%
Lebanon	78,658	2,667	3.4%
Lehigh	210,516	10,638	5.1%
Luzerne	189,510	11,802	6.2%
Lycoming	64,492	2,344	3.6%
Mckean‡	23,308	1,197	5.1%
Mercer	69,817	3,374	4.8%
Mifflin‡	24,133	1,050	4.4%
Monroe	95,643	4,576	4.8%
Montgomery	522,418	24,850	4.8%
Montour†	11,381	763	6.7%
Northampton	189,913	14,020	7.4%
Northumberland‡	52,182	3,146	6.0%
Perry†	26,444	611	2.3%
Philadelphia	996,226	126,310	12.7%
Pike‡	37,002	2,591	7.0%
Potter‡	10,444	420	4.0%
Schuylkill	83,418	3,742	4.5%
Snyder	20,826	1,157	5.6%
Somerset	47,760	2,704	5.7%
Sullivan†	4,122	202	4.9%
Susquehanna‡	24,615	932	3.8%
Tioga‡	24,813	1,062	4.3%
Union†	22,589	3,062	13.6%
Venango‡	30,974	1,073	3.5%

TABLE 6

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY COUNTY

ALL VOTER RECORDS

PA County	Registered Voters	Number without Valid ID	Percent of Registered Voters
Warren‡	27,618	2,269	8.2%
Washington	135,506	6,754	5.0%
Wayne‡	30,510	1,269	4.2%
Westmoreland‡	234,087	8,886	3.8%
Wyoming‡	16,733	625	3.7%
York	271,704	14,758	5.4%
Total	7,984,535	511,415	6.4%
† No DLC in County	115,419	7,683	6.7%
‡ DLC only open 1 or 2 days per week	894,628	44,709	5.0%

TABLE 6A

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY COUNTY

RESTRICTED TO NOVEMBER 2012 VOTERS

PA County	November 2012 Voters	Number without Valid ID	Percent of November 2012 Voters
Adams	42,331	728	1.7%
Allegheny	617,271	17,756	2.9%
Armstrong‡	29,684	372	1.3%
Beaver	80,277	1,392	1.7%
Bedford‡	21,905	353	1.6%
Berks	170,268	2,097	1.2%
Blair	50,764	894	1.8%
Bradford‡	23,545	340	1.4%
Bucks	319,591	4,326	1.4%
Butler	89,511	1,200	1.3%
Cambria	60,905	1,129	1.9%
Cameron†	2,112	51	2.4%
Carbon‡	25,538	407	1.6%
Centre	68,824	4,934	7.2%
Chester	249,578	4,415	1.8%
Clarion‡	16,226	206	1.3%
Clearfield	32,102	515	1.6%
Clinton†	13,172	220	1.7%
Columbia‡	25,613	511	2.0%
Crawford	35,538	782	2.2%
Cumberland	110,597	2,227	2.0%
Dauphin	122,388	1,859	1.5%
Delaware	283,444	8,308	2.9%
Elk‡	13,351	206	1.5%
Erie	119,584	2,061	1.7%
Fayette	48,769	828	1.7%
Forest†	2,313	39	1.7%
Franklin	62,844	764	1.2%
Fulton†	6,195	74	1.2%
Greene‡	14,599	218	1.5%
Huntingdon‡	17,501	260	1.5%

TABLE 6A

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY COUNTY

RESTRICTED TO NOVEMBER 2012 VOTERS

PA County	November 2012 Voters	Number without Valid ID	Percent of November 2012 Voters
Indiana‡	36,006	780	2.2%
Jefferson‡	17,837	257	1.4%
Juniata†	9,531	91	1.0%
Lackawanna	97,449	2,873	2.9%
Lancaster	222,301	3,965	1.8%
Lawrence	38,940	813	2.1%
Lebanon	56,662	677	1.2%
Lehigh	147,047	2,857	1.9%
Luzerne	122,962	2,967	2.4%
Lycoming	47,313	843	1.8%
Mckean‡	14,973	260	1.7%
Mercer	51,225	966	1.9%
Mifflin‡	16,229	226	1.4%
Monroe	62,790	1,066	1.7%
Montgomery	409,837	8,232	2.0%
Montour†	7,803	197	2.5%
Northampton	130,640	3,002	2.3%
Northumberland‡	33,285	619	1.9%
Perry†	19,067	188	1.0%
Philadelphia	689,826	41,145	6.0%
Pike‡	23,222	391	1.7%
Potter‡	7,260	102	1.4%
Schuylkill	58,165	1,358	2.3%
Snyder	14,934	396	2.7%
Somerset	34,058	528	1.6%
Sullivan†	2,949	54	1.8%
Susquehanna‡	18,079	279	1.5%
Tioga‡	17,171	311	1.8%
Union†	16,302	1,147	7.0%
Venango‡	22,236	299	1.3%
Warren‡	17,501	251	1.4%

TABLE 6A

REGISTERED VOTERS ESTIMATED TO NOT HAVE VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY COUNTY

RESTRICTED TO NOVEMBER 2012 VOTERS

PA County	November 2012 Voters	Number without Valid ID	Percent of November 2012 Voters
Washington	94,206	1,525	1.6%
Wayne‡	21,533	335	1.6%
Westmoreland‡	170,003	2,263	1.3%
Wyoming‡	11,895	199	1.7%
York	189,691	2,112	1.1%
Total	5,727,268	143,046	2.5%
† No DLC in County	79,444	2,061	2.6%
+ DLC only open 1 or 2 days per week	615,192	9,445	1.5%

TABLE 7

ROUND-TRIP DRIVING DISTANCE IN MILES TO DRIVER LICENSE CENTER ("DLC") FOR REGISTERED VOTERS WITHOUT VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY COUNTY

ALL VOTER RECORDS

PA County	Number Without Valid ID	Driving Distance in Miles				
		2.5 Percentile	25 Percentile	Median 50th Percentile	75 Percentile	97.5 Percentile
Adams	2,293	1.33	2.25	11.72	22.95	35.65
Allegheny	55,664	1.76	6.55	9.43	12.73	27.57
Armstrong‡	1,012	2.02	9.56	24.53	28.88	46.04
Beaver	3,725	4.29	14.28	21.97	30.38	39.77
Bedford‡	1,335	3.52	10.95	26.17	40.66	58.35
Berks	8,565	2.03	6.13	7.96	17.31	47.28
Blair	5,624	4.12	6.85	10.39	20.88	43.84
Bradford‡	1,284	8.55	40.52	42.98	44.46	60.44
Bucks	13,419	3.05	9.50	13.86	18.48	31.31
Butler	3,733	0.85	9.76	22.56	29.79	37.49
Cambria	3,274	2.37	7.56	13.37	36.04	63.83
Cameron†	241	27.36	38.60	53.40	59.69	87.94
Carbon‡	1,269	3.02	12.27	19.50	30.45	45.36
Centre	9,124	9.65	15.92	17.06	21.03	36.07
Chester	13,375	5.11	15.64	23.19	42.26	71.14
Clarion‡	588	3.83	5.63	18.02	29.49	45.64
Clearfield	2,236	1.40	11.52	35.33	41.08	57.29
Clinton†	1,380	39.27	47.91	51.09	52.15	105.47
Columbia‡	1,376	1.17	17.07	24.97	26.84	50.90
Crawford	2,505	5.13	11.09	13.70	34.08	58.19
Cumberland	5,578	3.10	3.86	9.58	17.54	31.22
Dauphin	7,006	2.24	4.65	9.13	18.54	29.48
Delaware	21,023	2.24	7.28	10.75	14.36	19.98
Elk‡	615	0.66	2.81	19.59	22.79	46.78
Erie	6,551	4.57	10.67	14.52	28.96	63.00
Fayette	3,519	1.46	4.19	18.78	25.35	44.11
Forest†	68	37.60	42.06	49.44	58.53	93.52
Franklin	2,629	3.03	8.76	19.99	29.15	44.97
Fulton†	323	38.89	47.32	58.08	69.82	83.99
Greene‡	707	11.14	15.64	30.21	38.85	55.08
Huntingdon‡	1,336	2.11	4.25	4.25	25.70	63.74
Indiana‡	3,625	0.88	3.08	4.81	23.42	46.79
Jefferson‡	1,261	0.60	3.64	28.04	39.48	54.89
Juniata†	181	29.63	31.92	38.71	46.33	66.19
Lackawanna	8,470	3.21	6.22	9.06	15.16	26.05

TABLE 7

ROUND-TRIP DRIVING DISTANCE IN MILES TO DRIVER LICENSE CENTER ("DLC") FOR REGISTERED VOTERS WITHOUT VALID PENNDOT OR DOS ID (EXCLUDES OOS ID) BY COUNTY

ALL VOTER RECORDS

PA County	Number Without Valid ID	Driving Distance in Miles				
		2.5 Percentile	25 Percentile	Median 50th Percentile	75 Percentile	97.5 Percentile
Lancaster	12,300	3.80	7.19	11.35	26.32	54.09
Lawrence	3,737	5.99	10.18	12.47	20.11	27.80
Lebanon	2,337	1.54	3.94	7.76	16.42	28.01
Lehigh	7,842	3.72	6.96	9.62	16.85	30.52
Luzerne	10,535	3.59	8.50	13.46	21.95	34.27
Lycoming	2,188	1.70	4.87	6.99	17.96	43.49
Mckean‡	970	0.47	2.73	7.28	38.06	56.69
Mercer	3,161	2.22	21.31	30.56	36.86	41.83
Mifflin‡	815	2.00	6.17	8.86	18.68	34.33
Monroe	2,679	9.60	17.08	24.28	35.97	46.05
Montgomery	23,007	2.70	7.61	13.90	19.37	48.79
Montour†	641	32.51	33.89	37.01	38.86	54.27
Northampton	10,611	2.23	7.71	11.19	13.95	30.67
Northumberland‡	2,847	0.58	8.74	15.18	22.36	41.10
Perry†	520	19.30	31.28	43.79	58.06	87.81
Philadelphia	122,790	1.31	3.94	5.86	7.81	12.54
Pike‡	1,032	0.35	12.03	24.14	35.00	47.72
Potter‡	342	0.45	12.07	34.25	42.51	59.00
Schuylkill	3,279	1.63	11.47	19.58	30.84	49.91
Snyder	566	1.38	3.31	10.89	28.68	38.27
Somerset	2,186	2.95	11.53	18.67	30.92	57.38
Sullivan†	55	29.44	31.05	42.44	49.56	66.41
Susquehanna‡	448	1.66	18.59	33.81	46.44	51.29
Tioga‡	857	1.49	17.61	24.53	40.86	60.76
Union†	2,468	26.99	27.99	28.12	28.88	41.59
Venango‡	950	5.00	11.11	19.17	28.97	51.97
Warren‡	1,567	4.33	9.95	13.73	28.48	58.40
Washington	5,922	1.82	7.05	14.80	21.07	41.21
Wayne‡	1,091	7.19	14.00	19.86	33.09	64.36
Westmoreland‡	6,730	1.69	7.49	16.14	24.40	37.32
Wyoming‡	316	0.47	4.05	14.51	21.54	33.71
York	13,147	3.28	7.18	12.78	25.78	49.91
Total	442,850	1.76	5.56	9.96	18.37	47.63

TABLE 7

**ROUND-TRIP DRIVING DISTANCE IN MILES
TO DRIVER LICENSE CENTER ("DLC") FOR REGISTERED VOTERS WITHOUT
VALID PENNDOT OR DOS ID (EXCLUDES OOS ID)
BY COUNTY**

ALL VOTER RECORDS

PA County	Number Without Valid ID	Driving Distance in Miles				
		2.5 Percentile	25 Percentile	Median 50th Percentile	75 Percentile	97.5 Percentile
† No DLC in County	5,877	26.99	28.18	36.63	50.49	75.86
‡ DLC only open 1 or 2 days per week	32,373	1.04	6.82	18.53	31.93	53.47

Note

Includes only Registered Voters whose addresses could be geographically mapped.

TABLE 7A

**ROUND-TRIP DRIVING DISTANCE IN MILES
TO DRIVER LICENSE CENTER ("DLC") FOR REGISTERED VOTERS WITHOUT
VALID PENNDOT OR DOS ID (EXCLUDES OOS ID)
BY COUNTY**

RESTRICTED TO NOVEMBER 2012 VOTERS

PA County	Number Without Valid ID	Driving Distance in Miles				
		2.5 Percentile	25 Percentile	Median 50th Percentile	75 Percentile	97.5 Percentile
Adams	700	1.21	2.25	9.46	23.01	34.45
Allegheny	16,033	1.90	6.32	9.24	12.48	27.33
Armstrong‡	312	2.53	10.13	23.67	28.59	45.30
Beaver	1,303	4.52	15.16	23.18	30.54	39.72
Bedford‡	286	3.38	10.77	28.61	40.44	59.16
Berks	1,837	1.48	6.36	10.71	23.83	48.35
Blair	721	3.30	6.59	11.02	21.01	44.13
Bradford‡	190	8.33	36.45	42.76	44.87	61.52
Bucks	3,969	3.38	9.66	13.77	18.00	30.05
Butler	1,064	1.10	9.84	21.85	28.97	36.93
Cambria	1,055	2.36	7.58	13.19	33.74	62.45
Cameron†	43	23.28	38.52	42.14	59.81	89.79
Carbon‡	360	3.05	12.23	18.57	24.22	45.39
Centre	2,923	9.92	15.92	16.99	20.32	34.59
Chester	4,086	5.11	15.96	25.86	46.61	71.01
Clarion‡	153	3.96	6.47	19.66	30.23	47.07
Clearfield	435	0.32	16.79	34.62	41.68	60.92
Clinton†	177	35.88	47.66	51.09	51.39	104.70
Columbia‡	337	1.09	4.90	24.05	27.83	53.77
Crawford	674	8.36	11.10	13.73	34.30	60.99
Cumberland	2,036	2.77	3.86	11.01	17.83	29.36
Dauphin	1,724	2.29	5.78	10.97	19.31	30.21
Delaware	6,839	2.28	7.25	10.51	14.21	20.00
Elk‡	188	0.68	2.09	14.82	22.17	48.26
Erie	1,384	4.34	10.35	15.42	28.96	61.65
Fayette	674	1.73	5.92	20.62	25.79	45.09
Forest†	22	36.86	41.92	50.52	58.88	92.04
Franklin	676	3.23	8.23	18.64	29.07	46.08
Fulton†	65	37.77	50.35	61.81	71.26	82.06
Greene‡	192	11.17	20.19	30.60	38.38	54.68
Huntingdon‡	211	1.92	4.25	4.42	27.04	68.26
Indiana‡	686	1.80	2.88	4.14	18.06	47.79
Jefferson‡	209	0.88	6.41	27.41	40.08	54.92
Juniata†	45	29.62	33.70	40.51	51.28	74.68
Lackawanna	2,411	3.04	6.13	9.89	16.07	27.67
Lancaster	3,591	3.89	7.19	13.53	28.38	54.25
Lawrence	758	6.00	10.17	12.10	20.18	28.60

TABLE 7A

**ROUND-TRIP DRIVING DISTANCE IN MILES
TO DRIVER LICENSE CENTER ("DLC") FOR REGISTERED VOTERS WITHOUT
VALID PENNDOT OR DOS ID (EXCLUDES OOS ID)
BY COUNTY**

RESTRICTED TO NOVEMBER 2012 VOTERS

PA County	Number Without Valid ID	Driving Distance in Miles				
		2.5 Percentile	25 Percentile	Median 50th Percentile	75 Percentile	97.5 Percentile
Lebanon	578	1.54	4.46	11.21	19.26	27.88
Lehigh	1,904	3.89	7.68	10.75	17.87	32.06
Luzerne	2,667	3.76	9.05	14.11	22.88	34.34
Lycoming	776	1.46	4.99	7.32	20.23	40.96
Mckean‡	204	0.51	3.63	7.38	37.95	56.66
Mercer	909	2.08	21.31	30.49	36.70	41.85
Mifflin‡	168	2.86	6.27	10.52	19.31	33.34
Monroe	658	9.15	17.39	21.11	35.40	47.65
Montgomery	7,590	2.82	7.68	13.85	19.37	48.27
Montour†	165	32.57	33.84	36.63	38.40	54.87
Northampton	1,909	2.28	7.98	10.99	13.15	29.59
Northumberland‡	571	0.62	3.43	14.78	19.35	41.03
Perry†	161	19.18	31.28	42.66	58.16	80.55
Philadelphia	39,928	1.31	3.87	5.72	7.63	12.53
Pike‡	230	0.35	8.66	23.01	34.06	47.59
Potter‡	80	0.41	9.07	30.69	40.76	59.52
Schuylkill	1,160	1.29	11.58	19.98	31.55	49.36
Snyder	174	1.60	3.31	12.82	28.43	40.68
Somerset	485	4.11	12.48	18.47	31.83	58.20
Sullivan†	14	30.64	31.13	39.67	43.31	46.05
Susquehanna‡	155	1.81	18.57	33.55	46.44	51.12
Tioga‡	244	1.47	11.19	24.53	40.86	60.86
Union†	905	26.99	27.99	28.12	28.73	42.98
Venango‡	271	5.54	11.19	19.15	27.77	51.90
Warren‡	212	4.45	10.04	14.06	28.45	59.35
Washington	1,351	1.80	6.81	14.68	20.69	39.69
Wayne‡	293	6.51	15.04	20.57	38.32	70.59
Westmoreland‡	1,733	1.37	7.38	17.09	25.34	37.32
Wyoming‡	93	0.50	3.29	14.52	21.03	29.22
York	1,943	2.82	7.44	15.22	26.77	44.80
Total	125,900	1.75	5.71	9.66	17.50	46.61

TABLE 7A

**ROUND-TRIP DRIVING DISTANCE IN MILES
TO DRIVER LICENSE CENTER ("DLC") FOR REGISTERED VOTERS WITHOUT
VALID PENNDOT OR DOS ID (EXCLUDES OOS ID)
BY COUNTY**

RESTRICTED TO NOVEMBER 2012 VOTERS

PA County	Number Without Valid ID	Driving Distance in Miles				
		2.5 Percentile	25 Percentile	Median 50th Percentile	75 Percentile	97.5 Percentile
† No DLC in County	1,597	26.48	28.11	29.50	42.99	71.83
‡ DLC only open 1 or 2 days per week	7,378	1.20	6.81	18.41	30.31	53.17

Note

Includes only Registered Voters whose addresses could be geographically mapped.

TABLE 8

ROUND-TRIP DRIVING DISTANCE AND TIME TO DLC FOR REGISTERED VOTERS WITHOUT VALID PENNDOT OR DOS ID (EXCLUDES OOS ID)

ALL VOTER RECORDS

A. Driving Distance

Average: 14.11 Miles
Median: 9.96 Miles
Maximum: 142.77 Miles
Range for Middle 95 Percent of Population: 1.76 to 47.63 Miles
Range for Middle 50 Percent of Population: 5.56 to 18.37 Miles
Proportion 20 miles or more: 21.9 %
Proportion 30 miles or more: 10.5 %

RANDOM SAMPLE OF 15,000 VOTER RECORDS

B. Driving Duration

Average: 25.02 Minutes
Median: 19.80 Minutes
Maximum: 152.93 Minutes
Range for Middle 95 Percent of Population: 5.07 to 71.07 Minutes
Range for Middle 50 Percent of Population: 13.13 to 32.30 Minutes
Proportion 30 minutes or more: 28.7 %
Proportion 45 minutes or more: 11.5 %

TABLE 8A

ROUND-TRIP DRIVING DISTANCE AND TIME TO DLC FOR REGISTERED VOTERS WITHOUT VALID PENNDOT OR DOS ID (EXCLUDES OOS ID)

RESTRICTED TO NOVEMBER 2012 VOTERS

A. Driving Distance

Average: 13.53 Miles
Median: 9.66 Miles
Maximum: 133.48 Miles
Range for Middle 95 Percent of Population: 1.75 to 46.61 Miles
Range for Middle 50 Percent of Population: 5.71 to 17.50 Miles
Proportion 20 miles or more: 20.0 %
Proportion 30 miles or more: 9.0 %

RANDOM SAMPLE OF 15,000 VOTERS - RESTRICTED TO NOVEMBER 2012 VOTERS

B. Driving Duration

Average: 24.30 Minutes
Median: 19.27 Minutes
Maximum: 151.73 Minutes
Range for Middle 95 Percent of Population: 5.37 to 69.39 Minutes
Range for Middle 50 Percent of Population: 12.87 to 31.50 Minutes
Proportion 30 minutes or more: 27.9 %
Proportion 45 minutes or more: 9.8 %

TABLE 9

ROUND-TRIP PUBLIC TRANSPORTATION
COMMUTING TIME TO DLC FOR REGISTERED VOTERS
WITHOUT VALID PENNDOT OR DOS ID (EXCLUDES OOS ID)
IN PHILADELPHIA AND PITTSBURGH

RANDOM SAMPLE OF 2,000 VOTER RECORDS

	Transit Duration
Average	51.82 Minutes
Median	46.30 Minutes
Maximum	222.50 Minutes
Range for Middle 95 Percent of Population	14.78 to 120.23 Minutes
Range for Middle 50 Percent of Population	33.98 to 63.07 Minutes
Proportion 60 minutes or more	28.1%

TABLE 9A

ROUND-TRIP PUBLIC TRANSPORTATION
COMMUTING TIME TO DLC FOR REGISTERED VOTERS
WITHOUT VALID PENNDOT OR DOS ID (EXCLUDES OOS ID)
IN PHILADELPHIA AND PITTSBURGH

RANDOM SAMPLE OF 2,000 VOTERS - RESTRICTED TO NOVEMBER 2012 VOTERS

	Transit Duration
Average	50.27 Minutes
Median	44.95 Minutes
Maximum	211.47 Minutes
Range for Middle 95 Percent of Population	14.20 to 117.26 Minutes
Range for Middle 50 Percent of Population	32.76 to 59.98 Minutes
Proportion 60 minutes or more	25.0%

APPENDIX A

APPENDIX A-1

MATCHING CRITERIA FOR THE SURE AND PENNDOT DATABASES

Step	Matching Criteria	Total Matches	Percent of Matches	Percent of Registered Voters
1	Match license number with expiration date on/after November 5, 2012; Exact and truncated First Name/Last Name match	6,844,529	85.8%	83.1%
2	Exact and truncated First Name/Last Name match; Exact date of birth match; Social Security Number match if fields populated	475,728	6.0%	5.8%
3	Match license number	224,273	2.8%	2.7%
4	Exact and truncated First Name/Last Name match; Exact date of birth match; DOT and DOS address within 5 miles	184,228	2.3%	2.2%
5	Exact and truncated First Name/Last Name match; Exact date of birth match; DOT and DOS address within 10 miles	333	0.0%	0.0%
6	Exact and truncated First Name/Last Name match; Exact date of birth match; DOT and DOS address within same county	1,337	0.0%	0.0%
7	First Name/Last Name matching using Fuzzy String matching; Exact date of birth; Social Security Number match if fields populated; DOT and DOS address within 5	51,392	0.6%	0.6%
8	First Name/Last Name matching using Fuzzy String matching; Exact date of birth; Social Security Number match if fields populated; DOT and DOS address within 10	207	0.0%	0.0%
9	First Name/Last Name matching using Fuzzy String matching; Exact date of birth; Social Security Number match if fields populated; DOT and DOS address within same	946	0.0%	0.0%
10	First Name/Last Name matching using Fuzzy String matching; Exact date of birth; Social Security Number match if fields populated; not geographically restricted	31,613	0.4%	0.4%
11	First Name/Last Name matching exact, truncated, fuzzy name match; date of birth year match, date of birth month or day match; Social Security Number match if fields populated; zip code match	136,091	1.7%	1.7%
12	Exact date of birth match; Social Security Number match if fields populated; name and geography not considered	29,190	0.4%	0.4%
	Total Matches	7,979,874	100.0%	96.9%
	Total Non-Matches	251,879	N/A	3.1%
	Total Registered Voters	8,231,753		

APPENDIX A-2

MATCHING CRITERIA BETWEEN THE SURE AND PENNDOT DATABASES WHERE PENNDOT ID EXPIRATION DATE IS BEFORE NOVEMBER 5, 2012

Step	Matching Criteria	Total Matches with Expired ID	Percent of Registered Voters
1	Match license number with expiration date on/after November 5, 2012; Exact and truncated First Name/Last Name match	0	0.0%
2	Exact and truncated First Name/Last Name match; Exact date of birth match; Social Security Number match if fields populated	360,532	4.4%
3	Match license number	16,816	0.2%
4	Exact and truncated First Name/Last Name match; Exact date of birth match; DOT and DOS address within 5 miles	10,310	0.1%
5	Exact and truncated First Name/Last Name match; Exact date of birth match; DOT and DOS address within 10 miles	56	0.0%
6	Exact and truncated First Name/Last Name match; Exact date of birth match; DOT and DOS address within same county	285	0.0%
7	First Name/Last Name matching using Fuzzy String matching; Exact date of birth; Social Security Number match if fields populated; DOT and DOS address within 5	4,284	0.1%
8	Social Security Number match if fields populated; DOT and DOS address within 10 miles	35	0.0%
9	First Name/Last Name matching using Fuzzy String matching; Exact date of birth; Social Security Number match if fields populated; DOT and DOT address within same	178	0.0%
10	First Name/Last Name matching using Fuzzy String matching; Exact date of birth; Social Security Number match if fields populated; not geographically restricted	3,754	0.0%
11	First Name/Last Name matching exact, truncated, fuzzy name match; date of birth year match, date of birth month or day match; Social Security Number match if fields populated; zip code match	17,208	0.2%
12	Exact date of birth match; Social Security Number match if populated; name and geography not considered	4,044	0.0%
	Total Matches to PennDOT ID that Expired Before 11/5/2012	417,502	5.1%
	Total Registered Voters	8,231,753	

APPENDIX B

BLDS, LLC

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Director

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SUMMARY
Bernard Siskin received his B.S. degree in Mathematics from the University of Pittsburgh and a Ph.D. in Statistics from the University of Pennsylvania. For many years, he taught statistics at Temple University and served as Chairman of the Department of Statistics.

Dr. Siskin has specialized in the application of statistics in law, particularly in the area of analyzing data for statistical evidence of discrimination. He has testified for both plaintiffs and defendants in more than 200 cases, many of which were large employment class actions. In addition to discrimination studies, he has conducted statistical studies and has testified in commercial and environmental cases involving statistical issues.

Dr. Siskin has frequently been appointed by federal judges as a neutral expert to aid the court in statistical issues and he was the statistical consultant to the Third Circuit Court of Appeals Task Force on Equal Treatment in the Courts.

Dr. Siskin is the author of many articles and textbooks on statistics and quantitative techniques including *Elementary Business Statistics, Encyclopedia of Management* and *Quantitative Techniques for Business Decisions.* He has also written and lectured extensively on the use of statistics in litigation.

He has served as a statistical consultant to the U.S. Department of Justice, the Equal Employment Opportunity Commission, the U.S. Department of Labor, the Federal Bureau of Investigation, the Central Intelligence Agency, the Environmental Protection Agency, the National Aeronautics and Space Administration and Fannie Mae (the Federal National Mortgage Association) and Freddie Mac (the Federal Home Loan Mortgage Corporation), as well as numerous other federal, state and city agencies and Fortune Five Hundred corporations.

BLDS, LLC

EDUCATION
University of Pennsylvania
Ph.D., Statistics (Minor, Econometrics), 1970

University of North Carolina
Graduate Study (Major, Economics; Minor, Statistics), 1966

University of Pittsburgh
B.S., Mathematics (Minor, Economics), 1965

PRESENT POSITION
BLDS, LLC, Director, 2011

TEACHING EXPERIENCE
Temple University, Adjunct Professor of Law School, 1992 to present
Temple University, Tenured Associate Professor of Statistics, 1973 to 1984
Temple University, Chairman-Department of Statistics, 1973 to 1978
Temple University, Assistant Professor of Statistics, 1970 to 1973
Temple University, Instructor of Statistics, 1968 to 1970

OTHER POSITIONS HELD
LECG, Director, 2003 to 2011
Center for Forensic Economic Studies, Senior Vice President, 1991 to 2003
National Economic Research Associates, Inc., Senior Vice President, 1989 to 1991
National Economic Research Associates, Inc., Vice President, 1986 to 1989
Center for Forensic Economic Studies, Ltd., President, 1984 to 1986
Center for Forensic Economic Studies, Ltd., Consultant, 1980 to 1984

PUBLICATIONS
Books

1. B. Siskin, “Employment Discrimination Litigation: Behavioral, Quantitative, and Legal Perspectives” John Wiley & Sons, Inc. 2005, Chapter 5 *Statistical Issues in Litigation* (with Joseph Trippi).
2. B. Siskin, "Use of Statistical Models to Provide Statistical Evidence of Discrimination in the Treatment of Mortgage Loan Applicants: A Study of One Lending Institution," *Mortgage Lending, Racial Discrimination and Federal Policy*, Urban Institute Press, 1996, J. Georing and R. Wienk, eds.
3. B. Siskin and J. Staller, *What Are The Chances?*, Crown Publishers, 1989.
4. B. Siskin and R. Johnson, *Elementary Statistics: A First Course*, Duxbury Press, 1982.

PUBLICATIONS (Continued)

Books (Continued)

5. B. Siskin and R. Johnson, *Elementary Business Statistics*, Duxbury Press, 1979 2nd Edition, 1985
6. B. Siskin, *Encyclopedia of Management*, McGraw Hill, 1979. (Ed. Les Bechtel).
7. B. Siskin and R. Johnson, *Quantitative Techniques for Business Decisions*, Prentice Hall, 1976.

Articles

1. B. Siskin and D. Griffin, "Litigating Employment Discrimination & Sexual Harassment Claims," *Litigation Handbook Series*, 2002.
2. B. Siskin, H. Carter, V. Lee, G. Page, M. Parker, R.G. Ford, G. Swartzman, S. Kress, S. Singer and D.M. Fry, "The 1986 Apex Houston Oil Spill in Central California: Seabird Mortality and Population Impacts, Injury Assessments, Litigation Process, and Initial Restoration Efforts," *Marine Ornithology*, 2002.
3. B. Siskin, AUtilizing Statistics in Discrimination Cases,@ *Litigation Handbook Series*, 2001.
4. B. Siskin, B. Sullivan, J. Staller, and E. Hull, ADefending and Proving Damages in Employment Discrimination Cases,@ *Litigation Handbook Series*, 2000.
5. B. Siskin, "Litigating Employment Discrimination Cases," *Litigation Handbook Series*, 1998.
6. B. Siskin and D. Kahn, "Litigating Employment Discrimination Cases," *Litigation Handbook Series*, 1997.
7. B. Siskin, R. DuPont, D. Griffin, S. Shiraki, and E. Katze ARandom Workplace Drug Testing. Does It Primarily Identify Casual or Regular Drug Users?,@ *Employment Testing Law & Policy Reporter*, Vol. 4, Number One, 1995.
8. B. Siskin, R. DuPont, D. Griffin, S. Shiraki, and E. Katze "Random Drug Tests at Work: The Probability of Identifying Frequent and Infrequent Users of Illicit Drugs," *Journal of Addictive Diseases*, Vol. 14, Number 3, 1995.
9. B Siskin, J. Staller, B. Sullivan and L. Freifelder, "Litigating Employment Discrimination Cases," *Litigation Course Handbook Series*, 1995.
10. B. Siskin, "Comparing the Role of Statistics In Lending and Employment Cases," *Fair Lending Analysis: A Compendium of Essays on the Use of Statistics*, American Bankers Association, 1995.
11. B. Siskin, "Relationship Between Performance and Banding," *Human Performance*, Vol. 8, No. 3, July 1995.
12. B. Siskin, "Statistical Issues in Litigating Employment Discrimination Claims," *Federal Publications*, 1993.
13. B. Siskin, "Use of Statistical Models to Provide Statistical Evidence of Discrimination in the Treatment of Mortgage Loan Applicants: A Study of One Lending Institution," *Discrimination and Mortgage Lending Research and Enforcement Conference* Department of Housing and Urban Development, May 1993.

BLDS, LLC

SPEECHES (Partial List)

1. Alabama Bar Association
2. American Bar Association
3. American Statistical Association
4. Defense Research Institute
5. Federal Bar Association
6. Harvard University
7. Institute of Industrial Research
8. International Organization of Human Rights Association
9. Law Education Institute
10. Law Enforcement Assistance Administration
11. Michigan Bar Association
12. National Center on Aging
13. Ohio Bar Association
14. Penn State University
15. Pennsylvania Human Relations Commission
16. Practising Law Institute
17. Security Industry Association
18. Women's Law Caucus: National Conference

STATISTICAL CONSULTANT (Partial List)

1. Attorney General's Office of the Commonwealth of Pennsylvania, and states of California, Oregon, Massachusetts, Connecticut, Mississippi, Louisiana and New Jersey
2. Board of Higher Education for Massachusetts and Oregon
3. Central Intelligence Agency (CIA)
4. Environmental Protection Agency (EPA)
5. Equal Employment Opportunity Commission (EEOC)
6. Federal Bureau of Investigation (FBI)
7. Freddie Mac (Federal Home Loan Mortgage Corporation)
7. Fannie Mae (Federal National Mortgage Association)
8. Homeland Security
9. International Organization of Human Rights Associations
10. Municipal Court of Philadelphia
11. National Aeronautics and Space Administration (NASA)
12. Office of Federal Contract Compliance, Department of Labor (OFCCP)
13. Pennsylvania Human Relations Commission
14. Security Exchange Commission
15. Third Circuit Court of Appeals Task Force on Equal Treatment in the Courts
16. U.S. Department of Agriculture
17. U.S. Department of Commerce
18. U.S. Department of Labor
19. U. S. Justice Department
20. Numerous Fortune 500 and other private corporations

APPENDIX C

APPENDIX C

Audit of Non-Matches and Matches

Computer databases are not 100% perfect. There can be errors in data entry with respect to the variables used in any matching process. Additionally, since I am dealing with two very large databases (the SURE Database has 8,231,753 Registered Voters, and the PennDOT Database has 14,428,644 license, non-driver photo identification card, and DOS ID holders), there can be differences between the two databases for a particular variable for a given person.

For example, a person's birth date can be entered as 02/03/1960 in the SURE Database but entered as 02/03/1990 in the PennDOT Database. I, therefore, expect that there will be some percentage of Registered Voters that I was not able to match in the PennDOT database but who, in fact, do have a valid PennDOT or DOS ID for voting purposes.

On the other hand, I likewise expect that there is some percentage of Registered Voters that I classified as a match for whom the match is false. For example, in Step 12 of my matching criteria (see Appendix A-1), I ignored name and classified matches if date of birth and last four digits of Social Security Number ("SSN") matched. As discussed below, most of these matches classified in Step 12 are false matches (i.e., the matching procedure classified two records as a match, but the two records are not the same person). For both of these reasons, I estimated error rates to test the validity of my matched and non-matched Registered Voters.

To audit the number of Registered Voters I classified as non-matched, I selected a random sample of 100 non-matched Registered Voters and manually searched through the PennDOT Database to see if I could locate the same individual with a valid PennDOT or DOS ID. I also selected five random samples of 50 Registered Voters each, for a total sample of 250

Registered Voters, who were classified as a match in the three matching steps that I determined were likely to have the highest number of false matches:

1. Step 3 -- License number match; no other criteria considered.

2. Step 11 -- First name and last name match (exactly, with truncation, or Fuzzy String matching); date of birth year match and date of birth month or day match; SSN match if fields populated; zip code match.

3. Step 12 -- Exact date of birth match; SSN match if fields populated; name and geography not considered. I have determined that all of the false matches from Step 12 fall into one of three subgroups:

    a. Last name matches, first name does not match
    b. First name matches, last name does not match
    c. Neither first nor last name matches

    In order to identify these subgroups, I used exact, truncated, and Fuzzy String matching.

I tabulated the results of the audit without OOS (Out of State) Registered Voters, who are not in my study population. After excluding OOS Registered Voters, I was left with 235 of the 250 randomly sampled matches and all 100 of the randomly sampled non-matches. The results of the audit follow:

A. Audit of Non-Matched Registered Voters

Number in Audit	Actual Matches	Non-Match Population	Estimated Number of Additional Matches
100	14	251,879	35,263

Accounting for sampling error, I estimate with 95% confidence the total number of additional matches to range from 18,133 to 52,393 Registered Voters.

B. Audit of Matched Registered Voters

Subgroup	Number in Audit	False Matches	Matched Population	Estimated Number of False Matches
1	50	2	215,891	5,636
2	47	6	130,313	16,636
3a	47	5	3,154	336
3b	47	2	12,757	543
3c	44	43	11,595	11,331
Total Estimated Number of False Matches				37,482

Accounting for sampling error, I estimate with 95% confidence the total number of false matches had we audited the entire population of these three subgroups to range from 20,366 to 54,598 Registered Voters (not including potential false matches from the other nine matching steps).

As shown above, the estimated number of false matches is approximately the same as (indeed, is slightly higher than) the estimated number of additional matches that my matching criteria missed. I conclude that these errors of similar magnitude in opposite directions virtually cancel each other out in terms of yielding the same approximate total number of Registered Voters without valid PennDOT or DOS ID. I note that if I had audited random samples of Registered Voters matched to the PennDOT Database during any of the other steps in the matching process, the estimated number of false matches could only increase.[1]

Nevertheless, even if I assume that all of the estimated false matches were true matches and account for only the upper bounds of the 95% confidence interval for the additional matches (20.8%), this means that my matching criteria still identified 199,486 Registered Voters without

[1] It also is worth noting that there is a likelihood that the Registered Voters determined to be non-matches in Step 12 but who I judged in the audit to be matches may not be able to vote in the November 2013 election because poll workers may determine that the names of those Registered Voters as written in the poll books do not substantially conform to the names on the PennDOT or DOS ID of those Registered Voters.

PennDOT or DOS ID prior to identifying the additional 417,502 Registered Voters with non-OOS PennDOT ID that expired prior to November 5, 2012, and therefore no longer will be valid during the November 2013 election.

APPENDIX D

Appendix D

Pennsylvania Reported Voting and Registration, by Sex, Race, and Hispanic Origin: November 2012

(in thousands)

Race and Hispanic Origin	Total Population	Total Citizen Population	Total Registered	Percent Registered (Total)	Margin of Error[1]	Percent Registered (Citizen)	Margin of Error	Total Voted	Percent Voted (Total)	Margin of Error	Percent Voted (Citizen)	Margin of Error
Total	9,847	9,452	6,795	69.0	1.4	71.9	1.4	5,824	59.1	1.5	61.6	1.5
Male	4,727	4,532	3,217	68.0	2.0	71.0	2.0	2,740	58.0	2.2	60.4	2.2
Female	5,120	4,919	3,578	69.9	1.9	72.7	1.9	3,084	60.2	2.1	62.7	2.1
White alone	8,382	8,228	5,951	71.0	1.5	72.3	1.5	5,074	60.5	1.6	61.7	1.6
White non-Hispanic alone	7,994	7,901	5,779	72.3	1.5	73.1	1.5	4,937	61.8	1.6	62.5	1.6
Black alone	1,006	940	675	67.0	5.4	71.8	5.3	614	61.0	5.6	65.2	5.6
Asian alone	272	110	68	25.0	10.0	61.7	17.5	53	19.3	9.1	47.6	18.0
Hispanic (of any race)	501	407	225	45.0	10.5	55.3	11.6	184	36.7	10.2	45.1	11.6
White alone or in combination	8,482	8,327	6,002	70.8	1.5	72.1	1.5	5,118	60.3	1.6	61.5	1.6
Black alone or in combination	1,078	1,012	725	67.2	5.2	71.6	5.1	653	60.6	5.4	64.5	5.5
Asian alone or in combination	295	133	74	25.1	9.6	55.7	16.3	58	19.9	8.8	44.0	16.3

Source: U.S. Census Bureau, Current Population Survey, November 2012

[1] This figure added to or subtracted from the estimate provides the 90-percent confidence interval.

NOTES:

Federal surveys now give respondents the option of reporting more than one race. Therefore, two basic ways of defining a race group are possible. A group such as Asian may be defined as those who reported Asian and no other race (the race-alone or single-race concept) or as those who reported Asian regardless of whether they also reported another race (the race-alone or race-in-combination concept). Results for both manners of reporting are presented.

1/ Includes people reported as 'did not vote,' 'do not know,' and 'not reported on voting.'

2/ Hispanics may be of any race.

APPENDIX E

APPENDIX E

Software, Tools, and Packages Used in the Matching and Statistical Analyses Presented in this Report

1. MySQL -- Primary database engine used for storage and processing.

2. Python -- General purpose programming language used to interface with the MySQL server for processing that was not possible exclusively within MySQL.

3. PostGreSQL -- Database engine used for geospatial calculations with the following extensions:

    a. PostGIS -- A spatial database extender for PostGreSQL database to add support for geographic objects allowing location queries to be run in SQL. http://postgis.net/

    b. Tiger Geocoder -- An SQL-based geocoder written to work with the TIGER (Topologically Integrated Geographic Encoding and Referencing system) / Line and Master Address database export released by the U.S. Census Bureau. http://postgis.refractions.net/docs/Extras.html

    c. pgRouting -- An extension to the PostGreSQL database / PostGIS database extender to provide geospatial routing functionality. http://pgrouting.org/

        i. OpenStreetMap -- Publically available mapping data used by pgRouting to determine driving distance calculations. http://www.openstreetmap.org/

4. SPSS -- A general purpose statistical tool (Statistical Package for the Social Sciences) used to analyze the data.

5. Excel -- A spreadsheet application developed by Microsoft used to present the data.